Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

28 July 2024

Executive Summary

This 2024 Update of the State Hazard Mitigation Plan (SHMP) for the Commonwealth of the Northern Mariana Islands presents a comprehensive planning vision for reduction of risks and improved resiliency related to the numerous natural hazards that have potential to impact Commonwealth socio-economic well-being. This plan was prepared in accordance with requirements set forth in the Disaster Mitigation Act (2000) as amended, and criteria set forth by the Federal Emergency Management Agency, and is formally adopted by the Governor of the Commonwealth.

The over-arching purpose of this plan is to establish a framework that government bodies, commercial interests, and the general public can work within to mitigate impacts to communities, essential services, the built environment, and the economy when natural disasters occur. Through mitigation and risk reduction measures as presented in this plan, the people of the Commonwealth will reduce the loss of life and property and will achieve timely recovery from natural hazards events.

Costs for recovery efforts, timely rebound of community quality of life, and maintenance of economic stability, are each directly related to good hazard mitigation planning. Natural hazards are unavoidable. Effective preparation based on good planning is the best response to the inevitable. This 2024 Update of the State Hazard Mitigation Plan for the Commonwealth aims to achieve these ends.

This 2024 SHMP Update builds on previous State Hazard Mitigation Plans developed for the Commonwealth (2004, 2010, 2014 and 2018). Significant improvements and enhancements that are incorporated into this 2024 Update include:

CNMI Planning Area Profile (Chapter 2.0)
All data presented in the CNMI Planning Area Profile are updated. Climate change information is expanded and improved. Climate change is acknowledged as a factor that will amplify severe weather events in the future. The discussion about community lifelines is extensively expanded.

Planning Process (Chapter 3.0)
To assist with a comprehensive update process, outreach and engagement was improved with agencies in multiple sectors and the members of the public. The following sectors were engaged throughout the update process: emergency management, flood plain administration, health and social services, infrastructure, natural and cultural resources, non-governmental agencies, and

the public at large. In February 2024, two outreach meetings were held on each of the main islands: Rota, Saipan, and Tinian. The Mayor of the Northern Islands was invited to the meetings on Saipan where the Mayor's office is located. On each island, public meetings were held in the afternoon to target government personnel and in the evening to target the general public. Surveys were made available to government personnel and the general public to engage and gather information about natural hazards and the respondent's experience and knowledge of these hazards, knowledge and awareness of preparedness programs, and mitigation actions.

Risk Assessment (Chapter 4.0, Sections 4.1–4.11)

The hazard profiles are reorganized to include the risk assessment and loss evaluation. For the risk assessment, the following asset categories are adopted:

- Commonwealth owned and operated buildings, critical facilities, infrastructure, and community lifelines;
- Commonwealth roads;
- general building stock;
- population;
- natural resources;
- cultural resources.

All information on the risk assessment is provided in Sections 4.1–4.11 as well as the referenced appendices.

Hazards are reorganized and new hazards added including Health Risk (Section 4.6) and Extreme Heat and Heatwave (Section 4.7) to reflect new information and conditions.

Section 4.5 (Flood) combines chronic coastal flooding and event-based flooding.

An analysis of community lifelines is added.

A geodatabase was developed for Commonwealth buildings and general building stock.

Data from the 2020 US Census Bureau was used to update and map vulnerable populations in each island jurisdiction. However, census track-level data was not available until mid-February 2024 and was not incorporated into this Update due to an extremely constrained project schedule and deadlines.

Natural resources were updated to include habitats of species listed under the Endangered Species Act, federally designated critical habitat and other occupied habitat and managed watersheds.

Specific changes incorporated for each hazard are presented in each Hazard Section (4.2–4.10).

The risk assessment summary is presented in Section 4.11. The risk assessment is a process by which the Commonwealth determines which hazards are of concern and addresses the potential impacts of those hazards Commonwealth-wide. This serves to communicate vulnerabilities, develop priorities, and inform decision-making for the hazard mitigation plan and other emergency management efforts.

The risk assessment for the 2024 SHMP Update provides the factual basis for developing a territory-wide mitigation strategy, which makes the connection between vulnerability and the proposed hazard mitigation actions.

Mitigation Capabilities Assessment (Chapter 5.0)

A comprehensive assessment of current mitigation capabilities was completed. Key areas of the evaluation included reviews of:

- Commonwealth laws, regulations, policies, programs, and plans related to hazard mitigation with particular emphasis on land use laws;
- participation in and administration of the National Flood Insurance Program and other national mitigation programs including challenges experienced by the Commonwealth;
- processes used by the Commonwealth to support and facilitate mitigation planning including a review the administration of hazard mitigation programs, education and outreach, administrative and technical support, and partnerships;
- the process to adopt and enforce building codes and safety.

The ability of the Commonwealth to apply for and use federal grants, such as BRIC, Pre-Disaster Mitigation, Community Development Block Grant-Disaster Recovery, to implement mitigation actions is discussed. Mitigation capability obstacles and challenges to mitigation implementation were identified by stakeholders. The obstacles and associated opportunities to overcome these barriers are summarized.

Mitigation Strategy (Chapter 6.0)

The mitigation actions described in the 2018 Standard State Mitigation Plan (SSMP) were each evaluated to determine the implementation status and relevance to ongoing mitigation needs. The 2018 SSMP actions are organized into a table to facilitate the evaluation. Because several major disasters occurred during the 5-year plan implementation period (2018–2023), post-disaster recovery projects were added to the evaluation. Several new mitigation actions are added for this 2024 SHMP Update. New evaluation criteria were developed, including cost-effectiveness, environmental soundness, and technical feasibility, to evaluate all actions carried over from the 2018 SSMP and new actions for this 2024 Update. These criteria are used to prioritize the mitigation actions and the results are provided in a table that related the mitigation actions back to relevant mitigation goals and objectives. Potential funding sources, including but not limited to Federal Emergency Management Agency (FEMA) grant programs, were identified for each mitigation action.

Plan Implementation and Maintenance (7.0)

The process to regularly monitor and review the plan was developed. Roles and responsibilities for 2024 SHMP Update implementation over the 5-year plan performance period (2024-2029) and monitoring are clearly assigned. A schedule for annual activities is provided to guide implementation, monitoring, and evaluation of the SHMP effectiveness.

Adoption of this 2024 SHMP Update signifies the commitment of the Commonwealth to implement the mitigation strategy and use the SHMP and its contents to guide hazard mitigation and resilience efforts over the next five years (2024–2029). The SHMP is the culmination of information provided by numerous stakeholders from local government agencies, federal government agencies, nonprofits, private entities, and the community. The goals, objectives, and actions identified in this 2024 SHMP Update serve to communicate the priorities of the Commonwealth for reducing vulnerability and building resilience to natural hazards.

Acknowledgements

Sincerest thanks and gratitude are given to the many individuals who contributed time, resources and knowledge to the success of this 2024 Update of the State Hazard Mitigation Plan. From the Hazard Mitigation Grant Program, Marian (*May*) Guerrero, Remedio (*Bedu*) Pangelinan, Leona Deleon Guerrero, Victoria Deleon Guerrero, and Querlaine Blas provided administration and oversight to ensure document quality and that a challenging project schedule was met. The HMGP team also provided extensive local logistics support for field work and engagement with stakeholders. Stakeholders from Commonwealth government agencies and the public at large contributed a wide range of information and perspective for hazards occurrence and impacts in the Commonwealth. Stakeholder input with regard to historical hazard events was especially beneficial. Nimbus Environmental Services of Hawaiʻi provided technical assistance to HMGP to help facilitate stakeholder engagement and to bring the many complex components of the plan together. Our federal partners at the Federal Emergency Management Agency, Region 9, gave generously of their time for discussions, trainings, guidance and plan reviews. And to our leader and Governor, the Honorable Arnold I. Palacios, goes our enduring appreciation for his sustaining support and enthusiasm.

Elizabeth S. Balajadia, P.E., Hazard Mitigation Officer
Commonwealth of the Northern Mariana Islands

Master Table of Contents

List of Acronyms

APC	Areas of Particular Concern
AR5	Fifth Assessment Report
ARFF	Aircraft Rescue & Firefighting
BCAT	Building Code Adoption Tracking
BECQ	Bureau of Environmental and Coastal Quality
BFE	Base Flood Elevations
BRIC	Building Resilient Infrastructure and Communities
BSCD	Building Safety Code Division
CAC	Community Assistance Contacts
CARE	Commonwealth Advocates for Recovery Efforts
CARES Act	Coronavirus Aid, Relief, and Economic Security Act
CAV	Community Assistance Visits
CDBG-DR	Community Development Block Grant-Disaster Recovery
CDBG-Mit	Community Development Block Grant-Mitigation
CDC	Centers for Disease Control and Prevention
CDC/ATSDR	Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry
CE	Common Era
CEDS	Comprehensive Economic Development Study
CHCC	Commonwealth Healthcare Corporation
CIP	Capital Improvement Program
CL	Community Lifeline
CNMI	Commonwealth of the Northern Mariana Islands
CNRA	Consolidated Natural Resources Act of 2008
COTA	Commonwealth Office of Transportation Authority
COVID-19	Coronavirus disease 2019
CRMO	Coastal Resources Management Office
CRS	Community Rating System
CSDP	Community Sustainable Development Plan
CUC	Commonwealth Utilities Corporation
DCCA	Department of Community and Cultural Affairs
DCRM	Division of Coastal Resources Management
DEQ	Division of Environmental Quality
DFIRM	Digital Flood Insurance Rate Map
DFW	Division of Fish and Wildlife
DLNR	Department of Land and Natural Resources
DMA	Disaster Mitigation Act
DPL	Department of Public Lands
DPW	Department of Public Works
EHP	Environmental Planning and Historic Preservation
ENSO	El Niño-Southern Oscillation
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency

ESF	Emergency Support Functions
FAM	Facilities Assessment Matrix
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FPMS	Floodplain Management Services
FY	Fiscal Year
GAO	US Government Accountability Office
GDP	Gross Domestic Product
GHTD	Global Historical Tsunami Database
GIS	Geographic Information System
H1N1	Swine flu
H5N1	Avian flu
HHPD	High Hazard Potential Dams Program
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HPO	Historic Preservation Office
HSEM	Homeland Security and Emergency Management
HUD	Housing and Urban Development
HURREVAC	Hurricane Evacuation Decision Support Tool for Government Agency Managers
IBA	Important Bird Areas
IBC	International Building Code
IPCC	Intergovernmental Panel on Climate Change
IRC	International Residence Code
IRP	Infrastructure Recovery Program
IUCN	International Union for Conservation of Nature
JTWC	Joint Typhoon Warning Center
LANDFIRE	Landscape Fire and Resource Management Planning Tool
LID	Low Impact Development
LiDAR	Light Detection and Ranging
LiMWA	Limit of Moderate Wave Action
LPR	Lawfully Admitted for Permanent Residence
MAC	Multi-Agency Coordination Group
MAT	Mitigation Assessment Team
Mgd	Million gallons per day
ML	Mariana Limestone
MMT	Island Mass Management Tool
MPA	Marine Protected Areas
MRI	Mean recurrence interval
NCRF	National Coastal Resilience Fund
NERPH	National Earthquake Hazard Reduction Program
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NGO	Non-Governmental Organization
NIMS	National Incident Management System
NLCD	National Land Cover Database

NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NVEWS	National Volcano Early Warning System
NWS	National Weather Service
OPD	Office of Planning and Development
P2A	Plan to Action
PAS	Planning Assistance to States
PDA	Preliminary Damage Assessment
PDM	Post-Disaster Mitigation
PGA	Peak Ground Acceleration
PLUP	Public Land Use Plan
PPE	Personal Protective Equipment
PTWC	Pacific Tsunami Warning Center
PTWS	Pacific Tsunami Warning System
RAC	Response Activity Coordinators
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RCV	Replacement Cost Value
Risk MAP	Risk Mapping Assessment and Planning
SAHSEM	Special Assistant to Homeland Security and Emergency Management
SARS-CoV-2	Severe Acute Respiratory Syndrome, Coronavirus-2
SDG	Sustainable Development Goals
SERC	Statewide Emergency Response Commission
SFHA	Special Flood Hazard Area
SH	Sustainable Habitat
SHMP	State Hazard Mitigation Plan
SHMO	State Hazard Mitigation Officer
SI/SD	Substantial Improvement/Substantial Damage
SLOSH	Sea, Lake, and Overland Surges
SLP	Sea Level Pressure
SLR	Sea Level Rise
SOP	Standard Operating Procedure
SSMP	State Standard Mitigation Plan
SPR	Stakeholder Preparedness Review
SVI	Social Vulnerability Index
SWIMS	Sustainable Water Infrastructure Management Strategy
SWR	Special Wind Region
SWOT	Strengths, weaknesses, opportunities, and threats
TB	Tuberculosis
THIRA	Threat Hazard Identification and Risk Assessment
TL	Tapochau Limestone
TPR	Tinian Pyroclastic Rocks
TR-SR	TsunamiReady® and StormReady®
TTX	Tabletop Exercise
UCS	Unconsolidated Sediments
UFC	Uniform Facilities Code
USDA	US Department of Agriculture

USDA-NASS	US Department of Agriculture, National Agricultural Statistics Service
INDOPACOM	US Indo-Pacific Command
USFW	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAAC	Volcanic Ash Advisory Center
VOAD	Volunteer Organizations Active in Disasters
WFO	Weather Forecast Office
WNP	Western North Pacific

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 1.0 Introduction
and
Chapter 2.0 CNMI Planning Area Profile

28 July 2024

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 Background

The Commonwealth of the Northern Mariana Islands (CNMI) has experienced a range of climate, hydrological, seismic, geological, and meteorological hazard events that have resulted in great costs to lives, property, and the economy. The island communities have experienced numerous federal disaster declarations and are currently experiencing the impacts of a changing climate. CNMI is committed to protecting its communities through ongoing efforts to reduce risk from future hazard events. The Federal Emergency Management Agency (FEMA) approval and Commonwealth adoption of each update to the CNMI State Hazard Mitigation Plan (SHMP) qualifies the CNMI to obtain federal assistance for hazard mitigation and for the repair and replacement of infrastructure damaged by natural disasters.

Mitigation is the effort to reduce loss of life and property by lessening the impacts of disasters. The purpose of mitigation planning is to identify hazards that impact the Commonwealth, conduct a robust risk analysis of current hazards to guide risk-informed decision-making, identify actions and activities to reduce losses from those hazards, and establish a coordinated process to implement the plan. It creates safer communities and helps maintain the quality of life. To be effective, all risks from natural hazards must be understood and investment in long-term community well-being through the implementation of short- and long-term strategies before the next disaster must be made (FEMA, 2022).

1.1.1 History of the CNMI State Hazard Mitigation Plan

The first multi-hazard mitigation plan for the CNMI was approved in 2004. The plan was updated in 2010, 2014, and 2018. As required by Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (the Stafford Act; Public Law 100-707), the CNMI continues to review and update the State Hazard Mitigation Plan on a five-year cycle. The 2024 SHMP is the fourth update.

1.2 Assurances and Authority

S20. Did the state provide assurances? [44 CFR § 201.4(c)(7)]

The 2024 SHMP Update meets the requirements of the Disaster Mitigation Act of 2000, Section 322 (a-d) plan requirements. The updated plan describes the process for identifying hazards, risks, and vulnerabilities, as well as evaluating and prioritizing mitigation actions.

The CNMI Hazard Mitigation Grant Program (HMGP), as the responsible entity for the CNMI SHMP, will fulfill the requirements for plan maintenance as outlined in applicable grant guidelines, federal statutes, and regulations, including 44 CFR 13.11(c). The HMGP further assures that the SHMP will be revisited as needed to reflect changes in law, statutes, and priorities at the Commonwealth and federal level as required by 44 CFR 13.11(d). The SHMP is considered a *living* document that accurately reflects the conditions, priorities, and requirements of the CNMI in relation to its identified threats and hazards. For full disclosure of assurances, please see the CNMI Letter of Adoption.

Authority for this plan originates from the following federal sources:

- The Stafford Act
- Code of Federal Regulations (CFR), Title 44, Parts 79.4, 201 and 206
- Disaster Mitigation Act (DMA) of 2000, Public Law 106-390, as amended

1.2.1 Stafford Act Section 404 and 406, Post-Disaster Response and Recovery

The Stafford Act of 1988 amended the Disaster Relief Act of 1974 (Public Law 93-288). The Stafford Act constitutes the statutory authority for most federal disaster response activities.

Section 404 mitigation activities are appropriated in amounts proportional to the cost of post-disaster response and recovery efforts authorized by the Stafford Act. It is the largest source of post-disaster funds for mitigation activities, and the one with the greatest potential to reduce future disaster losses. Section 404 provides that 15% (and in some cases 20% with an enhanced mitigation plan) of the funds spent for Mission Assignment, Public Assistance, and Individual Assistance may be spent for a wide variety of mitigation activities. Since early 1989, FEMA has paid out about $211 million per year, nationally. Funds are granted to the Commonwealth as the *grantee* and are spent by qualified *sub grantees* (e.g., agencies) on eligible projects located within the Commonwealth. Priorities are set by the Commonwealth and projects can be used to mitigate against losses from any hazard. Projects must be cost-effective and a non-federal match of at least 25% is required.

Section 406 allows for a narrower selection of mitigation activities under FEMA's Public Assistance program specifically supporting physical projects on damaged facilities and infrastructure. Under this program, all repairs must conform to applicable codes and standards, and damaged facilities can be improved for mitigation purposes if proposed measures are technically feasible, cost effective, and environmentally sound. Therefore, under this program hazard mitigation is defined as a cost-effective action taken to prevent or reduce the threat of future damage to a facility. A maximum non-federal match of 25% or less is required. Mitigation funded by Section 406 only applies to buildings and infrastructure damaged within a Presidential-declared disaster and is above and beyond the work required to return the damaged facility to its pre-disaster design. Section 406 mitigation is addressed by 44 CFR 206.226 and by Response and Recovery Policy 9526.1 (Fed Reg. 1998. Vol. 64, Issue 224, pp. 64423–64426). Section 7(c) of the FEMA policy provides that mitigation measures must be determined to be cost-effective. According to the policy, any of the following means may be used to determine cost-effectiveness:

- Mitigation measures may amount to 15% of the total eligible cost of the eligible repair work on a particular project.
- Certain mitigation measures will be determined to be cost effective, as long as the mitigation measure does not exceed the eligible cost of the eligible repair work on the project.
- For measures that exceed the above costs, the Grantee or Sub-grantee must demonstrate through an acceptable benefit/cost analysis that the measure is cost effective.

Appendix A of the Response and Recovery Policy (1998) defines mitigation measures as being cost-effective if they:

- Do not exceed 100% of the project cost.
- Are appropriate to the disaster damage.
- Will prevent future similar damage.
- Are directly related to the eligible damaged elements.
- Do not increase risks or cause adverse effects to the property or elsewhere.
- Meet standards of good professional judgment.

1.2.2 Disaster Mitigation Act of 2000

The Disaster Mitigation Act (DMA) of 2000, Public Law 106-390, is the current federal statute addressing hazard mitigation planning. It amended the Stafford Act to require the preparation of hazard mitigation plans by state, territorial, and local governments emphasizing planning for disasters before they occur. The law emphasizes identifying and assessing the risks to states and local government from natural disasters, implementing adequate measures to reduce losses from natural disasters, and ensuring that the critical services and facilities of communities will continue to function after a natural disaster (Public Law 106-390, Title I, Section 101 (a) (2)). The requirement for a SHMP is continued as a condition for disaster assistance. The CNMI must have an approved SHMP meeting the requirements in 44 CFR 201.4 as a condition of receiving the Stafford Act assistance and FEMA mitigation grants listed in Table 1.1.

Table 1.1. Non-Emergency Stafford Act Assistance Programs.

Program	Description
Public Assistance Categories C-G	Post-Disaster reimbursement of response and recovery costs
Fire Management Assistance Grants	Mitigation, management, and control of fires on publicly or privately owned forests or grassland that threatened destruction that would constitute a major disaster
Building Resilient Infrastructure and Communities (BRIC)	Pre-disaster funding for mitigation and community resilience projects and plans
Hazard Mitigation Grant Program (HMGP)	Post-disaster funding for mitigation and community resilience projects and plans
HMGP-Post Fire	Assistance to help communities implement hazard mitigation measures after wildfire disasters
Flood Mitigation Assistance (FMA)	Pre-disaster funding for flood hazard mitigation and community resilience activities that benefit properties insured under the National Flood Insurance Program (NFIP)

1.2.3 Final Rule 44 CFR Part 201

44 CFR 201.4(a). States must have an approved standard state mitigation plan meeting the requirements of this section as a condition of receiving non-emergency Stafford Act assistance and FEMA mitigation grants.

Title 44 was last amended 8/29/2023 (https://www.ecfr.gov/current/title-44). Published in the Federal Register in April 2014, the Final Rule (44 CFR Part 201) standardizes the frequency of Standard and Enhanced State Mitigation Plan updates and requires that plans be resubmitted every 5 years.

The CNMI will continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in Commonwealth or federal laws as required in 44 CFR 13.11(d).

The following FEMA guides and reference documents were used to prepare the 2024 SHMP Update. Refer to the References section for a complete list of resources used to prepare the plan.

- State Mitigation Planning Policy Guide, effective April 19, 2023
- State Mitigation Planning Key Topics Bulletins: Planning Process, October 2022
- State Mitigation Planning Key Topics Bulletins: Risk Assessment, October 2022
- State Mitigation Planning Key Topics Bulletins: Mitigation Capabilities, November 2022

- State Mitigation Planning Key Topics Bulletins: Mitigation Strategy, October 2022

1.3 CNMI Hazard Mitigation Responsibilities and Roles

This section outlines the roles and responsibilities for implementing mitigation actions among all levels of government and the private sector. Funding and technical assistance for hazard mitigation may be available from all levels of government and the private sector. The mitigation planning team engaged agency staff and community members and reviewed myriad plans to identify mitigation goals and objectives. These goals, objectives, and actions, as well as potential sources of funding, are discussed further in Chapter 6.0 (Mitigation Strategy). Responsibilities of each tier of government involvement are discussed below.

1.3.1 Federal Agency Responsibility

The primary responsibility of the federal government is to provide leadership by administering programs that support and encourage planning and implementation of actions to increase the resilience of the built environment to identified hazards to minimize potential damage and loss. Federal agencies create partnerships and support applied research on priority mitigative issues. Federal agencies are responsible for evaluating and mitigating risk to federal facilities.

1.3.2 Commonwealth Government Responsibility

The CNMI government is required to uphold federal regulations to reduce hazard losses and must seek to provide resources to achieve these goals. The CNMI government includes several agencies that help to identify, plan for, and mitigate natural hazards to minimize damage from these hazards to the built and natural environments, communities, and cultural resources. The CNMI government includes divisions and programs to address natural hazards and mitigation planning.

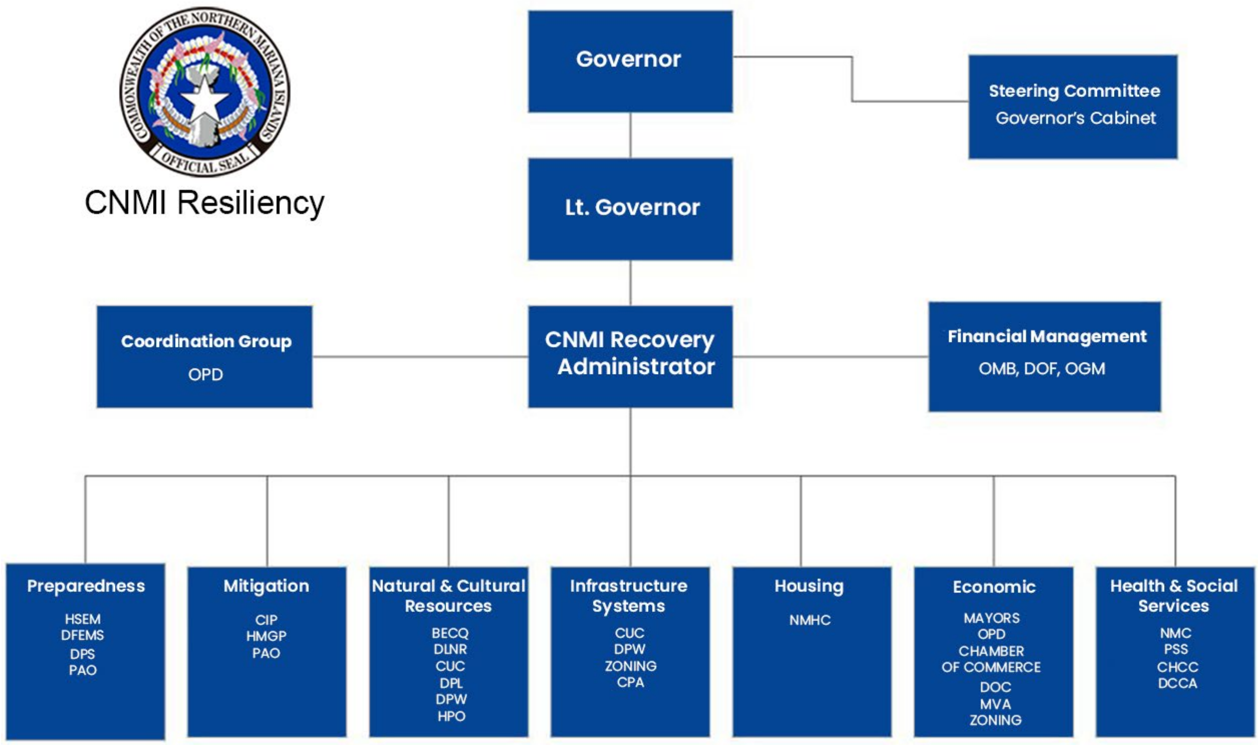
1.3.3 Local Island Government Responsibility

The principal role of the CNMI Mayoral Offices is to educate residents about natural hazards and promote mitigation planning and action.

1.3.4 Role of the Governor's Office

Under Article III, Section 10 of the Commonwealth Constitution, the Governor may declare a state of emergency in the case of invasion, civil disturbance, natural disaster, or another calamity. This declaration gives the Governor the authority to mobilize all government resources in preparation for and in response to the incident.

Since 2018, the Office of the Governor established the CNMI Recovery Administrator to coordinate recovery and mitigation efforts following Super Typhoon *Yutu* and the coronavirus disease 2019 (COVID-19) pandemic. To help coordinate efforts, the Office of Grants Management & State Clearinghouse and the Department of Finance used funds received from the federal Department of the Interior Office of Insular Affairs to develop a website to coordinate disaster recovery and to streamline financial management and reporting efforts of the recovery process following the devastation of Super Typhoon *Yutu* and Typhoon *Mangkhut* in 2018. The website will support the mission of capturing and processing documents of all disaster-related grants the CNMI has received in the aftermath of the two storms and serve as a conduit for information, financial management, and progress.



Source: https://www.cnmidr.gov.mp/recovery-management-structure.

1.3.5 Role of the State Hazard Mitigation Officer (SHMO)

The SHMO implements hazard mitigation activities throughout the Commonwealth. The SHMO provides expertise, guidance, advice, and assistance to the various components of the community, which include the various governmental agencies as well as representatives from the private sector that include business associations and individual community members. Additionally, the SHMO establishes requirements and determines entitlements for several grant programs. For purposes of this plan, the role of the SHMO is to coordinate with other agencies in implementing mitigation measures. The SHMO will also support implementation activities by helping lead agencies identify, coordinate, and obtain technical and financial resources. The SHMO will prepare progress reports and manage the Hazard Mitigation Grant Program (HMGP).

1.3.6 Role of the CNMI Homeland Security and Emergency Management

Public Law 18-04 authorized the CNMI Homeland Security and Emergency Management (HSEM) as the primary Commonwealth agency responsible for response coordination of significant emergencies and major disasters within the CNMI. HSEM is designated as the lead coordinating agency in the CNMI Emergency Operations Plan (EOP). The Special Assistant to Homeland Security and Emergency Management (SAHSEM) is responsible for coordinating all public and private organizations that provide emergency services within the CNMI and for is responsible to activate and staff the Emergency Operations Center (EOC). The SAHESM convenes the Multi-Agency Coordination Group (MAC Group formerly the Response Activity Coordinators [RAC]) to deliberate on policy and legal issues that arise in a complex, multi-agency response to an emergency or disaster. The MAC Group advises the SAHSEM to ensure that coordinated incident planning and operations occur through the EOC. Members of the MAC Group generally include the Governor's cabinet staff and other response organizations (e.g., Volunteer Organizations Active in Disasters [VOAD], American Red Cross, Salvation Army, etc.), involved agencies and senior officials of other relevant agencies and jurisdictions, as needed.

HSEM is responsible for preparation and updates to the CNMI All-Hazards Plan and associated annexes, the Threat Hazard Identification and Risk Assessment (THIRA) on a 3-year cycle, and the Stakeholder Preparedness Review (SPR) report annually. In 2023, the THIRA review process was completed for the Commonwealth. HSEM is also responsible for requesting federal disaster assistance and for coordinating with federal agencies.

1.3.7 Role of the CNMI Hazard Mitigation Grant Program

The Office of the Governor-HMGP works with FEMA to develop hazard mitigation plans and implement Hazard Mitigation Assistance (HMA) projects to help the CNMI rebuild, reduce, or mitigate future disaster losses. These projects help the Commonwealth rebound better, quicker, and safer, thus becoming a more resilient community altogether. Federal funding from FEMA grants is used to protect undamaged parts of a facility or prevent or reduce damage caused by future disasters. HMGP is responsible for producing and updating the SHMP on a 5-year cycle as well as to administer federal mitigation grants such as Building Resilient Infrastructure and Communities (BRIC) program, Flood Mitigation Assistance (FMA) program, HMGP, and Fire Management Assistance Grant (FMAG) program.

1.3.8 Office of Planning and Development

On October 6, 2017, Governor Torres signed into law Senate Bill No. 20-02, SD3, HD1 entitled *To establish the Office of Planning and Development, and for other purposes* (Public Law 20-20, 1 CMC §§ 20171–20186). This law directs the newly created Office of Planning and Development to create a *Comprehensive Sustainable Development Plan for the CNMI* (OPD, 2021) that includes a safety element for the protection of the community from natural and man-made hazards including features necessary for such protection. Commonwealth-wide planning in coordination with the CNMI's local island governments is envisioned by this law.

1.4 Summary of Changes and/or Updates to the 2018 Standard State Mitigation Plan

In accordance with FEMA guidance, each SHMP update builds upon and improves upon the previous SHMP. Highlights of the 2024 SHMP Update compared to the previous plan are presented below.

1.4.1 Chapter 2—CNMI Planning Area Profile

For the 2024 SHMP Update, all data presented in the CNMI Planning Area Profile was updated. Climate change information was expanded and improved. Climate change was acknowledged as a factor that will amplify severe weather events in the future. The discussion about community lifelines was expanded.

1.4.2 Chapter 3—Planning Process

For the 2024 SHMP Update, to assist with a comprehensive update process, outreach and engagement was improved with agencies in multiple sectors and the members of the public. The following sectors were engaged throughout the update process: emergency management, flood plain administration, health and social services, infrastructure, natural and cultural resources, non-governmental agencies, and the public. In February 2024, two outreach meetings were held on each of the main islands: Rota, Saipan, and Tinian. The Mayor of the Northern Islands was invited to the meetings on Saipan where the Mayor's office is located. On each island, public meetings were held in the afternoon to target government personnel and in the evening to target the general public. Surveys were made available to government personnel and the general public to engage and gather information about natural hazards and the respondent's experience and knowledge of these hazards, knowledge and awareness of preparedness programs and mitigation actions.

1.4.3 Chapter 4—Risk Assessment

For the 2024 SHMP Update, the hazard profiles were reorganized to include the risk assessment and loss evaluation. For the risk assessment, the following asset categories were adopted: 1) Commonwealth owned and operated buildings, critical facilities, infrastructure, and community lifelines; 2) Commonwealth roads; 3) general building stock; 4) population; 5) natural resources; and 6) cultural resources.

1.4.4 Chapter 5—Mitigation Capabilities Assessment

For the 2024 SHMP Update, a comprehensive assessment of current mitigation capabilities was completed. Key areas of the evaluation included reviews of: 1) Commonwealth laws, regulations, policies, programs, and plans related to hazard mitigation with particular emphasis on land use laws; 2) participation in and administration of the National Flood Insurance Program and other national mitigation programs including challenges experienced by the Commonwealth; 3) processes used by the Commonwealth to support and facilitate mitigation planning including a review the administration of hazard mitigation programs, education and outreach, administrative and technical support, and partnerships, and 4) the process to adopt and enforce building codes and safety. The ability of the Commonwealth to apply for and use federal grants, such as BRIC, Pre-Disaster Mitigation, Community Development Block Grant-Disaster Recovery, to implement mitigation actions is discussed. Mitigation capability obstacles and challenges to mitigation implementation were identified by plan stakeholders. The obstacles and associated opportunities to overcome these barriers are summarized.

1.4.5 Chapter 6—Mitigation Strategy

The mitigation actions described in the 2018 Standard State Mitigation Plan (SSMP) were each evaluated to determine the implementation status and relevance to ongoing mitigation needs. The 2018 SSMP actions were organized into a table to facilitate the evaluation. Because several major disasters occurred during the 5-year plan implementation period (2018–2023), post-disaster recovery projects were added to the evaluation. Several new mitigation actions were added for the 2024 SHMP Update. New evaluation criteria were developed, including cost-effectiveness, environmental soundness, and technical feasibility, to evaluate all actions carried over from the 2018 SSMP new actions for the 2024 update. These criteria were used to prioritize the mitigation actions and the results are provided in a table that related the mitigation actions back to relevant mitigation goals and objectives. Potential funding sources, including but not limited to FEMA grant programs, were identified for each mitigation action.

1.4.6 Chapter 7—Plan Implementation and Maintenance

For the 2024 update, the process to regularly monitor and review the plan was developed. Roles and responsibilities for SHMP implementation and monitoring are clearly assigned. A schedule for annual activities is provided to guide implementation, monitoring, and evaluation of the SHMP.

1.5 Plan Adoption

S19. Did the state provide documentation that the plan has been formally adopted? [44 CFR § 201.4(c)(6)]

Adoption of the SHMP signifies the commitment of the Commonwealth to implement the mitigation strategy and use the SHMP and its contents to guide hazard mitigation and resilience efforts over the next five years. The SHMP is the culmination of information provided by numerous stakeholders from local government agencies, federal government agencies, nonprofits, private entities, and the community. The goals, objectives, and actions identified in the SHMP serve to communicate the priorities of the Commonwealth for reducing vulnerability and building resilience.

The plan serves as the Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan and is formally adopted by the Governor of the Commonwealth, as required by 44 CFR 201.4(c)(6). On July 28, 2024, the Governor adopted the 2024 SHMP Update after receiving "Approvable Pending Adoption" status from FEMA on July 22, 2024. Following adoption by the Governor, the adoption resolution was submitted to FEMA and the FEMA Regional Administrator of FEMA Region 9 provided full approval of the 2024 SHMP Update on August 5, 2024. The effective period of the 2024 SHMP Update is July 28, 2024, through July 27, 2029.

1.5.1 Adoption resolution for the 2024 State Hazard Mitigation Plan Update from the Commonwealth of the Northern Mariana Islands Governor

Arnold I. Palacios
Governor

David M. Apatang
Lieutenant Governor

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
OFFICE OF THE GOVERNOR

July 28, 2024

GOV 2024-491

Sent via email: Kathryn.Lipiecki@fema.dhs.gov
Ms. Kathryn J. Lipiecki
Director, Mitigation Division
FEMA Region 9
US Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607

Subject: Adoption of State Hazard Mitigation Plan 2024 Update for the CNMI

Dear Ms. Lipiecki:

This letter serves to inform you that I have officially adopted the State Hazard Mitigation Plan 2024 Update (SHMP 2024 Update), as approved by FEMA, in compliance with the Disaster Mitigation Act of 2000 Public Law 106-390, §104(a), 42 USC §5165, through Directive 2024-005.

Please note that the SHMP 2024 Update reflects a change in document title from the previous "Standard State Mitigation Plan 2018". The change in name was deemed necessary for title specificity (i.e., "hazard" mitigation) and consistency with hazard mitigation plan titles for other states and territories.

Recent natural disasters that have impacted the life, health, and safety of CNMI residents and the CNMI economy demonstrate the need for the CNMI to proactively implement a range of hazard mitigation actions that will build community resiliency and reduce recovery time and costs for future natural hazard events.

The SHMP 2024 Update is particularly relevant in the context of changing climate conditions. Accelerated climate change affects the frequency, magnitude, and duration of natural hazard events, most notably typhoons, wildland fires, drought, extreme heat, and coastal inundation.

The SHMP 2024 Update serves as a valuable resource for government and community stakeholders. The SHMP 2024 Update presents updated hazard profiles based on empirical data and most recent relevant scientific literature. A range of mitigation actions are presented for the 5-year SHMP 2024 Update period. Mitigation actions are presented for implementation at the community, territorial

Juan A. Sablan Memorial Building • 12296 Pagan Loop • Capitol Hill, Saipan
Caller Box 10007 • Saipan, MP 96950 • (670) 237-2200 • governor.gov.mp

government, and federal government levels. Consideration for socially vulnerable populations is included throughout the SHMP 2024 Update.

Through progressive implementation of mitigation actions over the next 5 years the CNMI will build resiliency to natural disaster events. Successful mitigation actions will reduce natural disaster impacts on government functions and community quality of life and allow CNMI residents to return to normal socio-economic conditions as early as possible following a natural disaster event.

For questions or discussion on the SHMP 2024 Update adoption, please contact Ms. Elizabeth S. Balajadia, P.E., CNMI Hazard Mitigation Officer, at (670) 664-2402, or by email at elizabeth.balajadia@gov.mp.

Sincerely,

Arnold I. Palacios
Governor
Commonwealth of the Northern Mariana Islands

Enclosure

cc: Robert J. Fenton, Regional Administrator, FEMA Region 9
David M. Apatang, Lieutenant Governor, CNMI
Elizabeth S. Balajadia, P.E., Hazard Mitigation Officer, CNMI

Juan A. Sablan Memorial Building ▪ 12296 Pagan Loop ▪ Capitol Hill, Saipan
Caller Box 10007 ▪ Saipan, MP 96950 ▪ (670) 237-2200 ▪ governor.gov.mp

Arnold I. Palacios
Governor

David M. Apatang
Lieutenant Governor

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
OFFICE OF THE GOVERNOR

DIRECTIVE 2024-005

Date:	June 28, 2024
To:	All Department, Office, and Activity Heads
From:	Governor
Subject:	Formal Adoption of the 2024 CNMI State Hazard Mitigation Plan

This Directive formally adopts the August 2024 Update of the CNMI State Hazard Mitigation Plan (SHMP) in compliance with the Disaster Mitigation Act of 2000 (DMA 2000), Public Law 106-390, § 104(a), codified at 42 U.S.C § 5165. The DMA 2000 mandates that every State and Territory in the United States must develop, update, and obtain FEMA approval of its SHMP every five years to remain eligible for pre-disaster and post-disaster mitigation grant programs. The 2024 SHMP Update satisfies this requirement, building upon previous updates approved by FEMA in 2018, 2014, 2010, 2007, and 2004.

Recent catastrophic typhoons that have ravaged the CNMI underscore the urgent need for proactive hazard mitigation to enhance resilience against future typhoons and other natural and man-made hazards. Climate change is significantly altering global weather patterns, leading to extreme cold, extreme heat, drought, more frequent and intense storms, flooding, coastal inundation, and sea level rise. The CNMI is also susceptible to other natural hazards, including volcanic eruptions and frequent earthquakes, because it is located atop the Marianas Ridge along the Marianas Trench within the Pacific Ring of Fire, one of the world's most seismically active regions.

Natural hazards and evolving environmental conditions compel us to reassess our built environment, recognize vulnerabilities, and continue developing long-term hazard mitigation plans and strategies. Our objective is to strengthen infrastructure, protect critical facilities, industries, businesses, and residences, and minimize disaster impacts while facilitating effective recovery efforts. Promoting smart, safe growth and sustainable economic development are key goals.

The adoption of the 2024 SHMP update provides the CNMI with essential resources, including hazard analyses, risk vulnerability assessments, and mitigation goals, objectives, and strategies. This enables the CNMI to qualify for FEMA's pre-disaster and post-disaster hazard mitigation grant programs, thereby reducing the loss of life and property, minimizing economic disruption, safeguarding ecosystems and critical habitats, and preserving cultural and historic resources.

Juan A. Sablan Memorial Building • 12296 Pagan Loop • Capitol Hill, Saipan
Caller Box 10007 • Saipan, MP 96950 • (670) 237-2200 • governor.gov.mp

The Office of the Governor, in collaboration with the Hazard Mitigation Grant Program, led the coordination of the 2024 update of the CNMI SHMP, with technical assistance provided by Nimbus Environmental Services.

By the authority vested in me under the CNMI Constitution, Article III, § 10, and pursuant to Public Law 18-4, which established the CNMI Homeland Security and Emergency Management Office, I hereby formally adopt the updated 2024 CNMI State Hazard Mitigation Plan. I urge prompt implementation by all government agencies and organizations, the private sector, and our community to enhance the CNMI's resilience against all hazards.

Regards,

Arnold I. Palacios

2

Juan A. Sablan Memorial Building • 12296 Pagan Loop • Capitol Hill, Saipan
Caller Box 10007 • Saipan, MP 96950 • (670) 237-2200 • governor.gov.mp

1.5.2 Approval letter for the 2024 State Hazard Mitigation Plan Update from the Regional Administrator of FEMA Region 9

U.S. Department of Homeland Security
FEMA Region 9
1111 Broadway, Suite 1200
Oakland, CA 94607

FEMA

August 5, 2024

The Honorable Arnold I. Palacios
Governor of the Commonwealth of the Northern Mariana Islands
Caller Box 10007
Saipan, MP 96950

Reference: Approval of the Commonwealth of the Northern Mariana Islands (CNMI) State Hazard Mitigation Plan

Governor Palacios:

The Federal Emergency Management Agency (FEMA) Region 9 approves the Commonwealth of the Northern Mariana Islands (CNMI) State Hazard Mitigation Plan effective July 28, 2024 through July 27, 2029. This plan is approved in accordance with applicable mitigation planning regulations and policy requirements.[1] In addition, this plan meets the requirements to address wildfire risks and mitigation measures.

An approved state hazard mitigation plan is a condition of receiving certain FEMA non-emergency assistance and mitigation grants from the following programs:

- Public Assistance Categories C-G (PA C-G)
- Fire Management Assistance Grants (FMAG)
- Hazard Mitigation Grant Program (HMGP)
- Hazard Mitigation Grant Program Post-Fire (HMGP-PF)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- Safeguarding Tomorrow Revolving Loan Fund (STORM RLF)
- Pre-Disaster Mitigation (PDM)

Approval of a state hazard mitigation plan does not guarantee funding under any FEMA program. Please refer to the individual FEMA non-emergency assistance and mitigation grant program policy and/or annual Notice of Funding Opportunities for specific application and eligibility requirements for the FEMA programs listed above.

[1] Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended; the National Flood Insurance Act of 1968, as amended; Title 44 Code of Federal Regulations (CFR) Part 201; and the "Water Infrastructure Improvements for the Nation Act," or the "WIIN Act," on December 16, 2016, which amends the National Dam Safety Program Act (Pub. L. 92-367).

2024 CNMI Hazard Mitigation Plan Approval Notice
August 6, 2024
Page 2 of 2

State hazard mitigation plans must be updated and resubmitted to FEMA Region 9 for approval every five years. If the plan is not updated and approved by July 27, 2029, the plan is considered lapsed, and FEMA will not obligate funds until the mitigation plan is approved.

If at any time over the plan approval period FEMA determines that the CNMI is not complying with all applicable federal statutes and regulations in effect during the periods for which it receives funding or is unable to fulfill mitigation commitments, FEMA may take action to correct the noncompliance (44 CFR §201.3[b][5] and §201.4[c][7]).

FEMA will provide a reminder at least 12 months before the plan expiration date of the consequences of not having an approved state hazard mitigation plan, which is required to apply for and receive funding for FEMA non-emergency assistance and mitigation grant programs. To continue to apply for and receive funding from the programs listed on page 1, the CNMI must submit a draft of the next plan update before the end of the approval period and allow sufficient time for the review and approval process. This includes any revisions, if needed, and formal adoption by the state following the determination by FEMA that the plan has achieved a status of "approvable pending adoption."

We look forward to working with you to discuss the status of the state hazard mitigation program each year over the approval period of this plan. If you have any questions please contact Kathryn Lipiecki, Mitigation Division Director, by phone at (215) 313-4176, or by email at kathryn.lipiecki@fema.dhs.gov.

Sincerely,

Robert J. Fenton
Regional Administrator

Enclosure (1)
CNMI Plan Review Tool, dated July 28, 2024

cc: David M. Apatang, Lieutenant Governor, CNMI Office of the Governor
Brien S. Nicholas Jr., Special Assistant, CNMI Office of the Governor
Elizabeth S. Balajadia, P.E., Capital Improvement Program Administrator, CNMI Office of the Governor
Kathryn Lipiecki, Mitigation Division Director, FEMA Region 9
Alison Kearns, Planning and Implementation Branch Chief, FEMA Region 9

2.0 CNMI Planning Area Profile

2.1 Historic Overview

This section provides a brief overview of the human history of the CNMI. It is organized according to archaeologically defined and historical temporal periods, to provide context for the history of the Commonwealth. Section 2.10 (Cultural Resources) describes the historic properties listed on the National Register of Historic Places and National Historic Landmarks in the CNMI.

The prehistoric period of the CNMI has been reconstructed using a combination of archaeological research, ethnographic interviews, oral traditions, and historic documents during European contact (Office of Historic Preservation, 2011). Early settlement of the CNMI began when ancestors of the modern Chamorro people sailed from Southeast Asia and settled in the Marinas (Saipan, Tinian, Rota, and Guam) approximately 4,000 years ago. They brought ceramics, canoes, domesticated animals, and cultivated crops such as banana, taro, sugarcane, breadfruit, and coconuts. While rare due to poor preservation, archaeological research has identified a variety of archaeological features and artifacts from the Pre-Latte Period (3,500 to 1,600 years ago) early settlement sites along coastal beach areas and inland rock shelters or caves. Costal settlements relied heavily on marine resources for subsistence. Lithic tools, ceramics, canoes, and ornaments made from stone, bone, and marine shell are common during this period (Reinman, 1977).

During the Latte Period (1000 Common Era (CE) to 1668 CE) settlements expanded to inland and coastal environments on the islands of Rota, Tinian, Saipan, and Aguiguan. This expansion signified an increase in prehistoric population and an expansion of subsistence practices to include terrestrial faunal and rice. It is during the Latte Period that megalithic architecture appears in the archaeological record. Limestone pillars and capstones were erected in two parallel rows and were used to support pole and thatched residential and communal houses. The largest Latte Period site, House of Taga, is located on Tinian. The House of Taga is listed on the National Register of Historic Places. Basalt grinding stones, lithic quarries and artifact scatters, rock art, and burials are often found beneath or adjacent to latte structures.

Ferdinand Magellan visited the Mariana Islands in 1521, and the Spanish crown claimed the islands in 1565. During the Spanish Period (1668 to 1899 CE), the islands became an important stop for galleons along the trade route between Acapulco and Manila. By 1668, Spain formally colonized the islands with the arrival of Jesuit priests and the islands were renamed *Las Marianas* in honor of the Queen Regent, Mariana de Austria. Guam became the seat of the Spanish administration. Efforts to colonize the Chamorro were met with resistance at Saipan and Guam until a four-year *reducción* or contraction program was set up either through ecclesiastical or royal authority to facilitate colonization. Chamorros were converted to the Catholic faith and restricted to settlements in mission villages on Guam, Saipan, and Rota by the early 1700s. Rota was the only island that maintained a permanent population during this period. Warfare, disease, forced religious conversion and resettlement resulted in a 90% decline of the Chamorro population and a loss of many traditional cultural practices and oral histories. Carolinians from the Central Caroline Islands emigrated to the Marianas in the early 19th century using sturdy trans-oceanic canoes and traditional wayfinding techniques. They established a village on Saipan. Carolinian sailing and navigational skills were used by the Spanish to transport passengers and cargo between Guam and the other islands in the archipelago. By the mid-1800s, Chamorros living on Guam began resettling on Saipan. The Spanish christened the Carolinian and Chamorro settlement on Saipan the San Isidro de Garapan in 1858 after the Catholic Church was established. Remnants of buildings, mission structures, villages, shipwrecks, and archaeological deposits have been documented that date to the Spanish Period.

Following the Spanish-American War, Spain sold the Northern Mariana Islands to Germany in 1898 and the islands remained under the German flag until the beginning of World War I in 1914. During the German Period (1899–1914), the Germans established an administrative center in Saipan after the capture of Guam by the US in 1898. Germany developed a hospital and other public buildings across the colony, but few sites remain due to development and construction activities during the Japanese Period and shelling during World War II. German colonists were encouraged to emigrate to the Northern Mariana Islands, with copra production the main agricultural interest. In October 1914, the German administration was forced out of the islands and the Japanese navy took possession of the Northern Marianas and the rest of Micronesia. Historic resources from the German Period include the remnants of a German Stairway which is currently under review by the Historic Preservation Office.

After World War I, Japan received the Northern Marianas from the League of Nations was composed of World War I allied powers whose charter, known as the Covenant, was approved as part of the Treaty of Versailles at the Paris Peace Conference in 1919. The purpose of the Covenant was to “promote international cooperation and to achieve international peace and security.” Under this establishment, the islands were administered by Japan, who had been allies with the United States, Great Britain, and France during the latter part of the World War I.

During the Japanese Period (1914–1944), large sugarcane plantations and refineries were started on Saipan and Rota as part of a broad economic development plan. Formal educational facilities emphasized learning the Japanese language. In preparation for war, Japan began to fortify the islands by the 1930s, and by 1941 it had constructed airfields and naval stations. In 1935, Japan withdrew from the League of Nations but continued to occupy the Northern Mariana Islands. Historic resources from the Japanese Period include agricultural buildings, factories, mining sites, roadways, farmsteads, hospitals, stores, administrative buildings, and Shinoto shrines.

The Japanese fortified their hold on the Northern Marianas by relocating more Japanese personnel and citizens to the islands after the attack on Pearl Harbor on December 7, 1941. Japan proceeded to take Guam from the US, and Saipan, Tinian, Rota, Pagan, Agrihan, and Guam became bases for Japanese expansion. By 1944, the Japanese population outnumbered the Chamorros and Carolinians. On June 15, 1944, US aerial and naval forces bombardment of

Saipan began in anticipation of US marine landings. The US forces battled with some 30,000 Japanese military personnel that were garrisoned within the islands. American forces gained control of the islands on July 1944 and the islands would become a key strategic and logistical point against Japan that brought an end to World War II. Saipan, Tinian, and Guam become Allied bases for the bombing of Japan. The atomic bombs dropped on Hiroshima and Nagasaki were flown from the northern air base on Tinian. Historic resources related to World War II comprise the largest quantity of sites in the CNMI. These resources include airfields, hospitals, defensive gun stations, ammunition storage areas, shipwrecks, plane crashes, equipment dumps, officer housing, tunnels, caves, and mass grave sites (McKinnon, 2015; McKinnon & Carrell, 2014).

During the Post-War Period (1945–present) the Northern Mariana Islands were not a permanent legal possession of Japan at the time of the World War as it had only been entrusted to Japan under a mandate by the League of Nations. Therefore, the US could not strip territory from defeated Japan since the islands were never recognized as permanent legal possession of Japan in the first place. In July 1947, President Harry S. Truman signed an agreement with the United Nations, the successor to the League of Nations, to administer the Northern Marianas as a district within the Trust Territory of the Pacific Islands. During this period, civil administration was given to the US Navy under a Trusteeship Agreement with the United Nations. Architectural historic resources from the Post-War Period include churches, commercial buildings, districts, government buildings, and residences.

During the 1950s and early 1960s, the Nationalist Chinese and Tibetan guerillas used Saipan as a secret training base reportedly directed by the Central Intelligence Agency. The islands were generally off-limits to all but the local residents and military personnel. In 1962, the United Nations Trusteeship was transferred to the US Secretary of the Interior. Saipan became the capital of the Trust Territory of the Pacific Islands. In 1969, efforts to reunify with Guam were unsuccessful and the Northern Marianas were separated from the Trust Territory government. A Covenant to establish the Commonwealth of the Northern Mariana Islands was approved by the Marinas District Legislature in 1975 and signed into law by President Gerald Ford on March 24, 1976. Under this agreement, the CNMI is entitled to participate in federal programs including the Historic Preservation Fund program administered by the National Park Service.

During the Economic Boom Period (1986–2000) Saipan became the focus of tourist-related development with investors from Japan, Korea, and China. Tourist-related facilities such as resort hotels, golf courses, shops and restaurants were constructed on public and private leased lands. During this period, the CNMI became a production center for garment manufacturing. Foreign-owned factories were constructed throughout the CNMI, with the factories staffed by guest workers from Bangladesh, China, Philippines, and other Asian countries. In the 2000s geopolitical events and allegations of worker exploitation resulted in a dramatic decrease in tourism and the closure of the last garment factory in 2009. The US federal government took control of immigration in the CNMI on November 28, 2009, after President Barack Obama signed US Public Law 110-229 into law in May 2008. Abandoned buildings such as the La Fiesta Mall are a vivid reminder of the economic downturn that followed the economic boom.

2.2 Governing body

The CNMI is an unincorporated, self-governing territory of the United States. The CNMI became a US territory in 1975 after the Federal law (the Covenant) was ratified. By 1977, the CNMI adopted its constitution, and the first constitutional government was formed in 1978. The people of the CNMI have been represented by US Congressman Gregorio Kilili Camacho Sablan, a delegate in the House of Representatives since January 2009. The CNMI does not have a voting representative in the US Congress.

Since January 2023, the CNMI government has been headed by the Honorable Arnold I. Palacios, the 10th Governor of the CNMI, alongside Lieutenant Governor David M. Apatang. The CNMI is divided into 4 municipalities, which include Saipan, Tinian, Rota, and the Northern Islands. The seat of the CNMI government is located on Saipan, the largest and most populated island in the Mariana archipelago after Guam. There are no cities or towns in the Northern Marianas. Urban areas are usually referred to as villages or communities and none are incorporated with fixed, surveyed boundaries.

2.3 Physical Setting

2.3.1 Geography

The CNMI is in the northwestern Pacific Ocean between the Philippine Sea to the west and the Pacific Ocean to the east (Latitude: 15°12’43” N/Longitude: 145° 45’13” E) (Figure 2.1). Composed of 14 islands, five of which are inhabited, CNMI forms part of the 180 miles long Mariana Archipelago that is the back arc of the Mariana arc-trench system. CNMI has a total land area of approximately 112,952 acres at high tide and 117,770 acres during low tide. Located east of the Philippines and south of Japan, the Northern Mariana Island Archipelago extends 464 miles in a north/south orientation from Rota on the south to the northern island of Farallon De Pajaros (also known as Uracas).

The islands of the Mariana Archipelago range greatly in size; Farallon de Medinilla, is the smallest with < 1,250 acres of land and Guam the largest with 134,425 acres of land (Table 2.1). The largest island in the CNMI is Saipan, with a total land area of 134,425 acres. In contrast, the land area for the ten islands north of Saipan combined (No'os to Uracas) is only about 39,537 acres. Size, geology, and distance influence population densities and growth trends.

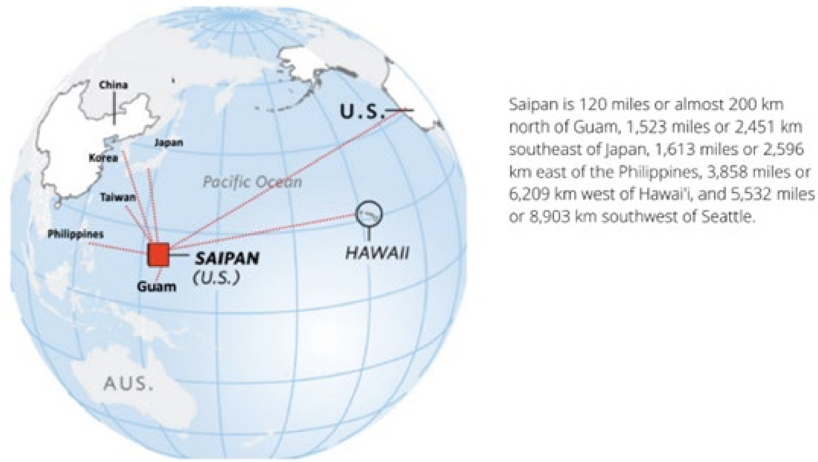


Figure 2.1. The Marianas in a global context.
Source: Draft–2023 Resources Report (OPD, in prep).

Table 2.1. CNMI island area, elevation, and population from south to north.

Island	Land Area (acres)	% of Total Area	Maximum Elevation (ft)	2020 Population	% of Total Population
Rota	21,036	18.0	1,627	1,893	4%
Aguiguan	1,732	1.5	187	Uninhabited	--
Tinian	25,012	21.4	614	2,044	4%
Saipan	29,400	25.2	1,555	43,385	92%
No'os (FDM)	183	0.2	82	Uninhabited	--
Anatahan	8,379	7.2	2,585	Uninhabited	--
Sarigan	1,105	0.9	1,765	Uninhabited	--
Guguan	1,048	0.9	942	Uninhabited	--
Alamagan	3,203	2.7	2,441	1	< 1%
Pagan	11,800	10.1	1,870	2	< 1%
Agrihan	10,885	9.3	3,166	4	< 1%
Asuncion	1,942	1.7	2,812	Uninhabited	--
Maug	529	0.5	745	Uninhabited	--
Uracas	556	0.5	1,181	Uninhabited	--
Total	**116,810**	**--**	**--**	**47,329**	**100%**

Adapted from *Wildlife Action Plan for the CNMI 2015–2025* (Liske-Clark, 2015).
Source for area and elevation Brainard et al. (2012), except No'os, Camp et al. (2015).
Source for human population figures for Rota, Tinian, and Saipan 2020 US Census Bureau (2024); Northern Island populations are estimates.

The island of Saipan, oriented in a north/south direction, is the largest of the Northern Mariana Islands and is comprised of approximately 29,400 acres. The uplands rise to a maximum altitude of 1,555 ft above mean sea level at Mount Tapochau. The island slopes step down to sea level in a succession of eroded horizontal limestone terraces that are separated by steep scarps. The 54 miles of coastline is irregular except on the western side where there is an existing fringing reef. Because of the complex geological composition of the island, many short and rugged valleys are formed between the extensive mountain range that extends from north to south. Saipan consists primarily of eroded limestone that overlies an old volcanic core. Due to the porosity of the limestone, there are relatively few perennial streams. These include Sadog Talufofo, Sadog Hasngot, and Sadog Denne, which flow near the central sector and drain towards the eastern side of the island, and Sadog Dogas and Sadog As Agatan, which drain towards the west. Several ephemeral streams also contribute to the continuity of the island's flowing water system.

The second largest island is Tinian, located 5 miles southwest of Saipan and is approximately 25,012 acres in area. The physical geography of the island can be distinguished in five landforms: a southeastern ridge, a median valley, a central plateau, a north-central highland, and northern lowland. Mount Kastiyu located along the southern ridge is the highest point of the island with an altitude of 614 ft above mean sea level. Tinian has a coastline of 38 miles. Limestone comprises approximately 98% of the island's surface, while volcanic rocks predominate below sea level and form the foundation of the island. The limestone is commonly coralliferous and highly porous, while the volcanic rock is composed of poorly sorted pyroclastic materials with low porosity. The surface terrain is dominated by flat terraces and plateaus are separated by steep scarp.

The island of Aguigan, located 5 miles south/west of Tinian, is uninhabited but periodically visited. Aguiguan is 3 miles long and 1 mile wide and 1,732 acres in size. The island is composed of sheer steep cliffs, with no natural harbor, bay, or beaches. The island is a mix of forests and fields.

The island of Rota is located approximately 71 miles south/southwest of Saipan and 30 miles north/northeast of Guam. The island is approximately 11 miles long and 3 miles wide and 21,036 acres in size. Rota has a coastline of 39 miles. The highest elevation on the island is Mount Sabana at 1,627 ft above mean sea level. The island has an excellent source of water from Matan Hanom Spring. Rota was not extensively developed during the Japanese occupation in World War II. Much of the landscape is preserved with native forest and fertile farmlands.

The Northern Islands consist of 10 islands with a combined land area of ~39,536 acres. On the island of Agrihan, stratovolcano Mount Agrihan has the highest elevation in the Northern Marina chain of islands with an elevation of 3,166 ft above mean sea level. Agrihan is densely forested with an area of 10,885 acres. Except for Pagan and periodically Anatahan, the remaining smaller northern islands are either uninhabited or have a small population of only a few residents.

2.3.2 Climate

The climate of the CNMI can be characterized as possessing relatively high and uniform temperatures with an annual mean temperature of 83°F. Average temperatures in Saipan range from 75 to 87°F (24 to 31°C) with the lowest and highest temperatures in the dry and wet season, respectively. The overall seasonal variation in mean monthly temperature is less than 3.5°F. However, there are some fluctuations in temperature which are primarily affected by elevation. The humidity is normally very high with monthly averages between 79% and 86%. This is offset by frequent wind patterns that provide relief. The humidity factor is most intense between the months of July and November.

The mean annual rainfall is approximately 83.8 inches, with intermittent variance throughout the year. The seasonal patterns are designated as dry and wet season, with greater rainfall experienced during the period of July through November. Average rainfall for the dry and wet seasons on Saipan are 20 inches (8 inches standard deviation) and 52 (13 inches standard deviation), respectively. However, rainfall across Saipan is variable and is affected by the topography. For example, the mean annual rainfall totals among recording stations on Saipan differ by as much as 15 inches, or approximately 20%. The region in the vicinity of Saipan's International Airport receives the lowest annual total of about 75 inches. The highest measured annual average of approximately 90 inches occurs at Capitol Hill and extends along the high ground from Marpi to Mount Tapochau. In addition, heavy and prolonged rainfall is usually associated with tropical depressions and typhoons that pass over or near the islands.

Within CNMI, there are three predominant wind patterns that commonly occur and include trade winds, doldrums, and typhoons. Trade winds are the results of wind circulation patterns that follow the North Pacific anticyclone, increasing in activity during the summer months. In the winter, there is a shift in the wind patterns by the arrival of the westerly and frontal influences from the North Temperate Zone becoming more prevalent. Westerly winds typically are characterized by the presence of strong winds and high wave activity from the southwestern section of the Pacific. The islands are situated within a fluctuation zone that lies between the Asiatic monsoon and the belt of northeast trade winds. On the island of Saipan, the trade winds are most prevalent between the months of November through March with an average wind speed of 9 knots (10.5 mph).

One of the most important drivers of climate in the region is the large-scale east-west tropical circulation and overturning of air known as the Walker circulation. This circulation is one of the primary drivers for seasonal winds and associated movement of weather systems across the equatorial Pacific. The Walker Circulation is one of the main reasons for Saipan's comfortable conditions from December–February.

Observed sea level pressure in the Pacific over the last century suggests that this circulation is weakening, and some climate models indicate that the weakened surface winds have altered the thermal structure and circulation of the tropical Pacific Ocean (Vecchi et al., 2006). Because this circulation affects all the various components that make up the CNMI's seasonal climate, the potential for further weakening of circulation in the Western North Pacific (WNP) during the 21st century poses some interesting implications regarding more specific climate variables.

On a shorter time scale the El Niño-Southern Oscillation (ENSO) introduces some of the most extreme variability to WNP climate patterns. During El Niño events the east-west circulation and trade winds that bring the CNMI its normal seasonal variation (cooler temperatures, regular rainfall, and consistent winds) weakens, and the CNMI faces greater potential for drought and typhoons. The cold phase of ENSO, La Niña, is characterized by a strengthening of the trade winds and east–west flow across the tropical Pacific. These events can increase rainfall in the region and bring higher sea levels as the enhanced east-west flow pushes surface water from the eastern Pacific toward the WNP.

Because of the extreme changes that ENSO can cause, any assertions concerning short-term impacts to regional climate come with uncertainty; however, long-term projections appear to place the average climate conditions of the future outside the range of current observed variability (Mora et al., 2013). For example, the mean high temperature experienced now in the CNMI will be similar to, if not less than, the average temperature in the CNMI in 2080. Keeping this concept in mind, a closer look at long-term climate change in the WNP is warranted, despite significant short-term variability.

A climate change profile for the CNMI is presented in Chapter 4.0 (Risk Assessment). Climate change is also discussed in the risk assessment for each hazard in Sections 4.2 through 4.10.

2.4 Demographics

Demographic data is essential for planning purposes. It sheds light on community characteristics or unique qualities that drive informed decisions for community programs and outreach. Demographic data provides detailed information on the social, economic, and housing characteristics of a community that can be used to understand whether strategies or policies actually make a difference. The following sections discuss updated demographic information derived from the 2020 US Census for the CNMI.

2.4.1 Resident population

Understanding the composition of the CNMI population, how it has changed in the past, and how it may change in the future is a powerful tool for uncovering the needs or strengths of the community to guide planning, policy development or decision making. Information about the total resident population is an important part of planning because it directly relates to housing, industry, public facilities and services, and transportation. According to 2020 US Census Bureau (2024), the population of CNMI was 47,329 residents with an institutionalized population of 0.4% (185). Most of the population is concentrated in Saipan, which has a total population of 43,385 residents. There was a 12.2% decline in population between the 2010 and 2020 US Censuses. In 2010, the population of CNMI was reported to be 53,883 residents. Resident population figures by municipality are shown in Table 2.2.

Table 2.2. CNMI resident population by municipality.

	Resident Population		
Municipality	**2010**	**2020**	**% Change**
Saipan	48,222	43,385	- 10%
Tinian	3,136	2,044	- 34.8%
Rota	2,527	1,893	- 25.1%
Northern Islands	0	7	--
Total	**53,885**	**47,329**	**- 12.2%**

Source for resident population, 2020 Census of the Commonwealth of the Northern Mariana Islands (US Census Bureau, 2024).

Saipan is the primary hub of residential and commercial activity within the CNMI. The 2020 Census reported 18,290 housing units in the CNMI, of which 16,523 were in Saipan. The highest concentration of residential housing units in Saipan is in Garapan followed by Finasisu, Dandan, Koblerville, and Susupe. Despite the smaller population size, 912 housing unit counts were reported in Rota with the highest concentration in Sinapalo followed by Songsong. In Tinian, 845 housing unit counts were reported with over half of the units located in San Jose. Renter occupied housing units (10,145) make up 71% of the total housing tenure on the CNMI.

The CNMI and Saipan in particular has experienced population growth and decline in the last few decades. In 2000 the population peaked at 62,392 people. By 2010, the population declined to 48,220. The Department of Public Lands commissioned a population forecast study in 2018 for use in their master plan. To develop population trends for 2028, the study examined three different scenarios for high, medium, and poor/negative future economic growth based on historical data, population trends for Northern Mariana descendants (Chamorro and Carolinian), non-Northern Mariana descendant residents, and foreign non-residents, and the CNMI Household Income and Expenditure Survey report, and the population projections were correlated with changes in labor demand for permanent jobs (DPL, 2019a). The 2028 projected population estimate for the CNMI ranges between 45,066 and 79,698 people. The projected population estimates for Saipan vary from a low of 40, 457 to a high of 67,414 people; Tinian from 2,325 and 8,707 people; and Rota from 2,284 and 3,577 people. The projected population estimates assume strong increases in tourism and a labor force.

The United Nations Population Division World Population Prospects published the average annual rate of population change for the CNMI in 2022. The chart shown in Figure 2.2 shows estimates and probabilistic projections of the total population of the CNMI (United Nations, 2022). The population estimates are based on all available sources of data (e.g., civil registration and vital statistics systems, population censuses, population registers, and household surveys) on population, housing, levels of fertility, mortality and international migration using Bayesian Hierarchical Modeling. The median (50%) prediction interval for the projected population of CNMI in 2029 shows a 0.30% growth rate. The 80% prediction interval suggests a population growth rate of 0.52%. The 95% prediction interval shows a population growth rate of 0.65% by 2029. Future levels of fertility and mortality scenario projections reflect the uncertainty of the projection based on historical variability of change in fertility, mortality, and migration. Prediction intervals reflect the spread in the distribution of outcomes across the projected trajectories and provide an assessment of uncertainty inherent in the medium scenario projection.

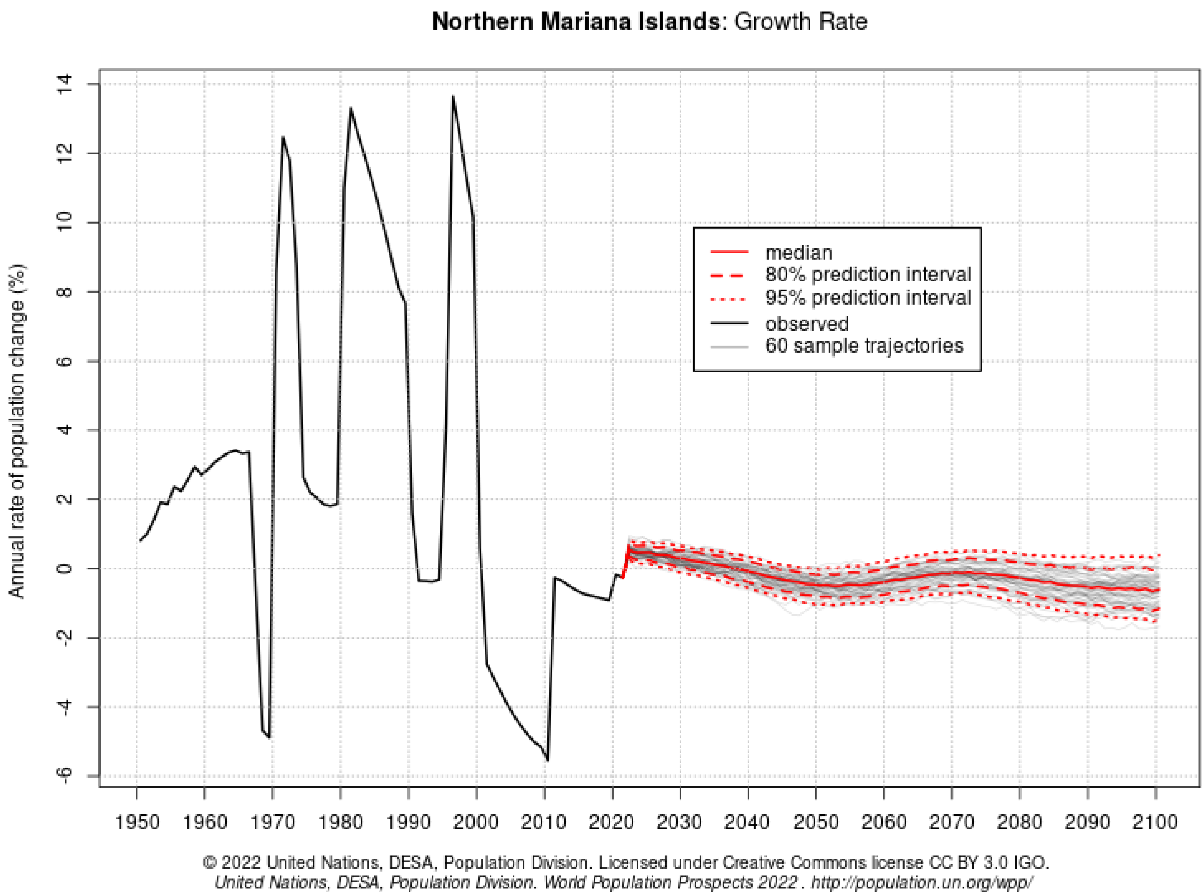


Figure 2.2. United Nations probabilistic projection for total population growth.

2.4.2 Age Distribution

The residents of the CNMI have a median age of 34.4 as of 2020, which is slightly younger than the US national average of 38.6. Males in CNMI have a median age of 35, which is minimally older than the median age of women (34). As of 2020, 32% of the population is 40–59 years old, and the single largest age group is 10–14 years old (9%) (Figure 2.3). The portion of the population aged 65–85 years is 6%.

As a group, the elderly are vulnerable because they are more likely to lack the physical and economic resources necessary to response to natural hazard events and are more prone to suffer health-related disabilities that contribute to slower recovery. Elderly residents and their caregivers may have more difficulty evacuating their homes, which may lead to them being stranded in dangerous situations. This population group is also more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event.

Children under 14 are dependent on adults for safety and protection against disasters and emergencies due to their physical, emotional, and cognitive abilities, making them particularly vulnerable to natural disaster events. Very young children are especially vulnerable to injury or sickness, which can worsen during a natural disaster because they do not understand what needs to be done to protect themselves from hazard events. Natural disaster education should explicitly address ways to improve child resiliency and information sharing to reduce the risk of hazards in their homes. Early education programs make it easier for children to think about natural disaster issues, resiliency, and risk reduction (Torani et al., 2019).

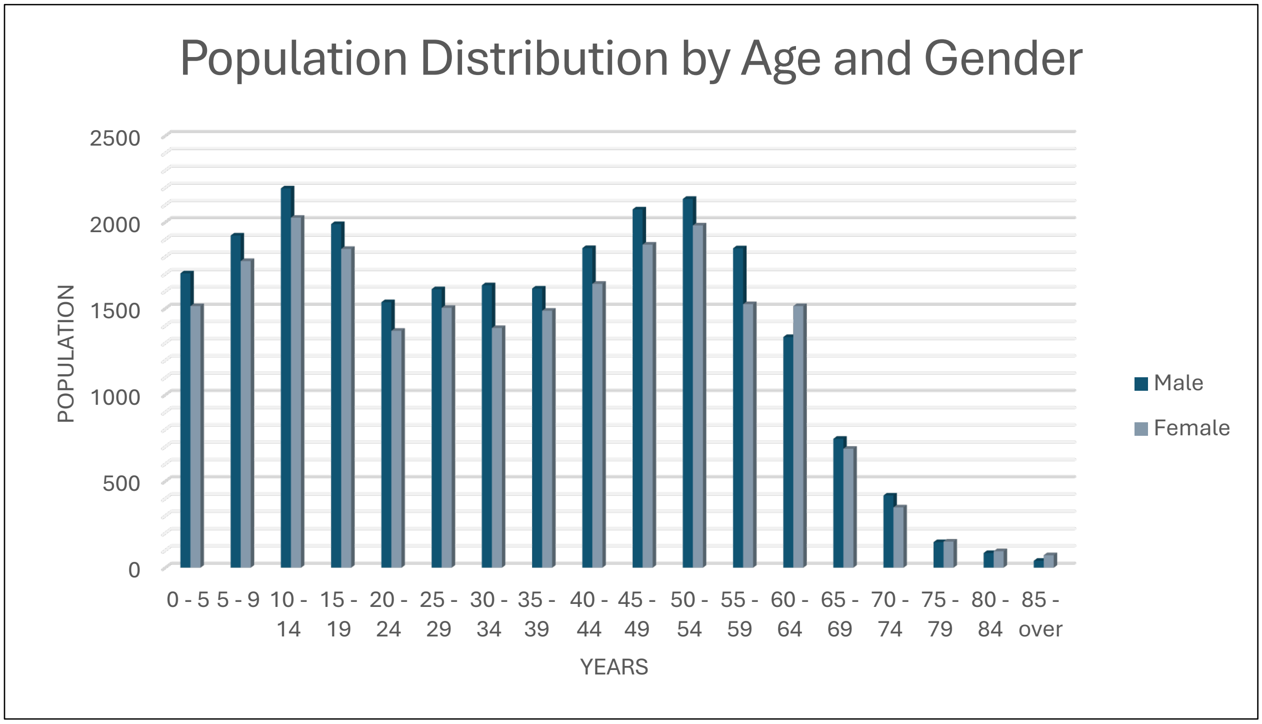


Figure 2.3. CNMI population distribution by age and gender.

The United Nations Population Division World Population Prospects published probabilistic projects for changes in age distribution through the year 2100. In general, the number of adults older than 65 years will increase (Figure 2.4) and the number of people below the age 14 is projected to decrease (Figure 2.5) (United Nations, 2022).

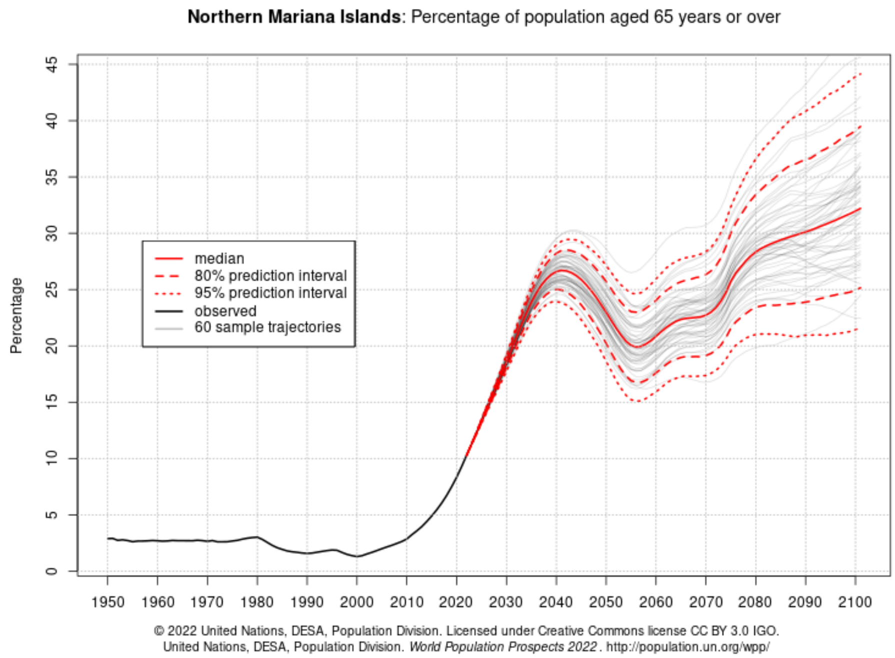


Figure 2.4. United Nations probabilistic projection for the proportion of the population over 65 years.

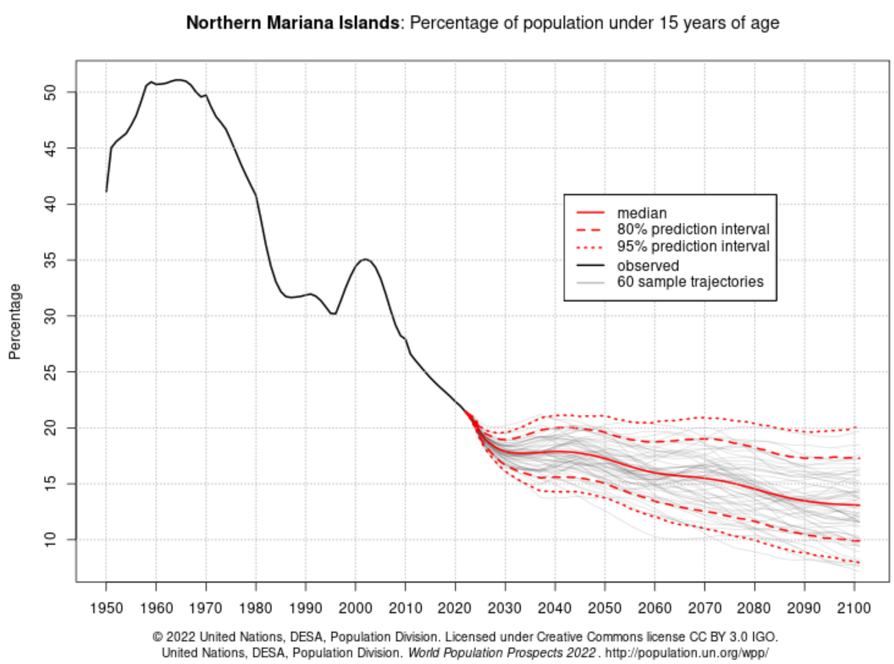


Figure 2.5. United Nations probabilistic projection for the proportion of the population under 15 years.

2.4.3 Education

Eighty-six percent of the population of the CNMI is a high school graduate or higher (US Census Bureau, 2024). Those residents with a bachelor's degree or higher account for 21% of the population and 5% have a graduate or professional degree. The most common bachelor's degree is in business.

As of the 2020 US Census, the largest portion of the population is enrolled in elementary school (50%) followed by high school (26%), college, graduate, or professional school (14%), kindergarten (6%) and nursery school, preschool or prekindergarten (4%).

2.4.4 Race, Place of Birth, and Language

According to the 2020 US Census, the largest portion of the CNMI population is of Asian descent (47%). Persons of Native Hawaiian and Other Pacific Islander descent account for 44% of the population, followed by residents of two or more races (7%), White residents (2%), Black or African American (0.1%) and Some Other Race (0.1%). Table 2.3 shows the racial distribution of the population of the CNMI.

Table 2.3. Racial distribution of the CNMI population.

Asian	Native Hawaiian and Other Pacific Islander	Other Native Hawaiian and Other Pacific Islander	White	Black or African American	American Indian and Alaska Native	Some Other Race	Two or More Races
22,054	20,665	3,362	1,015	65	12	65	3,453

According to the 2020 US Census, 55% of the population was born in the CNMI. Of the 39% of foreign-born residents, 60% were born in the Philippines, followed by China at 14%, Other Asia and the Federated States of Micronesian at 8%, and Korea at 6%.

Approximately 32,645 or 74% of the CNMI residents speak a language other than English at home. Residents that speak English very well is 39% with just slightly over 35% of the residents, approximately 15,512, speak English less than well. The most common languages spoken are Philippine (39%) followed by Chamorro (29%), Other Asian languages (16%), Other Pacific Island languages (7%) and Carolinian (6%). Understanding the language that residents speak is important in ensuring that risk and emergency information is effectively communicated to the population.

2.4.5 Persons with Disabilities or with Access and Functional Needs

Non-institutionalized residents with disabilities or with access and functional needs are vulnerable because they are more likely to have difficulty responding to a natural hazard event than the general population. The Commonwealth government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. Emergency managers must distinguish between functional and medical needs to plan for incidents that require evacuation and sheltering. Knowing the percentage of the population with a disability allows emergency management personnel and first responders to have personnel available to provide needed services by those individuals with access and functional needs. In the CNMI, persons with disabilities make up approximately 10% of the total civilian non-institutionalized population (US Census Bureau, 2024). Disability varies by age, with 4% of the CNMI population under 18 years old, 9% of people 18–64 years of age, and 39% of those 65 years and older.

2.4.6 Health Care

Natural disasters impact the physical, mental, and financial well-being of people. The majority of the civilian non-institutionalized population (65%) of the CNMI has health insurance coverage (US Census Bureau, 2024). Individuals with private health insurance coverage account for 34% while 35% have public health insurance coverage. Thirty-five percent of individuals do not have health insurance of which 21% are under 19 years. Civilian employed individuals 19–65 years have health insurance (60%) with 48% insured through private insurance. This contrasts with 40% of the civilian labor force that has no health insurance coverage.

2.4.7 Employment and Industry

Economic resiliency expedites recovery after a natural hazard event. It is essential to understand the major employers and economic sectors whose losses or inoperability would impact the economic security of the community and its ability to recover from a natural disaster. As of 2020, there were 18,843 (62%) individuals in the labor force in CNMI with 18,827 employed civilians and 16 Armed Forces personnel. The largest portion of labor force is employed in the arts, entertainment, recreation, and accommodation and food services (20%), education services, and health care and social assistance (12%), public administration (12%), construction (12%), retail trade (11%) followed by professional, scientific, management, administrative and waste management services (9%) (US Census Bureau, 2024). The high rate of employment in the arts, entertainment, recreation, accommodation, and food services reflect the Commonwealth’s tourism economy. The *Tourism Analysis Report for February 2022* by ARI, Ltd. (2022), commissioned by the Marianas Visitor Authority, suggests the future growth of the CNMI will be primarily related to the rate of expansion of the tourism market from Asia, in particular South Korea, China and Japan.

2.4.8 Income

To some extent, individual households are expected to use private resources to prepare for, respond to, and recover from natural disasters. Households living in poverty or experiencing financial difficulties are automatically disadvantaged when confronting natural hazard events. Investing in areas that can increase safety and resiliency is difficult or impossible for a household experiencing financial difficulties. Necessary structural and mechanical improvements, modern technology to access information, vehicles to improve mobility and evacuation procedures, among other investments, may not be possible. Low-income residents are vulnerable because they typically occupy more poorly built and inadequately maintained housing. These homes are more susceptible to damage in typhoons, tropical storms, and flooding. Residents living below the national poverty level have a great deal to lose during an event and may be the least prepared to deal with potential losses.

The median household income for the CNMI in 2020 was $31,362, an increase from $19,958 in 2009, and the unemployment rate was 14% (US Census Bureau, 2024). Of the 47,035 for whom poverty status was determined, 17,876 (38%) had incomes below the poverty level. Single parent households comprise the largest sector of low-income residents. Female householders with no spouse and related children under 18 years represent 58% of households living below the poverty level of which 55% have children under the age of 5. In contrast, male householders with no spouse and related children under 18 years comprise 48% of households below the poverty level. Of the male headed households, 40% have children under the age of 5. Thirty-two percent of married couples with related children under the age of 18 years live below the poverty level. Elderly individuals over 65 years represent 26% of the population living below the poverty level. In 2019, 13% of these households received Supplemental Security Income and 21% received food stamps and Nutritional Assistance Program (NAP) benefits (US Census Bureau, 2024). In recent years, the US Congress authorized additional funding for nutrition assistance in response to Super Typhoon *Yutu* and Typhoon *Mangkhut* and COVID-19. CNMI established a reserve fund to rapidly respond to natural disasters, national emergencies, economic down turns, and COVID-19 pandemic (Food and Nutrition Service, 2022).

2.4.9 Tourism

Historically, the CNMI economy relied heavily on high volumes of tourists that contributed to the need for public infrastructure and services. The uncertainties related to the global pandemic, international travel restrictions, and international monetary issues hampered the tourism market. According to the Marianas Visitors Authority, in January 2024 visitor arrivals were 43% lower when compared to pre-pandemic levels in January 2020. In the same period, arrivals from Korea were 66% higher than January 2023. The marked increase in visitor arrivals is due to the number of available flights to the CNMI (Marianas Visitors Authority, 2024). The strong US Dollar and weaker Korean Won and Japanese Yen continue to influence travelers from those countries. China, the second largest source market of visitors, also saw an increase in arrivals due primarily to the availability of direct flights to the CNMI. However, the number Japanese arrivals was 55% lower compared to pre-pandemic December 2019 and December 2023.

In June 2021, the CNMI was awarded a $21.2 million grant from the Department of Commerce to support the growth of the tourist sector and was projected to create 480 jobs (US Department of Commerce, 2021). The funding supported ongoing recovery from Super Typhoon *Yutu* in 2018 by providing resources to complete the Oleai Sports Complex, which allows for the CNMI to attract tourism by hosting large-scale regional sports events such as the Pacific Mini Games.

2.5 Communities

There are no cities in the Northern Marianas as normally considered nor is the term *town* usually applied to the island's heavily populated areas. Rather the urbanized areas are usually referred to as villages or communities and none are incorporated with fixed, surveyed boundaries. Each island—Saipan, Tinian, Rota, and collectively the remaining northern islands—are separate municipalities each with a mayor.

In the CNMI there is a strong cultural and social value of a community that addresses the needs of each individual within the family unit. The strong sense of community is exhibited in the numerous social agencies, both government agencies and non-government organizations, which exist within the CNMI, which provide a stable social foundation for those that need assistance.

On Saipan there are several residential population centers with the top five most populous villages being Garapan, Dandan, Finasisu, Koblerville, and San Vicente (Table 2.4). On Rota there are two main population centers—Sinapalo and Songsong villages. On Tinian most of the population is in San Jose and Marpo Heights villages.

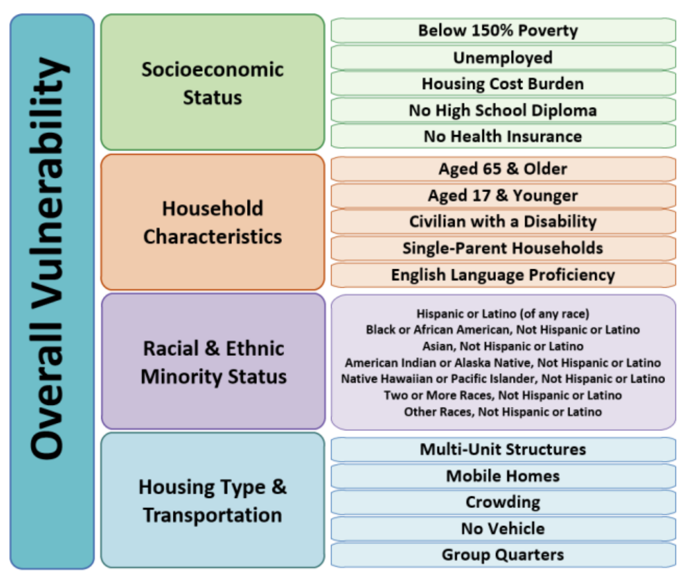
Table 2.4. Commonwealth residential population centers.

Island	Village	Population
Saipan	Garapan	3,096
Saipan	Dandan	2,922
Saipan	Finasisu	2,566
Saipan	Koblerville	2,470
Saipan	San Vincente	1,862
Rota	Sinapalo	1,107
Rota	Songsong	353
Tinian	San Jose	1,250
Tinian	Marpo Heights	428

Source: US Census Bureau, 2024.

2.5.1 Social Vulnerability

FEMA defines social vulnerability as the susceptibility of an individual or social groups to the adverse impacts of natural hazards including disproportionate death, injury, loss, or disruption of livelihood. Certain factors can affect an individual or group's ability to prepare, respond, cope, or recover from a natural disaster. FEMA and the US Department of Health & Human Services, Center for Disease Control (CDC) have identified several socio-economic characteristics considered to be potential indicators of social vulnerability that can inform resiliency, risk reduction, and equity enhancement efforts throughout the CNMI and at specific geographic or resource-



Source: CDC/ASTDR Social Vulnerability Index, 2024.

focused levels. As described by the CDC, social vulnerability refers to the resilience of communities (the ability to survive and thrive) when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss.

At the national level, socially vulnerable populations include those who have special needs, such as, but not limited to, people without vehicles, people with disabilities, older adults, and people with limited English proficiency. Census tracts are subdivisions of counties for which the Census collects statistical data. The CDC/Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI) ranks each tract on 16 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes (CDC-ATSDR, 2024). Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. Despite the growing interest in promoting equity and environmental justice throughout the US, the CNMI, and other US-affiliated islands are not included in the CDC/ATSDR SVI since its last update in December 2022. As such, relevant data points to determine SVI are not available. Working with federal agencies to ensure CNMI is included in national datasets such as the CDC/ATSDR SVI in the future is highly recommended.

On February 15, 2024, the US Census Bureau released 95 demographic, social, economic, and housing characteristics tables based on the 2020 Island Areas Censuses data. This final release of the 2020 Island Areas Censuses data includes the Island area, county-equivalent levels of geography, and census track or village geographies.

2.5.2 Community Values and Sustainable Development

In 2021, the Governor approved the *2021–2030 Comprehensive Sustainable Development Plan for the CNMI* (OPD, 2021) to guide development sustainably and to guide responsible resource management decision-making. The CSDP establishes the growth priorities of the CNMI and reflects community values, goals, and objectives to work towards sustainable development. Through extensive community outreach, several values and themes emerged to guide implementation of development projects. The CSDP algins with the SHMP through these planning themes and many of the goals and objectives in the plan mitigate hazards. To the extent practicable, the SHMP will incorporate these community derived values and themes for mitigation strategies and actions.

Theme 1: Build Resiliency of Natural, Built, and Human Systems through Smart, Safe Growth

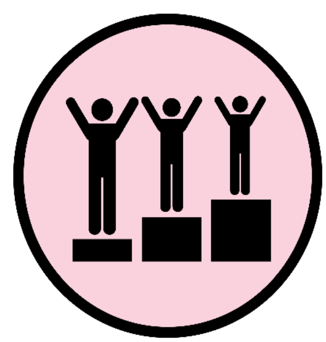
Smart, Safe Growth aims to achieve development goals that reduce vulnerability and increase the adaptive capacity of people, our economy, and our environment. By incorporating these principles using an approach that considers long-term resiliency outcomes, investment priorities, and growth plans can be achieved more efficiently and sustainably. Mainstreaming Smart, Safe Growth principles will help to identify and address procedural as well as substantive resource management challenges.

Theme 2: Maintain Efficient Governance and Social Safety Nets

The social safety net is a collection of services provided by the state or other institutions. It can include nutritional programs, healthcare, unemployment benefits, education, housing, legal aid, victims' rights, consumer protection, homeless shelters, and sometimes subsidized services such as public transport, which aim to prevent individuals from falling into poverty. By increasing coordination and implementing long-term plans to maintain and grow necessary government and private sector services, this theme aims to ensure CNMI meets the needs of vulnerable people while sustaining essential public health and safety protection programs and supporting wise development. This theme reflects and embodies the spirit of *inafa' maolek* or making good for all, which in Chamorro culture considers the importance of well-being for the entire community.

Theme 3: Grow Inclusive, Cohesive Community to Achieve

Community cohesion describes the ability of communities to function and grow in harmony together rather than in conflict. It has strong links to concepts of equality and diversity, given that community cohesion can only grow when society as a whole recognizes that individuals have the right to equality (of treatment, access to services etc.) and respects and appreciates the diverse nature of our communities. Forming strong and positive relationships between people from different backgrounds helps empower communities to address inequalities, support equity and develop a positive and productive framework to support the exchange of information and opinions to nourish diversity and accomplish shared visions for the future.



Theme 4: Leverage Partnerships and Alliances to Benefit All
Responding to public comments received in 2019 and 2020 public meetings regarding the importance of coordination of activities and transparent information sharing, a fourth theme, leveraging partnerships, was proposed for inclusion. This theme emphasizes the fact that partnerships are a cross-walk between all of the sustainable growth goals that are detailed further in this plan. By working together, we will help to ensure that 2021 is a decade of sustainable growth for the CNMI.

Source: *2021–2030 Comprehensive Sustainable Development Plan for the CNMI* (OPD, 2021).

2.6 Economy

According to the *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (OPD, 2019), CNMI's economy has been historically, and remains, rooted in the tourism industry. The growth or decline of the Gross Domestic Product (GDP) for the CNMI is closely linked to the export of goods and services, which consists primarily of visitor spending, including casino gambling. Between 2014 and 2017, visitor arrivals increased and CNMI's economy showed positive GDP growth. However, following Super Typhoon *Yutu* and the COVID-19 pandemic, decreased arrivals and spending by visitors, including revenue from gambling, contributed to declines in GDP between 2018 and 2020 resulting in negative percent changes from each preceding year—2017 to 2018 (- 19.6%), 2018 to 2019 (- 11.3%), and 2019 to 2020 (- 29.7%) (US Bureau of Economic Analysis, 2023). The decrease in economic activity increases challenges with funding maintenance and infrastructure construction. These funding challenges are further amplified by increased needs for capital improvements, decreases in local labor supply, and inflation, especially increased costs to import and extract raw materials. All these factors compound socio-economic impacts from recent natural disasters and the pandemic.

Prior to the COVID-19 pandemic, visitor arrivals from the China and Korea accounted for about 40% of the market. Following the COVID-19 pandemic, visitor numbers fell dramatically (- 81.7%) and have been slow to recover to pre-pandemic numbers (e.g., 2019). The drastic reduction in spending by consumers, visitors, businesses, and government due to the COVID-19 pandemic substantially affected the CNMI economy.

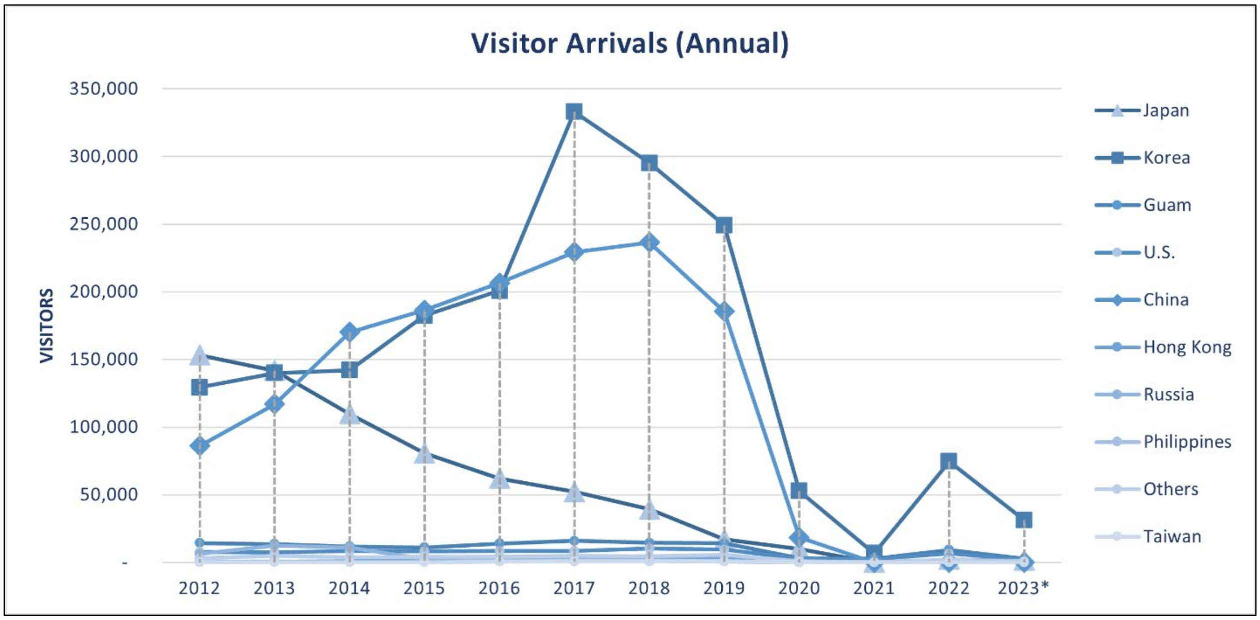


Figure 2.6. Visitor arrivals (annual) from 2012 through first quarter 2023.
Source: CNMI Central Statistics Division (https://ver1.cnmicommerce.com/ei-visitor-arrivals/).
* Arrivals in this graph are only through first quarter FY 2023. By third quarter FY 2023 total visitor arrivals were 160,557 with the most arrivals from Korea (Central Statistics Division, 2023b).

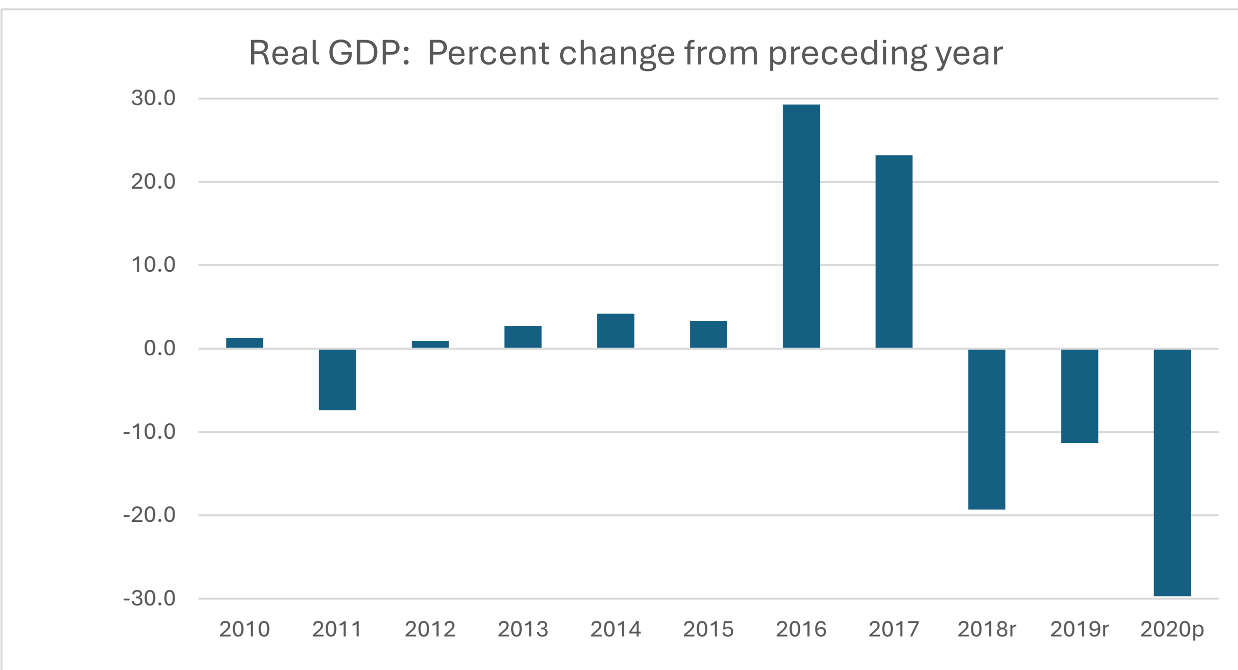


Figure 2.7. Percent change of the real Gross Domestic Product for the CNMI from 2010 through 2020.
Adapted from GDP for the CNMI, 2020 (US Bureau of Economic Analysis, 2023).

As mentioned previously, the CNMI was awarded a $21.2 million grant from the Department of Commerce in June 2021 to support the growth of the tourist sector and was projected to create 480 jobs (US Department of Commerce, 2021). However, according to the *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (DPL, 2019a), the nature of tourism is changing in the CNMI. Residence-based vacation rentals (not counted in the Marianas Visitors Authority lodging inventories) have been estimated at 35% of total inventory. Some new projects under development are limited-service *condo-tels* rather than full-service hotels. The potential increased use of residence-based vacation rentals and limited-service facilities may impact the number of workers required to support visitors at traditional hotels, which could have cascading effects within the economy.

The *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (OPD, 2019) (referred to hereafter as 2019 CEDS) was published in 2019 following Super Typhoon *Yutu*. In the 2019 CEDS, a strengths, weaknesses, opportunities, and threats (SWOT) analysis for the CNMI is presented. Through extensive public and agency stakeholder engagement, the OPD developed a list of projects to support economic activity. Projects were prioritized by 1) public benefit, 2) industry growth, 3) support of new or emergent industries, 4) SWOT impact, 5) employment sourcing 6) economic circulation, 7) environmental impact, and 8) infrastructure impact. Some of the projects listed in the CEDS align with risk reduction actions for natural hazards and are considered further in a later section covering mitigation strategy and actions (see Chapter 6.0 [Mitigation Strategy]).

Strengths	Weaknesses	Threats	Opportunities
• New Industry Development • Access to an expansive Asian marketplace • Supportive governance and regulatory structure • Stable US financial & legal system • Installation of new telecommunication infrastructure	• Lack of exportable natural resources • Domesitc labor pool availability & experience • Outdated and inadequate infrastructure • Supply chain infrastructure required for economic development • Land ownership restrictions	• Access to a skilled domestic labor pool • Unresolved labor issues due to US PL 110-229 • Potential of national policy restricting access to Asian source markets • Department of Defense realignment to Marianas	• Development of new industry in the CNMI • Access to federal programs (EB5, LIHTC, & NMTC) • Department of Defense realignment to the Marianas • Visa-free access to Chinese & Russian source markets

Source: *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (OPD, 2019).

According to the *Draft—2023Resources Report* (OPD, in prep.), global drivers also influence development and resources management trajectories. Drivers of significant socio-economic shifts in the Western Pacific include 1) globalization and geography; 2) population and migration; 3) economic and technological development; 4) traditional and contemporary values, attitudes, lifestyles, and governance; and 5) climate change and variability. These trends often result in resource pressure such as 1) land development, 2) resource extraction, and 3) consumption and waste.

To consider these global drivers for development and resource management in the CNMI, the OPD conducted community surveys, which identified economic development, environment, public health and safety, and hazard risk reduction as leading resource management issues to be addressed. Based on feedback from CNMI stakeholders, OPD developed a planning framework for the CSDP, which is also the basis for monitoring progress toward sustainable development goals (SDGs) and underpins the *Draft 2023—Resources Report* (OPD, in prep.).

2.6.1 Workforce

Worker availability continues to be an ongoing development concern in CNMI. Since the 1976 Covenant with the US, the CNMI had administered its own immigration system. However, the Consolidated Natural Resources Act of 2008 (CNRA) (Public Law 110-229) extended US immigration law to CNMI starting in 2009. Title VII of the CNRA includes provisions to phase-out the CNMI nonresident contract worker program and phase in the US federal immigration system in a manner that minimizes adverse economic and fiscal effects and maximizes the potential for future economic and business growth in the CNMI. However, due to limited worker availability, the CNMI lobbied the US Congress to extend the CNMI-Only Transitional Worker (CW-1) visa classification that allows employers in the CNMI to apply for permission to employ foreign nonimmigrant workers who are otherwise ineligible to work under other nonimmigrant worker categories.

On July 24, 2018, President Trump signed the Northern Mariana Islands US Workforce Act of 2018 (Workforce Act), extending the CW-1 program through December 31, 2029, and increasing the CW-1 cap for fiscal year (FY) 2019 from 4,999 to 13,000. Although the United States Citizenship and Immigration Services (USCIS) reports that CW-1 visas will generally no longer be available to workers who would be performing jobs classified as *construction and extraction occupation*, the Workforce Act exempted H-1B and H-2B workers from national caps until December 31, 2029, making these visa programs more widely available to support importation of skilled labor to fill these positions. Despite the 2029 extension provided by Congress and authorized by President Trump in 2018, absent any congressional amendments to expand the CW-1 transition period, the labor crisis in the CNMI will likely continue challenge future economic development efforts. Although these workers are reported in the decennial census, their contribution to the CNMI economy and presence in the general population cannot be overlooked.

In addition, the Workforce Act requires that following expiration of the second CW-1 renewal period, workers could not be again eligible for CW-1 status until after leaving the US, including CNMI, for a continuous period of at least 30 days before the submission of a renewal petition on their behalf. Due to disruptions caused by the COVID-19 pandemic, the USCIS issued a policy on August 25, 2022, stating that USCIS will only consider CW-1 petitions approved on or after June 18, 2020, when USCIS will apply the requirement that certain CW-1 nonimmigrant workers depart the CNMI for a period of at least 30 continuous days.

This temporary departure requirement (also known as the touchback requirement) does not apply to CW-1 long-term workers who were admitted to the CNMI, or otherwise granted status as a CW-1 worker during fiscal year 2015 and during each of fiscal years 2016 through 2018. Any extension of CW-1 status in the CNMI, if granted on or after June 18, 2020, will be considered a consecutive petition validity period. Enforcement of the touchback requirement is expected and will likely impose additional burdens on CNMI employers and CW-1 workers and has the potential to constrain the availability of workers in the future.

In 2022, the US Government Accountability Office (GAO) released a report on recent workforce trends and wage distribution for the CNMI (GAO, 2022). From 2001–2020 the number of foreign workers fell by 73% and in 2020 US workers accounted for 59% of the workforce (Figure 2.8).

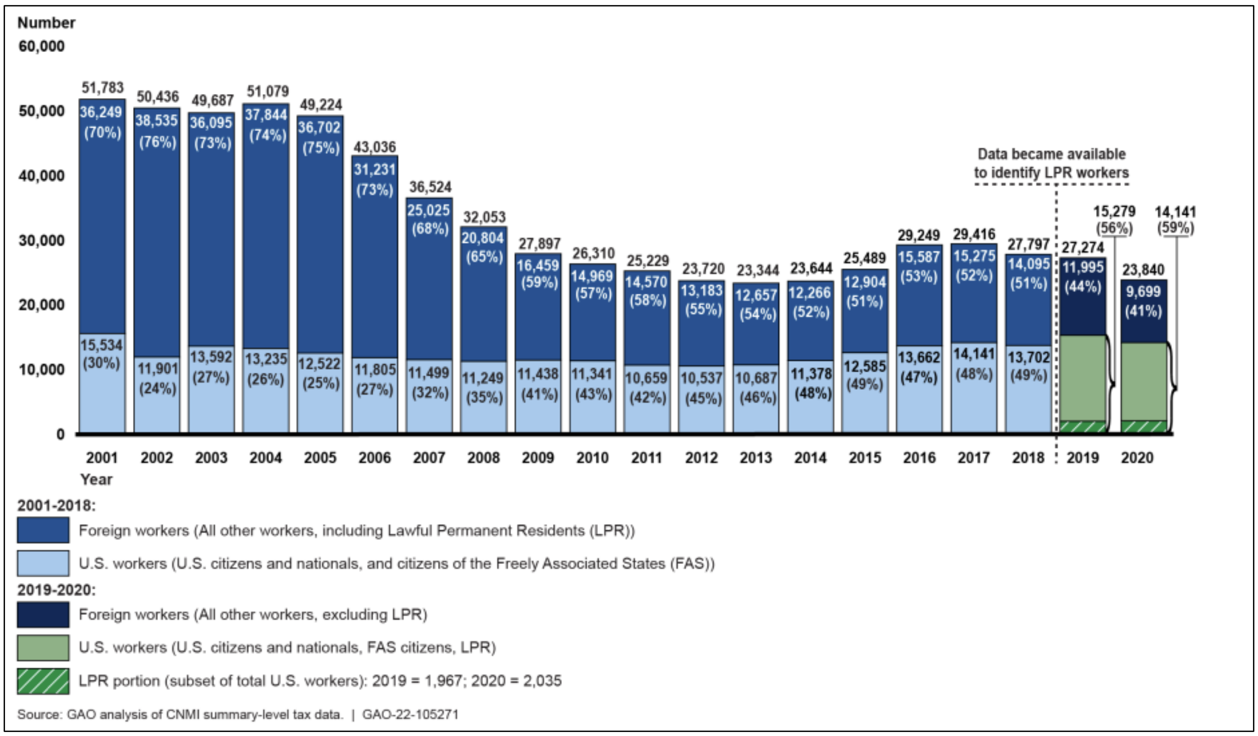


Figure 2.8. Employed workers in the CNMI, calendar years 2001-2020.

Figure 2-6 notes: For 2001 to 2018, United States workers include US citizens and nationals, and citizens of FAS—the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau—as reported by CNMI employers on employee W-2 forms. Foreign workers include all other workers, potentially including lawfully admitted for permanent residence (LPR), because the tax data provided to us included information on workers' country of citizenship but did not include information to identify LPR workers. The government of the CNMI began collecting information on these data in 2018. For 2019 and 2020, the count for United States workers includes LPRs identified by the CNMI government. The Northern Mariana Islands US Workforce Act of 2018 defines United States workers to include "alien[s] who ha[ve] been admitted for lawful permanent residence," which we refer to as LPRs for the purposes of this figure. Foreign workers include all other workers who are not United States workers.

In 2023, the CNMI Central Statistics Division reported that the percentage of US workers continues to trend upward to 66% of the workforce and CW-1 workers comprised just under 17% of the workforce (Central Statistics Division, 2023c) as shown in Figure 2.9.

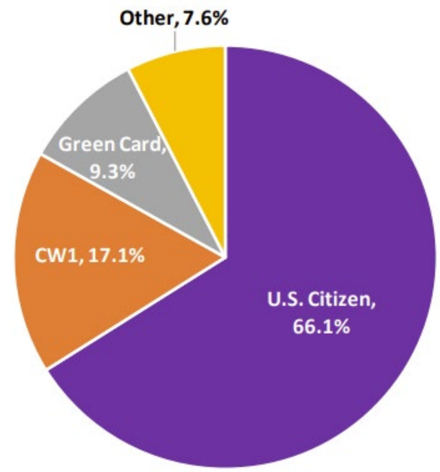


Figure 2.9. Percentage of total employees by visa type.
Source: Central Statistics Division, 2023c.

The COVID-19 pandemic led to large declines in the number of employees in the CNMI, which translated to a 13% drop in the number of workers from 2019 to 2020. This decline in workers was largely due to economic hardship during the pandemic, primarily in the tourism industry. For example, the GAO found that the accommodation and food services industry workforce declined by 67% between 2019 and 2021. The number of workers declined disproportionally among wage bands with the largest decline (68%) in the lowest wage band—workers earning less than $8 per hour and primarily in the service industry (Figure 2.10). These declines are in addition to, and compound, previous economic declines from Super Typhoon *Yutu*.

Currently, the minimum wage in CNMI is $7.25, which is the same as the US national minimum wage. Per the Prevailing Wage Study of the CNMI (Central Statistics Division, 2023c), the mean hour wage for all major industries is above the minimum wage (Figure 2.11). However, the highest percentage of jobs by industry tends to correspond to the lowest paid wage bands (Figure 2.12). For example, accommodation and food service workers comprise 12.8% of the workforce but the mean hourly wage is one of the lowest ($10.28 per hour). In recent years, several bills have been introduced in Congress that propose to raise the minimum wage by various amounts. If Congress increased the national minimum wage, it would have a disproportional impact on industries with a high percentage of low-wage workers.

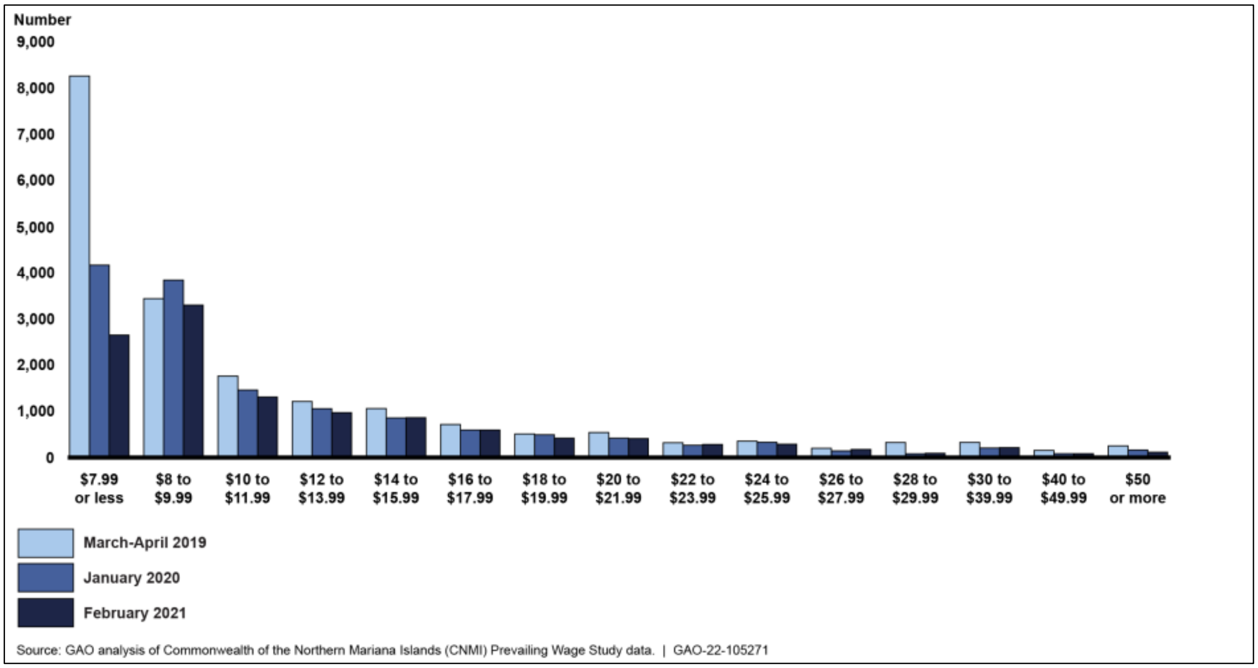


Figure 2.10. Number of workers in each wage band in the CNMI Prevailing Wage Study, 2019-2021.

Figure 2.10 note: The Prevailing Wage Study (PWS) is an annual study of CNMI employers and the wages they pay, conducted by the CNMI Department of Commerce. The study provides a snapshot of wages paid in a single month or pay period of each year, specifically March-April 2019, January 2020, and February 2021. Due to nonresponse from some employers, and because the PWS only records workers employed in 1 month or pay period of each year, the PWS does not capture every worker in the CNMI economy. The number of employers responding to the study dropped from 946 in 2019 to 631 in 2020 and to 550 in 2021. We use the PWS data in this report because they are the best available data on CNMI wages. However, the numbers reported in the PWS reports and in this figure should be interpreted with caution, as it is not clear whether the employers that did not respond to the study are systematically different from those that did.

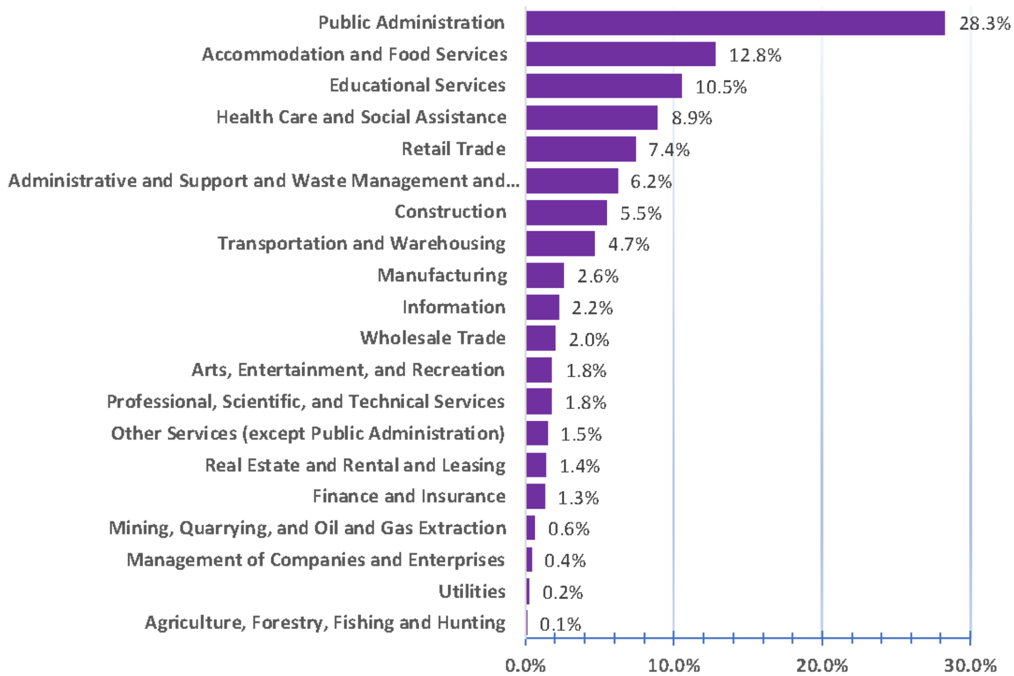


Figure 2.11. Mean hourly wage by major industry.
Source: Central Statistics Division, 2023c.

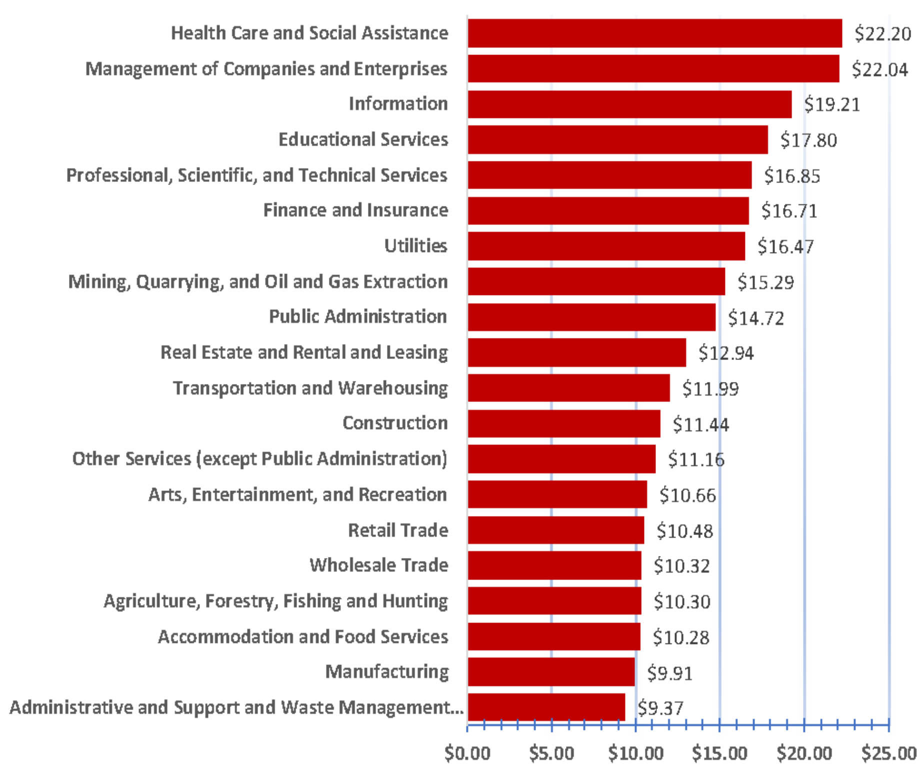


Figure 2.12. Percent total employees by major industry.
Source: Central Statistics Division, 2023c.

2.6.2 Census on Agriculture

According to the 2018 Census on Agriculture, approximately 1,515 acres of land are used for agriculture, which is down from 4,013 acres (62%) in 2007. Another 924 acres are used for pasture or grazing lands for several cattle ranching operations, which is down from 2,955 acres (67%) from 2007. Most of the remaining agricultural lands are used for croplands. About 83% of the farms are less than 8 acres with the greatest proportion of farms less than 1 acre. The primary product groups that support the agricultural industry within the CNMI include root crops; vegetables and melons; fruits, nuts, and nursery crops; livestock, poultry, and eggs; and aquaculture. The market value of agricultural products sold within the CNMI in 2018 contributed approximately $1.6 million annually. However, as the *2016–2021 Comprehensive Economic Development Strategy* notes, the small land area and limited infrastructure in the CNMI limit the extent to which in-demand natural resources can be exported (Commonwealth Economic Development Strategic Planning Commission, n.d.). However, as of the 2018 update the Office of Grants Management reports numerous efforts to improve local agricultural and aquaculture production to increase economic benefits to local farmers and reduce reliance on imported foods. The *2019 CEDS* (OPD, 2019) includes projects to improve agricultural facilities and infrastructure and to evaluate the feasibility of agricultural products.

In March 2024, the US Department of Agriculture, National Agricultural Statistics Service (USDA-NASS), in collaborations with the CNMI Department of Commerce, Central Statistics Division will visit all farms on Saipan, Rota, and Tinian to conduct the Census of Agriculture data collection. Response to the Census of Agriculture is required by Federal Law, under Title 7 USC 2204(g) Public Law 105-113 and as well as the CNMI 1990 Statistical Act Public Law 7-35.

2.6.3 Facilities that support Economic Activity

Several institutions and facilities are integral to the CNMI economy and if affected by natural disasters the local or regional economy may be significantly disrupted. Institutions include banks such as the Bank of Guam, Bank of Hawai'i, Bank of Saipan, City Trust Bank, First Hawaiian Bank, and Bank Pacific, Ltd. Other facilities include hotels and tourists' facilities and shopping and entertainment centers. The CNMI offers convenient shopping for residents and tourists. Major shopping areas abound with modern supermarkets, duty free ships replete with designer goods, specialty shops and many smaller owner-operator stores.

2.7 Land Use and Development Trends

Land management is addressed through laws, regulations, and policies of the Department of Public Lands (DPL), the Office of Zoning, and the Bureau of Environmental and Coastal Quality (BECQ). Formerly the Marianas Public Lands Authority, the DPL is mandated to administer the Commonwealth's public lands according to the provisions of Article XI of the Commonwealth Constitution (Public Laws 12-33, 12-71, 15-2, 2 CMC § 2800 et seq.). This includes managing use, leasing, development, and disposition of public lands, which belong "collectively to the people of the Commonwealth who are of Northern Marianas descent" to support fundamental policies outlined in Section 5 of the Constitution such as providing a homestead program and adopting a comprehensive land use plan that includes priority land uses. Overall responsibilities of DPL include ongoing programs such as a homesteading, the commercial leasing and permitting of idle public lands, the settling of land claims and designating of public land parcels to other government agencies for the fulfillment of public purpose. Additional revenue is remitted to the Marianas Public Land Trust to continue to benefit the CNMI.

In 2017, Senate Bill 20-35 was passed. The bill extends land leases for hotel properties to a combined 55 years. With new certainty, owners of major properties are more likely to invest in repairs and renovations, contributing to enhancement and possible expansion of the hotel inventory in Saipan.

On Saipan, land management efforts are further supported by the Office of Zoning, which was established by the Saipan Zoning Law of 1993 and modified through numerous subsequent amendments to establish designated use districts to further guide development on Saipan (Saipan Local Law 8-7, §, modified; amended by SLL 15-22, §§ 4-10, amended 2013, 10 CMC § 3511). On Saipan, the Zoning Office must first issue a development permit before the environmental clearance application process can begin with BECQ.

The BECQ Division of Environmental Quality ensures compliance with environmental regulations to protect water and air quality as outlined in the Commonwealth Environmental Protection Act of 1982 (PL 3-23, 2 CMC § 3101 et. seq.). Established in 1983 as the Office of Coastal Resources Management and merged with BECQ in 2013, the Division of Coastal Resources Management (DCRM) administers the federal Coastal Zone Management Act to promote efficient resources management through coordination across CNMI departments to achieve twenty-three legislative policies, including to "plan for and manage any use or activity with the potential for causing a direct and significant impact on coastal resources" (Public Law 3-47, 2 CMC § 1500 et. seq.). Permits are required for all earthmoving activities that exceed six cubic yards. BECQ coordinates with other agencies to ensure project proposals meet CNMI regulations before issuing permits.

2.7.1 CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands

The DPL manages public land resources of the CNMI and plays an important role in the economic development of the CNM. DPL is advancing their management strategy to streamline the application process on long-term leases and temporary occupancy agreements to augment social and economic benefits for the people of Northern Mariana descent (NMD). In 2019 DPL updated the *CNMI Comprehensive Public Land Use Plan for Rota, Tinian, Saipan, and the Northern Islands* (PLUP)—the first update since 1989 (DPL, 2019a). Although Public Law 15-02 requires that the comprehensive public use plan be updated every 5 years, due to setbacks from the COVID-19 pandemic, an update to the 2019 plan is pending.

The goal of the 2019 PLUP is to provide guidance for the efficient and effective services in the management, use, disposition, and development of public lands for the economic and social betterment of the CNMI. To this end, the PLUP attempts to project several key indicators including projected population growth based on 3 economic scenarios. The estimated populations greatly differed by economic scenario due to the wide range of economic futures that were modeled for the Commonwealth. However, the COVID-19 pandemic interrupted and delayed the expected growth in the tourism market and the CNMI population decreased by 12.2% between 2010 and 2020 (Table 2.2). Planning for wide variations in population and economic growth presents land management challenges that may be most effectively addressed through flexible goal setting and iterative reassessment of development trends and trajectories in the CNMI.

2.7.2 Public Land Inventory

DPL established five public land uses and produced maps and tables to inventory public and private lands on Saipan, Tinian, Rota, and the Northern Islands: 1) Grant of Public Domain Public Land, 2) Designated/In Use Public Land, 3) Undesignated/Not In Use Public Land, 4) Leased Public Land, and 5) Covenant/Military Leased Public Land. Corresponding land use maps are in Appendix B.

Table 2.5. Saipan land inventory.

	Hectares	% of Total Land	Public Land (ha)	% of Public Land
Total Land Area	**11,913**	--	--	--
Private Land	5,822	49%	--	--
Public Land	6,090	51%	--	--
Grant of Public Land Domain Land	--	--	1,604	26%
Designated / In use Public Land	--	--	1,057	17%
Undesignated / Not in Use Public Land	--	--	2,819	46%
Leased Public Land	--	--	558	9%
Covenant Leaded Public Land	--	--	52	> 1%

Table 2.6. Tinian land inventory.

	Hectares	% of Total Land	Public Land (ha)	% of Public Land
Total Land Area	**10,177**	--	--	--
Private Land	985	10%	--	--
Public Land	9,179	90%	--	--
Grant of Public Land Domain Land	--	--	649	7%
Designated / In use Public Land	--	--	517	6%
Undesignated / Not in Use Public Land	--	--	1,163	13%
Leased Public Land	--	--	590	6%
Covenant Leaded Public Land	--	--	6,260	68%

Table 2.7. Rota land inventory.

	Hectares	% of Total Land	Public Land (ha)	% of Public Land
Total Land Area	**8,693**	--	--	--
Private Land	2,412	28%	--	--
Public Land	6,282	72%	--	--
Grant of Public Land Domain Land	--	--	473	8%
Designated / In use Public Land	--	--	3,042	48%
Undesignated / Not in Use Public Land	--	--	2,618	42%
Leased Public Land	--	--	149	2%
Covenant Leaded Public Land	--	--	0	0%

Table 2.8. Northern Islands land inventory.

	Hectares	% of Total Land	Public Land (ha)	% of Public Land
Total Land Area	**13,307**	--	--	--
Private Land	0	0%	--	--
Public Land	13,307	100%	--	--

2.7.3 Land Cover

Land cover has been mapped in the CNMI by the US Forest Service (Liu & Fischer, 2006), NOAA's Coastal Change Analysis Program (NOAA, 2024), and the US Fish and Wildlife Service (USFWS) (Amidon et al., 2017). Because each of these efforts uses a different vegetation classification scheme it is difficult to determine if changes in land cover between each mapping effort are actual or if the changes are due to differences in methodology.

The C-CAP High Resolution National Land Cover database (NLCD) (Dewitz, 2014) can help track changes in land use over time and it is recommended this tool be used to evaluate future changes in land use during the next update cycle. Table 10 shows the acres of developed/urban land class from the NLCD for 2011 (OPD, in prep.).

Table 2.9. Updated land cover type from the Coastal Change Analysis Program High Resolution Land Cover Database.

USFS Mapped Vegetation Class	Acres	% Total Land Area
Saipan		
Acres Total	29,420.7	--
Developed/Urban	2,511.0	8.54
Cropland	233.7	0.79
Agroforest	400.7	1.36
Total Developed	**3,145.4**	**10.69**
Tinian		
Total Acres	24,989.8	--
Developed/Urban	1,917.5	7.67
Cropland	331.1	1.33
Total Developed	**2,248.7**	**9.00**
Rota		
Acres Total	21,011.8	--
Developed/Urban	761.1	3.62
Cropland	352.5	1.68
Agroforest	629.1	2.99
Total Developed	**1,742.7**	**8.29**

Adapted from the *Draft*—2023 *Resources Report* (OPD, in prep.).

In 2017, the USFWS mapped land cover in the CNMI and estimated developed land cover as 10% on Saipan, 2% for Rota, and 3% for Tinian (Amidon et al., 2017). These USFWS land use cover maps are used to describe the vegetation of the CNMI in Section 2.9.5 (Vegetation).

2.7.4 Changes in Development since the 2018 SSMP

Building permits for commercial development have steadily declined since 2016. Since 2015, the CNMI Government has received the greatest number of building permits annually. This is presumably due to the influx of federal funding to assist with post-disaster recovery and other federal assistance programs (Figure 2.13). Permits issued for residential construction show no specific trend but increases and decreases are likely driven by post-disaster damage and funding availability.

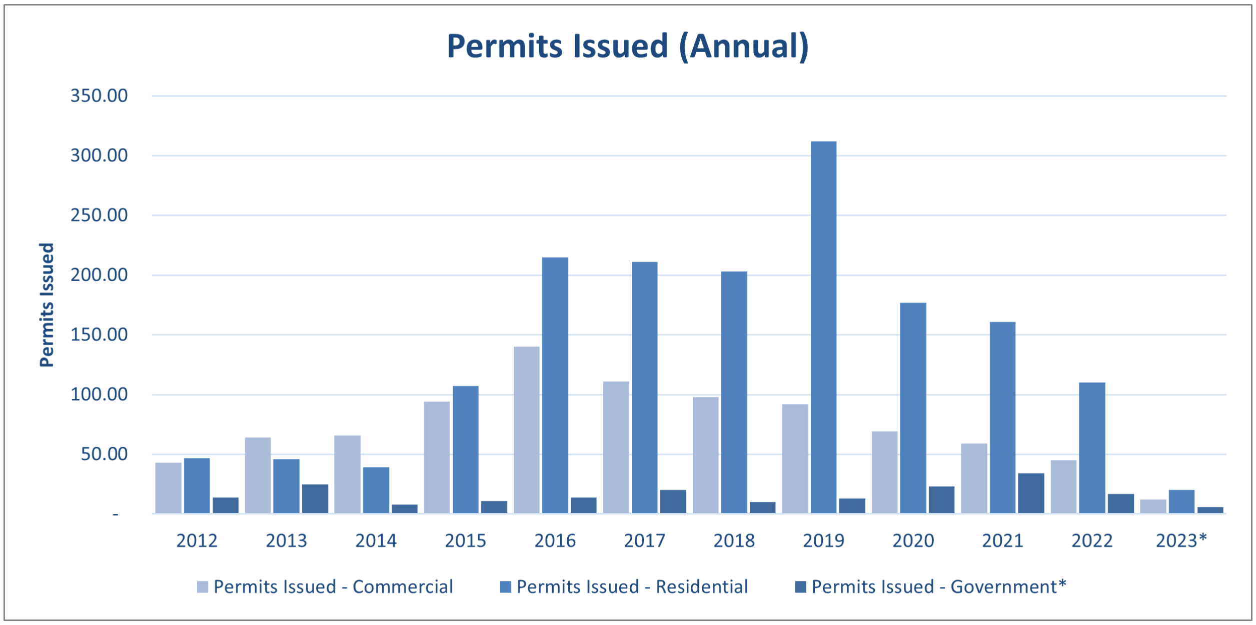


Figure 2.13. Annual building permits issued in the CNMI 2012 to first quarter 2023.
Source: Economic Indicator: Building Permits (Central Statistics Division, 2023a).

Although fewer commercial building permits were issued, these construction projects generally cost more than government-funded or residential projects (Figure 2.14).

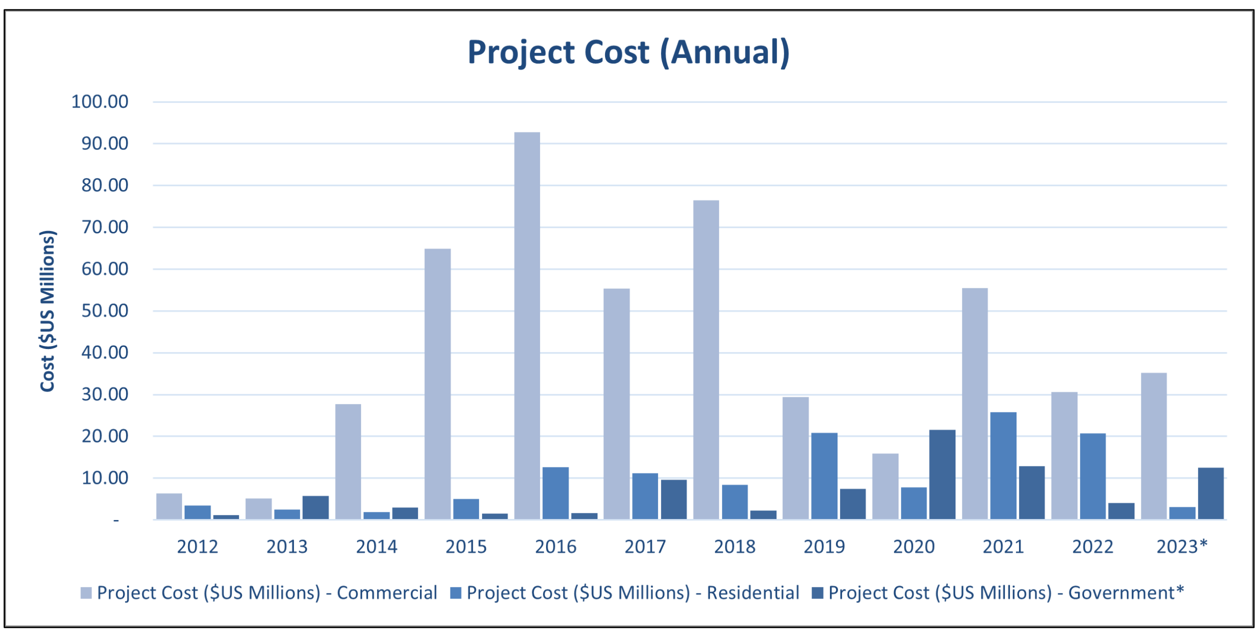


Figure 2.14. Project cost per year for building permits issued between 2012 and first quarter 2023.
Source: Economic Indicator: Building Permits (Central Statistics Division, 2023a).

2.7.5 Current Land Use and Development

The island of Saipan is the primary hub of commercial and residential activity within the Northern Mariana Islands and the population of 43,385 (US Census Bureau, 2024) resides mainly in developed/urban areas. Areas along the island's coastline have attracted commercial, retail, and tourism attractions. Garapan is the principal hotel and tourism district with a higher density of commercial, retail, and hotels to serve its guests. Several major hotels including the Fiesta Resort, Hyatt Regency, and the Grandvrio/Hafa Adai Hotel are located within this district with the Duty-Free Shopping Galleria and other pedestrian commercial centers in proximity.

On Tinian, the population of 2,044 (US Census Bureau, 2024) resides in a developed rural setting primarily located in the village of San Jose and parts of the adjacent central plateau and southeastern ridge, occupying approximately 25% of the island. The remaining 75% of the island is grassland and secondary forest, of which about 40% of those lands are reserved for military purposes on the northern part of the island. The remaining grassland and forest are used for scattered grazing of cattle and horses.

Public land use accounts for approximately 60% of the rural area on Tinian, with land uses that include the airport, harbor, schools, cemetery, agricultural cooperatives, marshland, parks and beaches, and unused grassland and secondary forest. Residential and commercial land covers approximately the remaining 40% of the rural area on Tinian with designated land uses that include a casino resort, small businesses, farming, grazing, and housing.

The island of Rota has a population of 1,893 (US Census Bureau, 2024) that reside in a primarily rural and agricultural setting. Most of the island remains in agricultural use or open space with a few, scattered agricultural, mixed-use residential, commercial, and industrial uses located within the rural interior. Business, government, and industrial activities are predominantly concentrated in the main village of Songsong, which is situated on the island's southwestern peninsula, and in the village of Sinapalo, in the north-central portion of Rota.

As of the 2019 PLUP, there were approximately 400 displaced residents of the Northern Islands currently residing in the CNMI (DPL, 2019a). The 2020 US Census estimated the population of the Northern Islands at 7 (US Census Bureau, 2024). The 2019 PLUP analyzed the Northern Islands of Agrihan, Alamagan, Anathan and Pagan. The islands of Farallon De Pajaros, Maug, Asuncion, and Guguan are designated conservation areas and the islands of Farallon De Medinilla and Sarigan were not analyzed in the 2019 PLUP. The 2001 Northern Islands Development Plan was prepared to establish more permanent settlements on the islands of Agrihan, Alamagan, Anathan, and Pagan. Plan goals include establishing homesteads, vital public services, and opportunities for economic development and programs. The plan recommended feasibility studies to develop safe boat or canoe access to all 4 islands and a feasibility study to rehabilitate the runway on Pagan.

2.7.6 Homesteads

In accordance with the Constitutional mandate pertaining to homesteads for eligible residents, most public lands designated for development have been committed for residential development with the remainder of available lands set aside for community facilities, land exchanges, roads, and other public uses.

The DPL continues to make progress with allocating homesteads and the number of Village homestead applicants on Saipan has decreased from 3,182 in 2016 to 2,138 in 2021 and 23 permits were issued for Saipan homesteads in 2023 (DPL, 2019b, DPL, 2020, DPL, 2021, DPL, 2023). Also, between 2020 and 2023 a combined total of 213 quitclaim deeds (village and agricultural combined) were issued—18 on Saipan, 189 on Tinian, and 6 on Rota. In 2021, DPL in collaboration with the Infrastructure Recovery Program and Commonwealth Utility Corporation, was approved for ongoing homestead infrastructure projects—$15,701,655 for drinking water and $69,124,337 for wastewater (DPL, 2021). However, funding infrastructure projects continues to be a challenge for developing and awarding homesteads.

2.7.7 Projected Changes in Development

DPL conducted public outreach to gather input from stakeholders and community members regarding future land use. DPL developed future land use maps for Saipan, Tinian, Rota, Agrihan, Alamagan, Anatahan, and Pagan (full-page maps are in Appendix B).

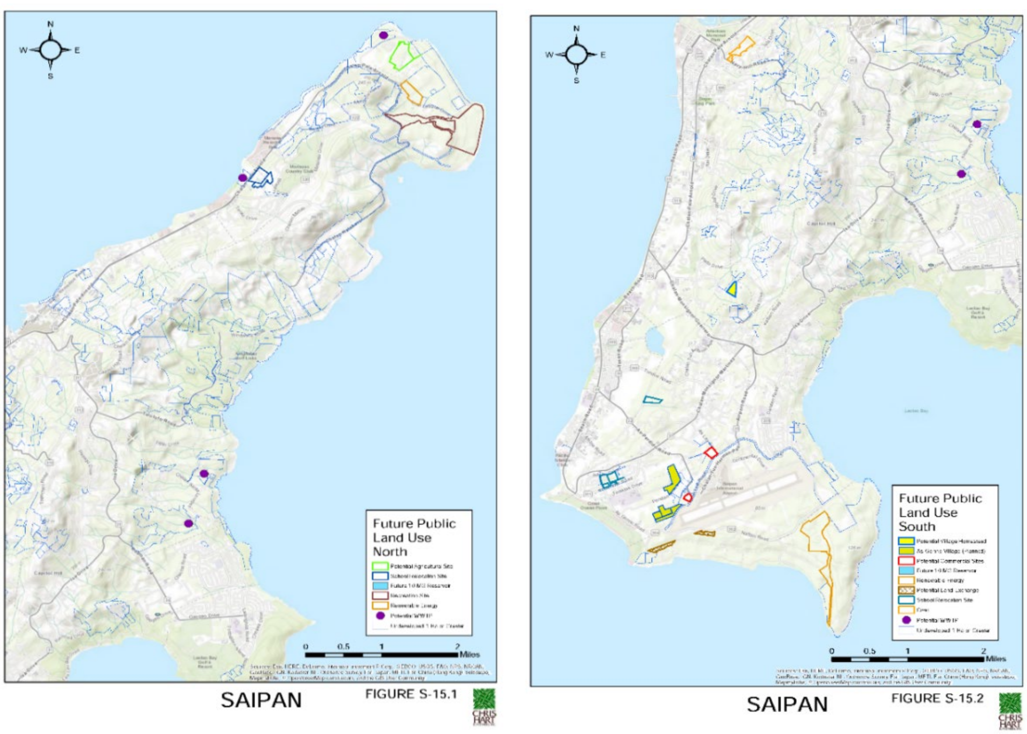


Figure 2.15. Future public land use maps for Saipan.

For Saipan, the PLUP identifies locations for proposed future land use including sites for future reservoirs, agriculture, recreation, wastewater treatment plants, village homesteads, commercial buildings, renewable energy installations, parcels for potential land exchange, civic uses, and schools to relocated them outside the Tsunami zone.

For Tinian, the PLUP identifies potential locations for proposed future land use including sites for village and agricultural homesteads, agricultural land, municipal civic center, and parcels for potential land exchange, and lands for future economic development.

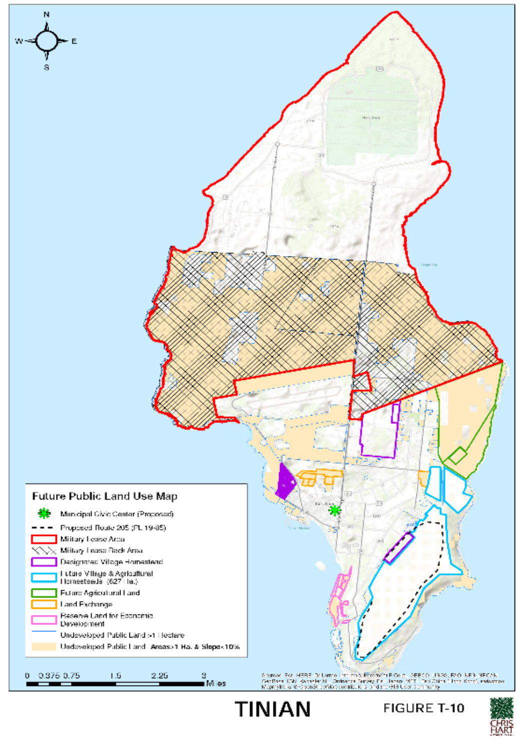


Figure 2.16. Future public land use map for Tinian.

For Rota, the PLUP identifies potential locations for proposed land use including sites for village and agricultural homesteads, a visitor's center, civic uses, renewable energy projects, power plant relocation, and parcels for potential land exchange.

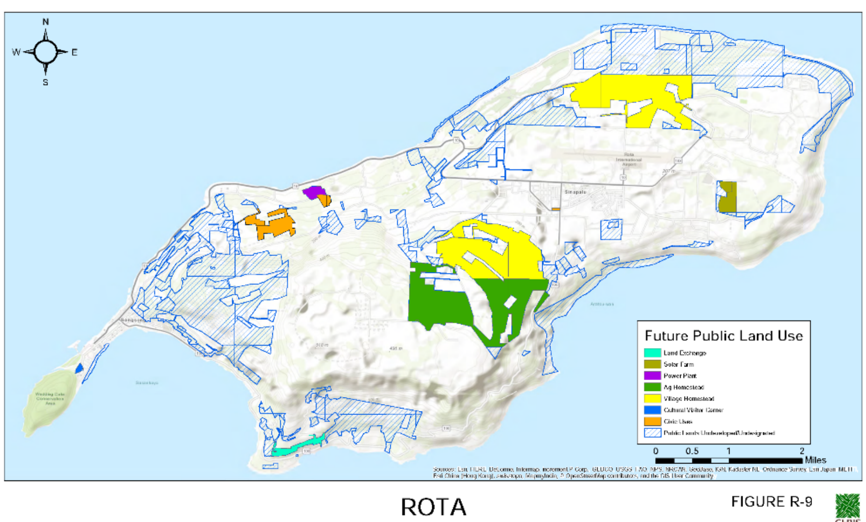


Figure 2.17. Future public land use map for Rota.

For the Northern Islands of Agrihan, Pagan, Alamagan, and Anatahan, the PLUP identifies potential locations for proposed future land use including sites for agricultural homestead on each island and a Mayor's Office facility that is proposed to include an emergency shelter and lodging.

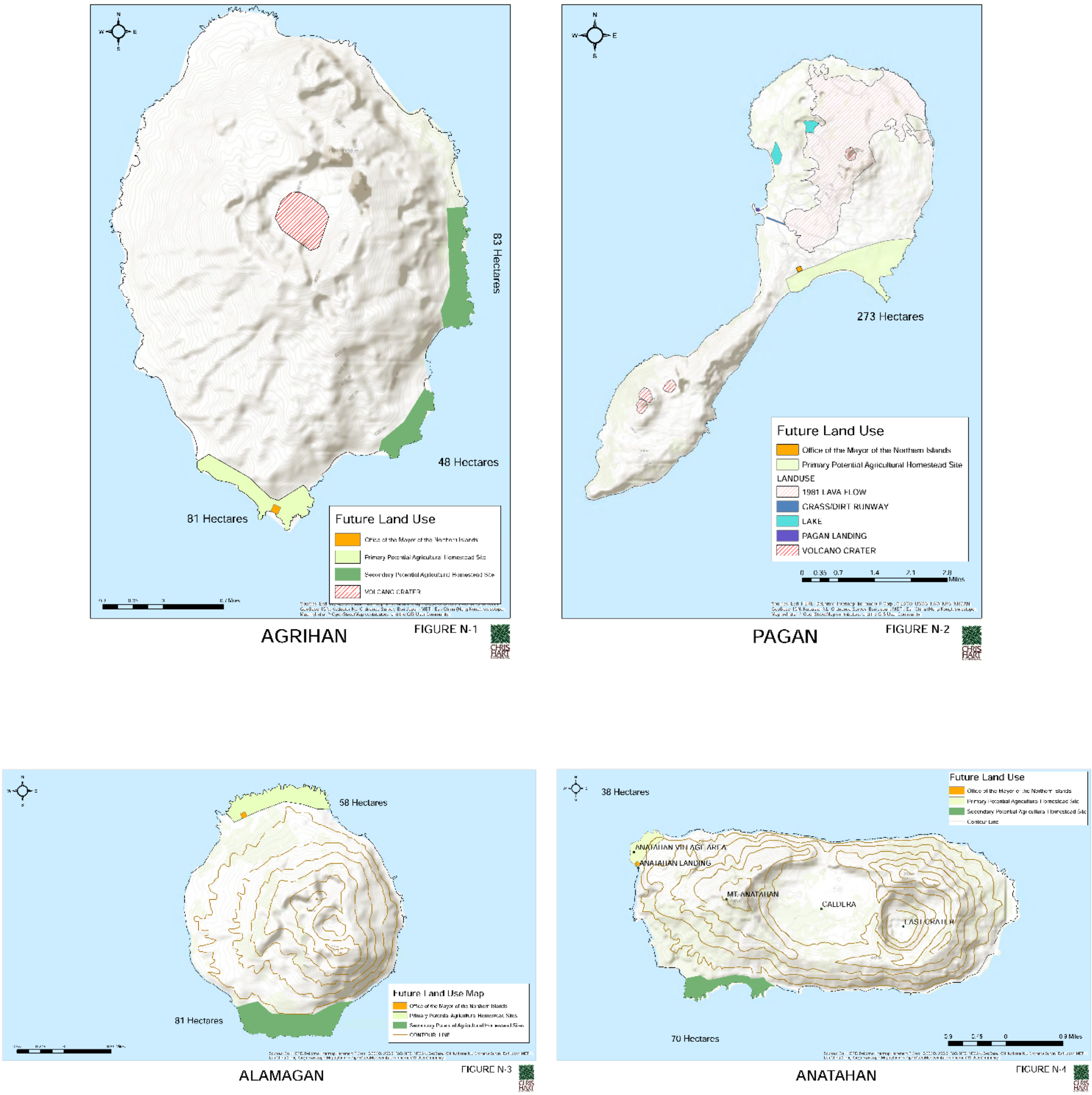


Figure 2.18. Future public land use map for Agrihan (upper left), Pagan (upper right), Alamagan (lower left), and Anatahan (lower right).

2.8 Commonwealth Assets, Community Lifelines, and Critical Facilities

For the Commonwealth profile section, a high-level overview of the assets, community lifelines, and critical facilities is provided. A more detailed description and inventory of these assets is provided in Chapter 4 as part of the natural hazards risk assessment and loss evaluation.

2.8.1 Commonwealth Buildings and Infrastructure

Commonwealth buildings and infrastructure includes government owned and operated buildings, infrastructure, critical facilities, and community lifelines. The 2018 SSMP included a Facilities Assessment Matrix (FAM), which is a list of Commonwealth buildings and infrastructure that was first developed in 2010. The FAM includes data about which agency is responsible for the asset, use description, year built, square footage, wall type and roof type, and replacement costs for the structure and building contents (if applicable).

However, the facilities listed in the FAM did not have geospatial information; therefore, the information was difficult to use within a Geographic Information System (GIS) environment to evaluate risks and perform vulnerability analyses and loss estimations. To update the FAM, geolocations were assigned to all the listed facilities and CNMI agency personnel verified facilities, which were then accurately assigned geospatial coordinates and/or the location of the facility was ground-truthed. All the information from the FAM was ported into a geodata base within the Esri ArcGIS Pro platform. Asset replacement costs in the 2018 FAM had not been updated since 2010.

For the 2024 SHMP Update, replacement cost values for the Commonwealth assets were developed. The replacement cost values include costs to replace the building/ structure and the contents. Structure replacement costs used for the 2024 SHMP Update were based on FEMA estimates provided in the Hazus 6.0 program. To estimate the square ft. replacement costs for structures in the Mariana Islands, FEMA used RSMeans estimates from 2014 and adjusted these estimates to 2016 values using the Consumer Price Index approach and applied cost-modification factors for Hawaiʻi. For buildings where square foot data were not available in Hazus 6.0, building footprints in OpenStreetMap were used to estimate the square footage of the building and then the structural replacement costs were generated in the GIS for these structures using the square foot replacement costs from Hazus. Information about the specific occupancy of the buildings was not readily available for this analysis. Therefore, some of the replacement values estimates are likely not accurate to the specific type of building occupancy (e.g., residential, commercial, industrial, etc.) and will likely lead to an underestimation of replacement costs. Future replacement estimates will be improved as data are improved in Hazus and/or the geodatabase developed for the Commonwealth buildings and the general building stock.

The contents replacement value was estimated as a percent of the structure replacement value consistent with Hazus guidelines. Again, because information about the specific occupancy of the buildings was largely lacking, the value of the contents was generally assumed to be 50% of the structure replacement value. As with the replacement value estimates, the estimated replacement value for the contents is likely an underestimate. However, these estimates provide a way to compare the relative impacts to the economy and to agencies from various hazards. Lastly, the building and content replacement values are combined and presented as the total replacement cost value in the loss evaluations (Table 2.10).

Table 2.10. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by municipality.

Municipality	Total No. of Bldgs.	Building Replacement Cost	Contents Replacement Cost Value (RCV)	Total Replacement Cost Value (RCV)	% of Total RCV
Saipan	246	$457,936,891	$251,007,607	$708,944,498	73%
Tinian	83	$93,625,578	$46,721,891	$140,347,469	14%
Rota	58	$73,898,816	$49,133,860	$123,032,676	13%
Total	**387**	**$625,461,285**	**$346,863,358**	**$972,324,643**	

Agency staff also identified several buildings owned or operated by the Commonwealth government that were missing from the 2018 FAM. The buildings were added to the new geodatabase of Commonwealth owned and operated buildings and infrastructure. However, these new entries will not have all the building characteristics/data as the buildings identified in the 2018 FAM because time was not allotted to gather this extra information to populate the database.

Table 2.11. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by agency.

Agency	Total No. of Bldgs.	% of Total Bldgs.	Building Replacement Cost	Contents Replacement Cost Value (RCV)	Total Replacement Cost Value (RCV)	% of Total RCV
Commonwealth Healthcare Corporation	14	4%	$133,102,318	$48,361,941	$181,464,259	19%
Commonwealth Legislature	1	0%	$3,494,990	$1,747,495	$5,242,485	1%
Commonwealth Utilities Corporation	63	16%	$72,585,268	$80,798,643	$153,383,911	16%
Council on Developmental Disabilities	1	0%	$346,423	$173,212	$519,635	0%
Dept. of Commerce	5	1%	$2,333,379	$1,088,589	$3,421,968	0%
Dept. of Community and Cultural Affairs	28	7%	$16,054,472	$7,960,962	$24,015,434	2%
Dept. of Finance	8	2%	$5,438,587	$2,476,473	$7,915,060	1%
Dept. of Fire and Emergency Services	14	4%	$6,105,756	$3,789,878	$9,895,634	1%
Dept. of Labor	8	2%	$4,233,123	$2,295,625	$6,528,748	1%

Table 2.11. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by agency (*cont'd*).

Agency	Total No. of Bldgs.	% of Total Bldgs.	Building Replacement Cost	Contents Replacement Costs Value (RCV)	Total Replacement Cost Value (RCV)	% of Total RCV
Dept. of Lands and Natural Resources	30	8%	$63,416,323	$32,400,338	$95,816,661	10%
Dept. of Public Safety	24	6%	$11,595,466	$13,528,738	$25,124,204	3%
Dept. of Public Works	11	3%	$36,527,954	$11,585,905	$48,113,859	5%
Judiciary	2	1%	$3,443,869	$1,721,935	$5,165,804	1%
Mariana Public Land Trust	1	0%	$987,468	$493,734	$1,481,202	0%
Marianas Visitors Authority	3	1%	$454,400	$77,464	$531,864	0%
Mayor's Offices	17	4%	$14,249,183	$3,705,038	$17,954,221	2%
Northern Marianas College	1	0%	$2,840,000	$4,970,000	$7,810,000	1%
Office of the Attorney General	4	1%	$1,278,000	$1,164,400	$2,442,400	0%
Office of the Governor	15	4%	$12,484,100	$6,242,051	$18,726,151	2%
Office of Homeland Security & Emergency Management	10	3%	$6,948,067	$3,332,033	$10,280,100	1%
Office of the Public Auditor	3	1%	$1,376,355	$688,178	$2,064,533	0%
Ports Authority	44	11%	$69,688,936	$64,560,775	$134,249,711	14%
Private Entity	6	2%	$7,354,522	$3,677,262	$11,031,784	1%
Public Library	2	1%	$3,686,526	$1,843,262	$5,529,788	1%
Public School System	55	14%	$134,606,300	$43,899,827	$178,506,127	18%
Women's Association	1	0%	$987,468	$493,734	$1,481,202	0%
Other	14	4%	$9,096,225	$3,412,964	$12,509,189	1%
Total	**387**		**$625,461,285**	**$346,863,358**	**$972,324,643**	

Commonwealth Buildings in the Northern Islands

Critical infrastructure and community lifelines are inherently different for the Northern Islands. Because of the limited number of facilities and infrastructure in the Northern Islands, the importance of this infrastructure is overwhelmed by the large number of facilities in the Southern Islands. Assets on the Northern Islands will be discussed separately from other Commonwealth assets in each hazard risk assessment.

Critical facilities in the Northern Islands includes government offices on Agrihan, Alamagan, and Pagan, which house radio communication equipment and serve as health dispensaries and typhoon shelters (Figure 2.19). There are also water catchment systems with 10,000 gallon tanks on Agrihan and Alamagan and a 20,000 gallon tank on Pagan. These facilities are vital to the health and well-being of people living in the Northern Islands. Transporting materials and fuel for construction, maintenance, and repair of facilities is costly and logistically challenging due to the remoteness of the islands and lack of port/landing facilities. Replacement costs for the buildings and tanks on the islands is estimated at $1.2 million (Table 2.12).

Figure 2.19. Public facilities constructed by the Northern Islands Mayor's Office on Agrihan (left) and Alamagan (right).

Table 2.12. Northern Island commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents).

Northern Islands	Total No. of Bldgs.	Building Replacement Costs	Contents Replacement Cost Value (RCV)	Total Replacement Cost Value (RCV)	% of Total RCV
Agrihan	9	$516,148	$258,074	$774,222	44%
Alamagan	5	$192,263	$96,131	$288,394	16%
Pagan	9	$468,205	$234,102	$702,307	40%
Total	**23**	**$1,176,616**	**$588,307**	**$1,764,923**	

2.8.2 Roads

Existing Commonwealth roads are divided into 2 main categories: 1) primary roads, which consist of the numbered highways and other paved roads, and 2) secondary roads, which are unpaved. The Department of Public Works (DPW) Roads and Grounds Division develops and maintains primary roads and highways while respective Mayors' offices and sometimes private landowners maintain secondary unpaved roads. The Department of Public Works recently released the *20-year Highway Master Plan* (GHD, 2023), which suggests standardizing the road classification system. In addition the Northern Mariana Healthcare Corporation also released recent analyses of the Commonwealth road and transportation network in walkability assessments for Saipan (Cash et al., 2021), Tinian (CHC, 2022b) and Rota (CHC, 2022a).

Commonwealth plans and reports provide various statistics for the total milage of primary (paved and secondary (unpaved) roads for Saipan, Tinian, and Rota. There are no paved roads on the Northern Islands. For the 2024 SHMP Update, the roads layer on OpenStreetMap was deemed to be the best, most current data readily available. Most of the paved roads are on Saipan followed by Tinian and Rota (Table 2.13).

Table 2.13. Primary road length by municipality.

Jurisdiction	Total Length of Primary Roads (Miles)	Percent of the Total State Mileage
Saipan	87.0	45%
Tinian	67.1	35%
Rota	39.6	20%
Total	**193.7**	**--**

Source: OpenStreetMap.

2.8.3 Community Lifelines and Critical Facilities

A critical facility may be defined as one that is essential in providing, service, utility, or direction either during the response to an emergency or during the recovery operation. The US Department of Homeland Security recommends using community lifeline categories to standardize the classification of critical facilities and infrastructure in planning documents. A community lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable consolidations between government and other organizations (e.g., infrastructure owners and operators)
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets
- Highlight lifeline related priority areas regarding general operations as well as response efforts

Table 2.14. Number of Community Lifelines by category and estimated replacement cost value.

Community Lifeline (CL) Categories	Total No. of CL	% of Total CL	Total Replacement Cost Value (RCV) (structure and contents)	% of Total RCV
Communications	4	2%	$864,517	> 0.1%
Energy	46	19%	$140,851,551	23%
Food, Water, Shelter	24	10%	$37,356,099	6%
Hazardous Material	9	4%	$48,091,161	8%
Health and Medical	19	8%	$187,643,812	30%
Energy	35	15%	$38,639,592	6%
Transportation	48	20%	$119,925,667	19%
Water Systems	52	22%	$50,052,062	8%
Total	**237**	**--**	**$623,424,461**	**--**

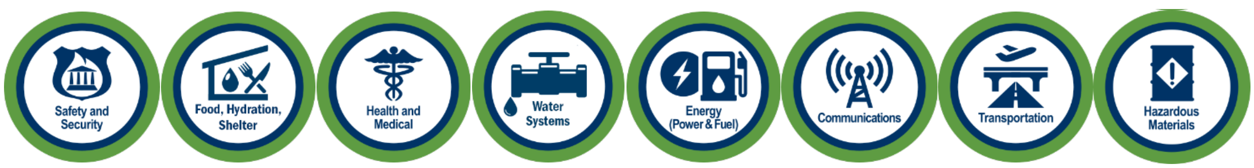


Table 2.15. Number of community lifelines by municipality and estimated replacement cost values.

Jurisdiction	Community Lifelines (CL)		Replacement Cost Value (RCV) (structure and contents)	
	Number of CL	% of Total CL	RCV	% of RCV
Saipan	138	58%	$443,440,083	71%
Tinian	56	24%	$100,943,913	16%
Rota	43	18%	$79,040,465	12%
Total	**237**	**--**	**$623,424,461**	**--**

2.8.4 Environmental Management and Protection

The Division of Environmental Quality (DEQ) within BECQ administers hazardous waste management programs for the CNMI. DEQ determines facility compliance with the Hazardous Waste Management Regulations (Chapter 65-50). The CNMI has a multi-agency Emergency Response Team that includes DEQ, Emergency Management, the Departments of Public Safety and Works, Division of Coastal Resources Management, Office of the Mayor, and Commonwealth Ports Authority-Aircraft Rescue and Fire Fighting. This team is equipped to respond to natural and human-caused disasters such as typhoons, earthquakes, and chemical and oil spills.

The Office of Homeland Security and Emergency Management (HSEM) addresses capabilities to respond to hazardous materials following severe weather, earthquake, or other disaster during the Threats and Hazards Identification Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR) processes. To protect valuable natural resources and reduce risks of negative impacts to people and the environment in the wake of disaster events, CNMI aims to build capabilities to deploy HazMat teams to conduct assessments and execute response operations to control the release and effects of contaminants at bulk fuel facilities, utility facilities, inundated sites, and other sources of contaminant release within 24-hours. Gaps and needs were identified across all functional areas—planning, organization, equipment, training, and exercises—in the THIRA (HSEM, 2024) and SPR (HSEM, 2023).

The importance of such emergency response capabilities was highlighted by Typhoon *Soudelor*, which ruptured a fuel tank at the Mobil Oil facility located at the Saipan Port on August 5, 2015. The US Department of Energy Situation Report indicated that the rupture occurred when a vessel broke free of its moorings and breached a 1,000-gallon diesel tank on Delta Wharf in the Port of Saipan, leading to the release of about 500 gallons of diesel into the water. This spill led to closing the port for 5 days during clean-up activities and limited the operations of some service stations. Impacts from Typhoon *Soudelor* emphasized the importance of environmental management and protection which have supported updated preparedness and mitigation planning discussions.

2.8.5 General Building Stock

Residential, commercial, industrial, and other structures in the CNMI comprise the general building stock. Understanding where structures are located, their value, and their potential for damage is important to describe the overall risk from the hazards of concern as damage to the general building stock has cascading effects to recovery efforts. Understanding the risks to the general building stock can help planners design and implement cost-effective mitigation strategies that have the greatest potential for reducing risk to lives and property. Risks to the general building stock from each hazard of concern are evaluated in the Exposure and vulnerability of the general building stock to each hazard of concern is presented in Chapters 4.2 (Typhoon) through 4.10 (Volcanic Activity).

Table 2.16. General building stock estimated replacement cost value (structure and contents) by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV) (Structure and Contents)	% of Total RCV
Saipan	12,761	$6,179,343,282	89%
Tinian	98	$399,885,060	6%
Rota	1,261	$343,591,589	5%
Total	**14,930**	**$6,923,089,892**	**--**

2.9 Natural Resources

The CNMI has a strong constitutional foundation to ensure sustainable stewardship for the shared public goods and services CNMI's natural resources provide. Natural resources management programs are administered by the Department of Lands and Natural Resources (DLNR), the BECQ, the DPL and to some extent the Office of Zoning, and their divisions, as well as the Offices of the Mayors. Preserving native habitats and biodiversity protects ecosystem functions and services and helps retain natural resiliency to environmental stressors in these systems. Resilient natural systems (i.e., natural infrastructure) can help attenuate and reduce the impacts of severe weather events on the built environment and communities.

Numerous legal mechanisms are in to ensure management and protection of natural areas and guide development in CNMI, including protected conservation areas on land and in the water that are aimed at preserving habitat and supporting fishing, hunting, and other uses. According to the *Wildlife Action Plan for the Commonwealth of the Northern Marianas 2015–2025* (Liske-Clark, 2015), native forest, which provides habitat for numerous listed species is primarily found on Rota and in the southwest region of Tinian. However native forest cover has declined between 2014 and 2018 on Saipan with only 12% of native limestone forest cover recorded in the 2017 USFWS *Vegetative Mapping of the Marianas* (Amidon et al., 2017). Managing invasive species and replanting native trees are identified as important management objectives to support native species conservation and recovery.

The *Wildlife Action Plan for the CMI 2015–2025* (Liske-Clark, 2015) details threats to biodiversity and habitat in the Commonwealth. The plan describes threats posed by invasive species including habitat modification, introduced ungulates, non-native predators, and invasive or nuisance marine species. In addition, the plan discusses threats from ongoing development, climate change, military expansion, pollution, harvest, tourism and recreation, natural disasters, and sea transportation. Mitigation actions that reduce threats to native habitats, biodiversity, and natural areas in general, can help support natural systems that provide the ecosystem services that the built environment relies upon remain resilient and functioning into the future.

2.9.1 Geology and Soils

Most of the soils in CNMI can be characterized as lateritic, having evolved under high temperatures and abundant rainfall. In the elevated portions of Saipan, the soil is surface clay while the lowland has rich topsoil, which is generally less than 30 inches deep. Of the 29,811 acres of land on Saipan, approximately 1,300 acres or about 5% of the land can be classified as fair in overall productivity ratings for agricultural use. Another 35% can be categorized as suitable for productive grazing lands. Approximately, 60% of the lands on the island of Saipan can be categorized as having steep slopes, shallow soil, rocky surfaces, or are comprised of wetlands. These lands are best adaptable for watershed, secondary grazing, or conservation use.

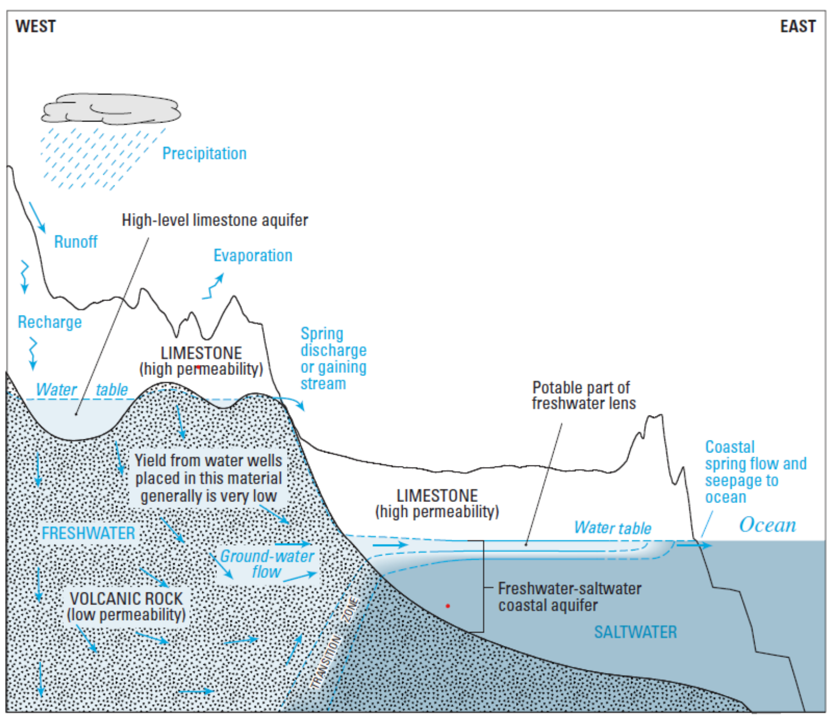
Four major geologic units form the island of Tinian, which include the Tinian Pyroclastic Rocks (TPR), the Tapochau Limestone (TL), the Mariana Limestone (ML), and unconsolidated sediments (UCS) consisting of beach deposits, alluvium, and colluviums. The TPR are of the late Eocene Age and are the oldest exposed geological unit, which are comprised of fine to coarse-grained consolidated ash and angular fragments of volcanic origin with outcrops that are highly weathered and altered to clay. The TL units are of early Miocene Age and are composed of fine to coarse-grained, partially recrystallized broken limestone fragments and reworked volcanic fragments and clay with highly weathered surface exposures. The ML units are of Pliocene to Pleistocene Age and are the most extensive unit volumetrically above sea level. The ML units are composed of fine to coarse-grained fragmented limestone, commonly coralliferous, with some fossil and algal remains, and lesser amounts of clay particles.

The UCS units are of the Pleistocene to Holocene Age that are composed of poorly consolidated sediments, mostly calcareous sand and gravel deposited by waves, but also clays and silt deposited inland beside Hagoi Lake and Marpo Wetland.

The geological formation of Rota is a high volcanic center, which is surrounded by raised coral terraces and a fringing reef. There is abundant grassland and dry scrublands on the volcanic slopes serving as a habitat to threatened plant species and endemic avifauna species (see Appendix D for a list of species of conservation concern).

2.9.2 Hydrology and Groundwater Resources

The primary groundwater resource in the Commonwealth is coralliferous limestone that contains a freshwater lens that floats on a saltwater base near sea level (Carruth, 2003). The freshwater lens is recharged by rainwater, whereupon the lens shrinks and expands in response to the variations in recharge and groundwater withdrawal activity at well sites. The salinity of water withdrawn from wells will rise if the withdrawal rate is too high or rainfall is too low for prolonged periods.



Source: Carruth, 2003.

Groundwater production from Commonwealth Utilities Corporation (CUC) wells on Saipan is approximately 9.5–10.5 million gallons per day (mgd) depending on seasonal fluctuations. Total production is difficult to calculate due to the multitude of privately owned and operated wells on Saipan. However, CUC estimates that it may be as much as 20 mgd or higher. Groundwater is pumped from limestone aquifers throughout the island and pumping is concentrated in southern Saipan. The CUC supplies municipal water on Saipan. As of 2023, CUC states there are 13 aquifers on Saipan that supply 12,000 customers, excluding resort properties. There are 127 wells that provide up to 10.3 mgd to 14 large water storage tanks across the island in 13 service tanks areas. A similar number of privately owned wells are scattered throughout Saipan for light industries, irrigation, and tourist-related businesses such as resorts and golf courses.

On the island of Tinian, USGS reports that the maximum thickness of the freshwater lens is about 40 ft at the most inland well that is situated in the Median (Marpo) Valley. Previously conducted studies revealed that the freshwater lens can increase 3–5 ft during the wet season and decrease to 1–2 ft during the dry season. Two wetland areas near sea level are supplied perennially by groundwater—Hagoi Lake in the northern lowland is a fresh to brackish water body surrounded by a wetland and Marpo wetland in the Median Valley is a small area of shallow open water. As of 2023, CUC states that the Maui II well has 2 backup generators and 4,100 gallon per minute well pumps supply water to the transmission main that fills the single tank in their system in Carolina Heights. This tank provides water to the community of San Jose, outlying areas, and the airport.

Rota is about 12 miles long and 5 miles wide at the widest point and has a population of about 2,500. The entire island surface is covered by uplifted limestone, except for the 2.5-mile scarp along the southernmost flank of the island, where the volcanic core is exposed. As of 2023, the sole water supply for Rota comes from a spring located within a cave in the local mountain heights. Based on the location of the cave and the installation of several pressure relief and pressure sustaining valves, the main supply line maintains adequate supply and pressure to each customer connected to the system. However, there are on-going concerns about watershed management to protect the quality of this water supply. Planning efforts to protect the watershed were held between 2018 and 2019 and involved multiple agencies and the community. In 2020, the *Talakhaya Integrated Watershed Management Plan–2020* (BECQ-DCRM, 2020) was published. The plan outlines actions to manage threats, protect water resources, and work toward a more sustainable future for residents. Rota also has 3 groundwater wells that are used as backup.

2.9.3 Nature-based Infrastructure and Natural Resiliency Hubs

As part of the National Mitigation Investment Strategy, the Department of Homeland Security, FEMA, and other federal agencies are embracing nature-based solutions to improve resiliency of the built environment to natural hazards today and under future climate conditions. FEMA defines nature-based solutions as sustainable planning, design, environmental management, and engineering practices that incorporate natural features into the built environment to promote adaptation and resilience (FEMA, 2021). Nature-based solutions can be a cost-effective approach to help communities meet sustainable development and hazard mitigation goals and to keep natural hazards from becoming costly disasters. Nature-based solutions encompass 1) green infrastructure and low impact development, 2) natural infrastructure such as coral reefs, 3) engineering with nature, and 4) Bioengineering. Categories of nature-based solutions include 1) watershed management to connect natural areas and open space, 2) neighborhood or site scale distributed stormwater management, and 3) use of nature-based solutions in coastal areas to stabilize shorelines, reduce erosion, and buffer the coast from storm impacts.

The National Wildlife Foundation, under contract to the National Oceanic and Atmosphere Administration (NOAA), completed the *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (Dobson et al., 2020) to identify existing natural infrastructure and natural resiliency hubs in the CNMI. In the report, resiliency hubs are defined as large areas of natural, open space or habitat where, if any investments are made in conservation or restoration, there is potential for improved human community resilience and benefits to fish and wildlife habitats and species. The analysis identified resiliency hubs throughout the CNMI. Specifically, the extensive fringing and barrier coral reefs create coastal habitats that help to absorb wave energy and minimize the impact from storm surge. This is particularly important for the densely populated coastal communities along the extensive lagoon of west coast Saipan.

2.9.4 Biodiversity

The biodiversity of plants and animals in the Commonwealth is high with species adapting to the unique ecological habitats that exist on each island. The limestone forest regions are a common habitat to several endemic species. See Appendix D for a list of species of conservation concern, including species listed as threatened or endangered under the Endangered Species Act. For a more complete list of flora and fauna, see *Common Flora and Fauna of the Mariana Islands* (Vogt & Williams, 2004).

The native species of the CNMI—defined as species that were present on the Islands when the Chamorro people first arrived—evolved in the archipelago and many are found nowhere else in the world (i.e., they are endemic to the archipelago). Often, endemic species are suspectable to threats (i.e., competition for resources) from species introduced by people. Some non-native species introduced by people have become invasive meaning that these species have, or have the potential, to cause environmental or economic harm or harm to human health. Invasive species can decrease biodiversity and reduce the resilience of the native communities, especially under changing climate conditions. These changes in the natural communities can have cascading effects on other species, especially rare, threatened, and endangered species, and the built environment. For example, the introduction of the African scarlet gourd vine (*Corcinnia* grandis), threatens the vegetation ecology of Saipan. The DLNR works to monitor and control invasive species such as the brown tree snake (*Boiga irregularis*), the little red fire ant (*Wasmannia auropunctata*), and the coconut rhinoceros beetle (*Oryctes rhinoceros*), to protect the natural environment.

Non-native marine species can also become invasive and cause significant impacts to marine habitats and species by out-competing and replacing native taxa and even altering the entire ecosystem. The introduction of non-native and potentially invasive coral reef species can be intentional, typically to enhance fisheries, or accidental, primarily by transport on ship hulls and ballast water or by aquarists disposing of unwanted organisms. There are also concerns that red tilapia (*Oreochromis mossambica*), which was intentionally introduced in the 1950s, may enter the Saipan Lagoon from adjacent open-system pools (Starmer, 2005).

Federally protected Threatened and Endangered species and Federal Critical Habitat

The Endangered Species Act of 1973 (ESA) provides a framework to conserve and protect endangered and threatened species and their habitats. Under this Act, the USFWS is responsible for all terrestrial and freshwater species, as well as migratory birds. The National Marine Fisheries Service (NMFS) is responsible for all marine water species. The USFWS and NMFS jointly manage sea turtles.

The USFWS lists 29 species as threatened or endangered in the CNMI—2 mammal species (bats), 8 bird species, 1 terrestrial reptile species, 6 invertebrates, and 12 plant species. The NFMS lists an additional 12 species as threatened or endangered that reside in or visit marine habitats surrounding the CNMI—6 marine mammal species, 3 fish species, and 3 marine invertebrate (coral) species. Together the USFWS and NFMS list 5 sea turtle species as endangered. See Appendix D for a list of federally listed threatened or endangered species that are found in the Commonwealth.

The ESA also provides a framework to designate critical habitat. Critical habitats are ecosystems that are essential to sustain endangered or threatened species. In 2004, the USFWS designated critical habitat for the Fanihi (*Pteropus mariannus*, Mariana fruit bat; *Pteropus tokudae*) and the Aga (*Corvus kubaryi*, Mariana Crow). In 2006, the USFWS designated critical habitat for the Nosa (*Zosterops conspicillatus*, Rota bridled white-eye). In 2023, the USFWS proposed critical habitat for another 23 species. Also in 2023, the USFWS, with NFMS, proposed critical habitat for the green sea turtle (*Chelonia mydas*) on land and in the water. The NMFS proposed critical habitat for 1 coral species (*Acropora globiceps*) in the CNMI in 2023. Rules that were proposed for critical habitat are expected to become final in 2024.

2.9.5 Vegetation

In 2017, the USFWS mapped vegetation and land cover in the CNMI and produced the report *Vegetative Mapping of the Mariana Islands* (Amidon et al., 2017). The report updated the previous land cover maps produced by the US Forest Service in 2006 (Liu & Fischer, 2006). The updated vegetation map reflects the status of the forest in 2016, the year of the satellite images used to classify the vegetation. Maps from the USFWS report (Amidon et al., 2017) for the main islands and 4 Northern Islands are included in Appendix D.

In 2020, Willsey et al. (2020) use the 2016 land cover data developed by Amidon et al. (2017) to evaluate the status of forests in the Commonwealth by 4 types: 1) native, 2) secondary/mixed, 3) monoculture, and 4) Leucaena. Similar to past vegetation assessments (Liu & Fischer, 2006), Willsey et al. (2020) found that native forest lands are primarily found on Rota and in the southwest region of Tinian (Table 2.17, Figure 2.20, and Figure 2.21). Native forests are also still present on Aguiguan and Guguan (Willsey et al., 2020). Very few areas of native forest remain on Saipan, with a few scattered pockets on the Banadero cliffs and the Kagman Peninsula (Figure 2.20). Saipan and Tinian forests were primary secondary/mixed forests and leucaena forests.

Table 2.17. Estimated acreages and percent of island in each forest type as of 2016.

	Native		Secondary/Mixed		Monoculture		Leucaena	
Island	**Acres**	**% Is.**	**Acres**	**% Is.**	**Acres**	**% Is.**	**Acres**	**% Is.**
Saipan	427	1%	10,656	36%	526	2%	5,492	19%
Tinian	1,067	4%	6,202	25%	888	4%	8,279	33%
Rota	10,052	47%	2,163	10%	667	3%	229	1%

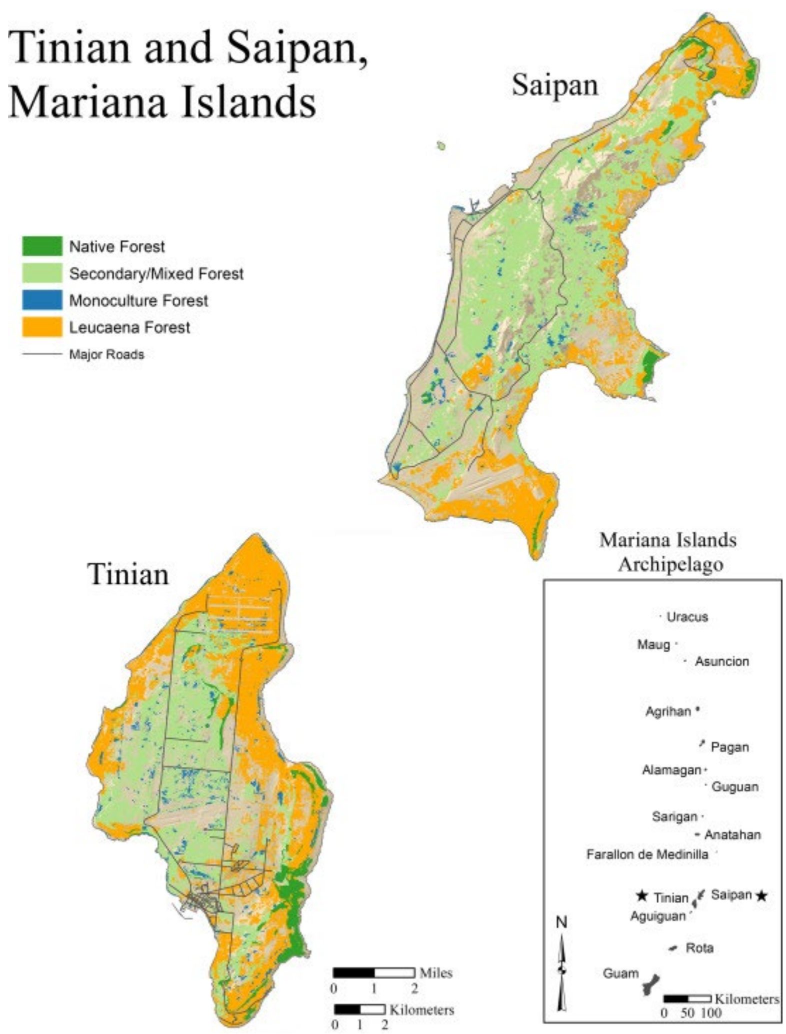


Figure 2.20. Forest cover classified into 4 types on Saipan and Tinian based on data from 2016.
Source Willsey et al. (2020).

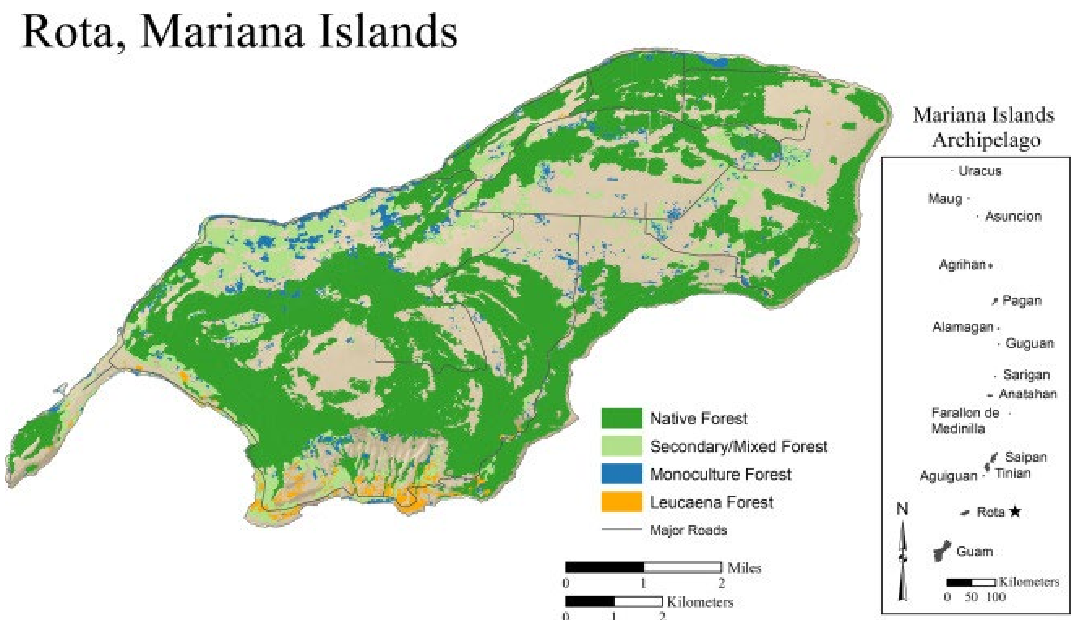


Figure 2.21. Forest cover classified into 4 types on Rota based on data from 2016.
Source Willsey et al. (2020).

2.9.6 Watershed Management and Water Quality

Water resources include inland coastal and marine resources. Water quality is closely connected with overall ecosystem health and resiliency of aquatic systems from the uplands to the marine environments. The Bureau of Environmental and Coastal Quality reported in 2022 that most of the shorelines and inland waterways were impaired for at least one designated use (Yuknavage et al., 2022). To help improve water quality across all aquatic systems, the CNMI implements several watershed protection plans aimed at reducing non-point source pollution by improving upland habitats to attenuate effects to downstream and shoreline water quality. Actively managed watersheds with management plans include Achugao, Garapan, and Laolao Bay on Saipan and Talakhaya on Rota. Through the Watershed Working Group, the BECQ partners with local and federal government agencies, environmental non-profits, and other stakeholders to provide technical expertise and project support on watershed initiatives. Through proactive watershed management, CNMI aims to reduce land-based pollutants in aquatic systems and improve water quality.

2.9.7 Wetland and Mangroves

Former agricultural practices have affected much of the original extent of coastal and freshwater wetlands in the CNMI, especially from sugar cane and rice cultivation during the Japanese period (1914–1944). For example, wastewater from sugar mill operations deposited high quantities of organic material into Lake Susupe on Saipan. In addition to agriculture and development impacts to wetlands, the exotic mosquito fish (*Gambusia affinis*) and the tilapia (*Sarotheradon mossambicus*) also alter these aquatic ecosystems.

Lake Susupe and the large contiguous wetlands on the western coastal plain of Saipan comprise over 60% of the remaining freshwater wetlands in the CNMI. Smaller wetlands on Saipan, the Pagan lakes, Lake Hagoi, and a wetland on Tinian make up most of the remaining wetland systems, with riparian stream systems being concentrated in the Talakaya area on Rota as well as in Papago, Talafofo, and Tanapag on Saipan. Lake Hagoi, which is situated near the north field runways on Tinian, is an important wetland ecosystem within the CNMI that provides habitat for several endemic and migratory bird species. Further, the freshwater wetlands of Saipan and Tinian are essential to the survival of the endangered Mariana Moorhen (*Gallinula chloropus guami*) and the endangered Nightingale Reed-warbler (*Acrocephalus Luscinia*).

2.9.8 Protected Land

Protected lands and waters are legally designated by the federal or CNMI government primarily for conservation of natural resources. Conservation Areas, Marine Protected Areas, and National Monuments are examples of protected lands or waters. Generally, protected lands and waters are secured from habitat conversion to development and have associated regulations regarding hunting, fishing, and other uses of the area. These regulations vary among protected areas, as each area has a distinct history and purpose for protection.

The Division of Fish and Wildlife (DFW) manages conservation areas on land and in the water. Designated conservation lands total 13,739 acres, representing 12% of the total land area of the CNMI. This includes conservation lands on Rota (22%) Tinian (4%), and Saipan (9%). On Saipan, DFW manages five protected areas and three on Rota. Brief descriptions of these protected resources are provided below. The CNMI Constitution sets aside the islands of Maug, Uracas, Asuncion, and Guguan as wilderness wildlife conservation areas not to be developed or inhabited by people. Sarigan is owned by the DPL but is regulated by the DFW.

The CNMI government has protected waters around Rota, Saipan, and Tinian to ensure sustainable use of highly visited areas and protect source populations of species that can be harvested outside of protected waters.

Protected Lands: Saipan

Bird Island Wildlife Sanctuary

The Bird Island Wildlife Sanctuary extends from the Bird Island Marine Sanctuary landward. It consists of 220 acres of land, including the Grotto. It is designated to conserve and protect plant and wildlife resources. There is no taking of plants, animals, or wildlife in the conservation area.

Kagman Wildlife Conservation Area

The Kagman Wildlife Conservation Area was established to enhance habitat functions for targeted endangered and threatened species. It is 330 acres along the shoreline of Kagman Peninsula and includes the Forbidden Island Overlook. The area is bounded to the north, east, and south by the Forbidden Island Marine Sanctuary. To the west, it is generally bounded by the Laolao Bay Golf Course and Kagman Village. There is no taking of plant or animal species.

Lake Susupe Conservation Area

The Susupe Wetland is one of the only large, freshwater wetlands in the CNMI. It is regulated to preserve, protect, and restore this unique ecosystem. Freshwater wetlands filter runoff from land to protect coral reefs from sedimentation. Additionally, these wetlands are important sources of freshwater, storm water catchment, and harbor many rare or unique species. In 2019, Lake Susupe and the surrounding wetland was declared a wildlife park under DLNR administration. Efforts to develop a plan to guide use and conservation of the area were funded and planning efforts are ongoing as of 2023.

Costco Park Wetland Mitigation Pond

The Costco Park Wetland Mitigation Pond mitigates the loss of wetland habitat from construction of the Costco Building. The pond is designated to protect, preserve, and restore freshwater wetlands habitat and species. Other, future development proposals that impacts wetlands may off-set impacts to wetlands by purchasing and protecting an ecologically similar area.

Saipan Upland Mitigation Bank

The Saipan Upland Mitigation Bank is a reserve for the Nightingale Reed-Warbler (*Acrocelphalus luscinia*), a federally and locally listed endangered species. Proponents of development that impacts the habitat of this species can purchase credits to protect breeding pairs within the reserve.

Megapode Conservation Areas

The Nightingale Reed-Warbler Conservation Area (77.1 acres) and the Micronesia Megapode Conservation Area (43.5 acres) were established in consultation with the USFWS during the planning process for the Marpi Point village homestead. Clearing, construction, recreation, or other activities that are incompatible with the protected species are not allowed within the conservation areas.

Protected Lands: Rota

Sabana Protected Area

Heights is a wildlife conservation area where taking plants, fish, or wildlife is prohibited to protect endemic plant and animal species.

Mariana Crow Conservation Area

The Marianas Crow Conservation Area (MCCA) was created by DFW regulation (Subchapter 85-30.4) to protect the area in a natural state to serve as a refuge for native wildlife with an emphasis on the Mariana Crow. The MCCA is a no-take area for plants and wildlife expect by permit from DFW.

<u>I'Chenchon Park Wildlife Conservation Area</u>

I'Chenchon Park Wildlife Conservation Area, also known as the I'Chenchon Bird Sanctuary, was established by Rota Local Law 9-1 for the conservation of wildlife and forest vegetation. The conservation area is home to a variety of nesting seabirds and contains the primary limestone forest extending along the eastern shoreline.

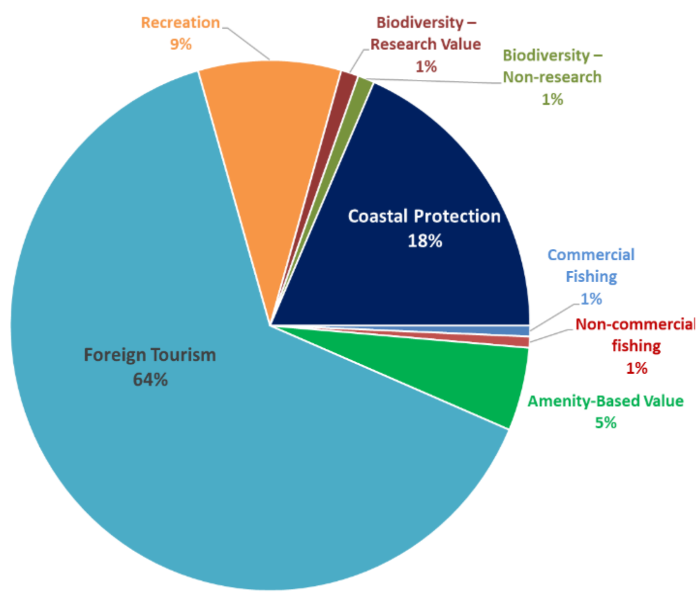
<u>Liyo Conservation Area</u>

The Liyo Conservation Area was created by Rota Local Law (Title 10: Division 1: Section 1821) and encompasses Mt. Taipingot, also known as Wedding Cake Mountain, to conserve indigenous wildlife and forest vegetation that exists on and around Mt. Taipingot. The Liyo Conservation Area is a no-take area for all plants and animals except for medicinal plants.

2.9.9 Marine Waters, Coral Reef, and Marine Species

Marine waters within the CNMI archipelago support a relatively high coral reef species diversity, with a total of over 5,600 known reef-associated species (Paulay, 2003), but the actual number of reef-associated species is likely considerably higher than what is currently known. Even at currently reported numbers the coral reef ecosystems of the Mariana Archipelago are among the most biologically diverse of all US States and Territories (Liske-Clark, 2015).

BECQ reported that together corals and seagrass provide an annual value of $114.8 million (BECQ, 2019). Foreign tourism accounts for most of the value followed by coastal protection and recreation benefits. Ecosystem services provided by coral and seagrass include commercial fishing, non-commercial fishing by residents, tourism and recreation, amenity/property value, research, biodiversity, and coastal protection. Areas of highest economic importance include Mañagaha Island, the Grotto, and Laolao Bay.



Source: *Draft—2023 Resources Report* (OPD, in prep.).

Between 2013 and 2017, corals have undergone four serious bleaching events, resulting in large-scale mortality and community composition changes. Between 2012 and 2018, 66% of the overall coal cover was lost and over 90% of the staghorn coral species (*Acropora*) lost (OPD, in prep.). The resilience of the coral reef system is impacted by rising ocean temperatures and bleaching events combined with ocean acidification and local stressors (e.g., runoff and pollution). In 2018, BECQ reported that most coral reefs in CNMI are in fair condition but suffering from local and global environmental stressors (BECQ, 2019). Despite management challenges at local and global levels, there are also numerous management local management to improve water quality and reduce localized stressors can help build system resiliency and reduce impacts and enhance outcomes for marine waters, seagrass, and coral reefs. Healthy coral reef and seagrass systems support marine ecosystem resiliency.

Seagrass beds are a distinct marine habitat typically found on fringing reef platforms and within barrier reef lagoons. Seagrass beds are ecologically, culturally, and economically important in the CNMI. Here, seagrass beds are limited to the shallow reef flat and barrier reef lagoon areas along the west coast of Saipan and comprise ~1,655 acres of the island's nearshore environment. Three seagrass species are present in the CNMI—*Enhalus acoroides, Halodule uninervis,* and *Haplophila minor.* Seagrass communities are integrally linked to the coral reef and mangrove ecosystems, serving as habitat and food for numerous marine species. Seagrasses provide ecosystem services for human populations by providing habitats for biodiversity preservation and for subsistence and commercial food fishes and invertebrates, stabilizing sand, trapping coastal sediments, sequestering carbon, filtering nutrients and contaminants, and protecting shorelines from erosion.

2.9.10 Areas of Particular Concern

The Coastal Resources Management Office (CRMO) was established in 1983 to promote the conservation and sustainable development of coastal resources. In 2014 CRMO merged with the Division of Environmental Quality, becoming the Division of Coastal Resources Management (DCRM) under BECQ (Executive Order 2013-24). The DCRM has established Areas of Particular Concern (APC), which are geographically delineated regions within the CNMI that have special management requirements. In January 2018, several definitions and management standards for APCs were updated in the revised Coastal Resources Management Rules and Regulations (see NMIAC § 15-10). APCs are areas that 1) possess a unique or vulnerable natural habitat, 2) are essential habitat for living resources, 3) where urban concentration for shoreline utilization is competitive, 4) that might be subject to significant hazards due to storms, slides, and floods, or 5) that are needed to protect, maintain, or replenish coastal resources. The following regions have been classified as APCs:

- Shoreline APC: This APC is identified as the area between the high tide line and 150 ft inland (changed from mean high water mark in prior publication).
- Lagoon and Reef APC: This APC is identified as the area consisting of a partially enclosed body of water formed by sand spits, bay mouth bars, barrier beaches, or coral reefs within the Commonwealth.

- Wetlands and Mangrove APC: This APC is identified as areas that are inundated or saturated by surface of ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
- Port and Industrial APC: This APC is identified as those land and water areas surrounding the commercial ports of Saipan, Tinian, and Rota.
- Coastal Hazards APC: This APC reflects those areas identified as a coastal high hazard flood zone (V and VE) in the FEMA Flood Insurance Rate Maps (updated to specify zones V and VE).

Saipan's Lagoon encompasses about 20 square miles of mostly shallow water and is separated from the Philippine Sea by a long barrier reef about 2 miles offshore at the entrance to Tanapag Harbor. The depth of the lagoon created by the reef varies from less than one foot to over three hundred ft. This area is managed jointly by CNMI resource management agencies for various use and conservation objectives, and a Saipan Lagoon Use Management Plan has been in place through the DCRM since 1985. In 2017 DCRM published an updated *Saipan Lagoon Use Management Plan Update* that provided use and conservation recommendations for the area (HWG-HEC, 2017).

2.9.11 Marine Protected Areas

Currently, CNMI has seven marine protected areas (MPAs). Within MPAs natural and/or cultural resources are more protected compared to surrounding waters. MPAs span a range of habitats and vary in purpose, legal authority, management approaches, levels of protection, and use restrictions. No-take reserves prohibit the fishing or harvesting of any marine species of plant or animal, prohibit take of coral (live or dead), and prohibit all exploitive or destructive activities to marine life. There is currently a local moratorium on harvesting trochus and sea cucumber in the CNMI. Harvesting of these species is currently illegal.

There are five no-take reserves (Figure 2.22):

1) Saipan, Mañagaha Marine Conservation Area (Public Law 12-12), 2,009 acres,
2) Saipan, Forbidden Island Marine Sanctuary (Public Law 12-46), 6.17 acres,
3) Saipan, Bird Island Marine Sanctuary (Public Law 12-46), 371 acres,
4) Rota, Sasanhaya Fish Reserve (Rota Local Law 9-2 §1), 208 acres and
5) Tinian, Tinian Marine Reserve, (Public Law 15-90), 1,158 acres.

Permanent Topshell Gastropod Reserves exist on a mile-long stretch of the Saipan Lagoon barrier reef, the Lighthouse Reserve, and at Tank Beach (Figure 2.22). The Tank Beach Reserve overlaps with the Forbidden Island Sanctuary. Permanent Sea Cucumber Reserves have been established by DFW regulation at Laolao Bay and Bird Island, the latter of which overlaps with the Bird Island Sanctuary. The total area covered by no-take reserves is estimated at 2,380 acres while the total area of all MPAs is estimated at approximately 2,965 acres.

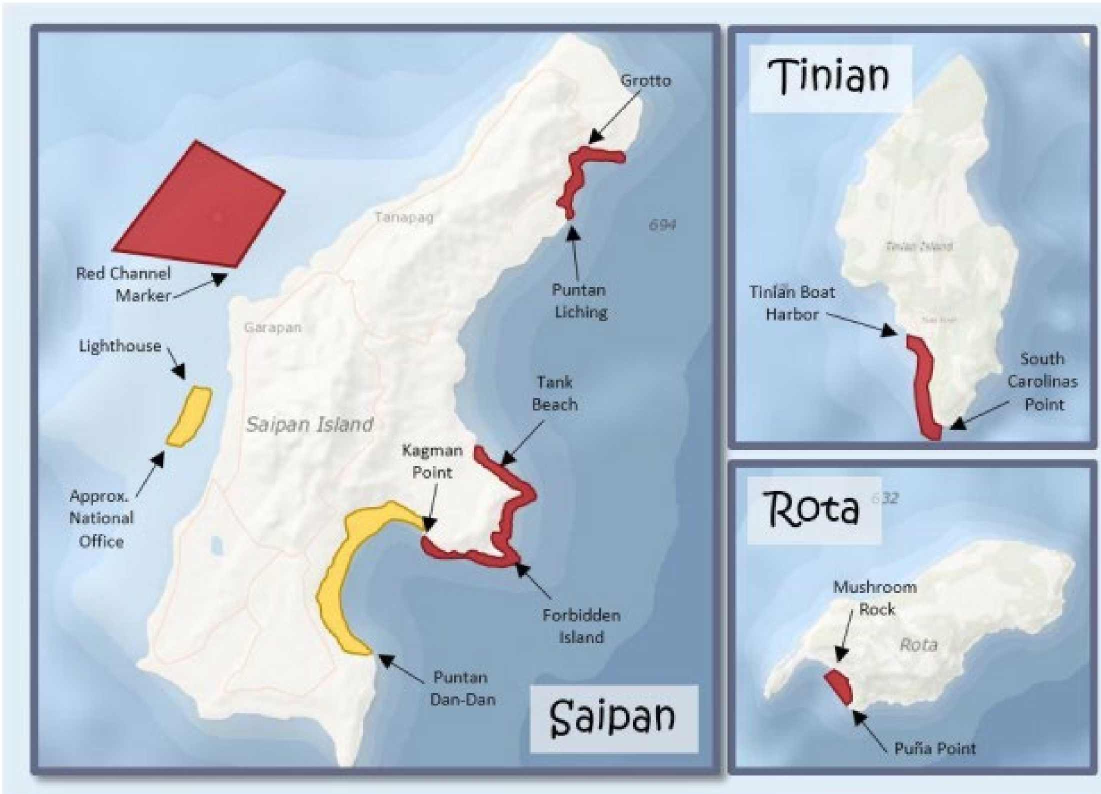


Figure 2.22. Marine Protected Areas.
Source: *Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands 2015-2025* (Liske-Clark, 2015).

2.9.12 Mariana Trench Marine National Monument

In 2009, US President George W. Bush established the Marianas Trench Marine National Monument, which covers approximately 95,215 square miles of waters and submerged lands in the Mariana Islands (Figure 2.23). The Monument is comprised of 1) the Islands Unit, which includes the submerged lands and waters surrounding Uracas, Maug, and Asuncion, the three northernmost islands; 2) the Volcanic Unit, which includes the submerged lands within one nautical mile of 21 designated volcanic sites; and 3) the Trench Unit, which includes the submerged lands extending from the northern limit of the Exclusive Economic Zone of the United States in the CNMI to the southern limit of the Exclusive Economic Zone of the United States in the Territory of Guam; no waters are included in the Volcanic or Trench units. The Monument is part of the National Wildlife Refuge System administered by the USFWS. The Secretary of Commerce, through the NOAA, manages fishery activities within the waters of the Islands Unit. The CNMI government maintains jurisdiction of the area landward of mean low tide on Uracas, Maug, and Asuncion. As part of a pending joint management plan for the Monument between the US Departments of Commerce (NOAA) and Interior and the CNMI Government, title to the submerged lands around Uracas, Maug, and Asuncion will likely be conveyed to the CNMI Government from the US Department of Interior.

In the Islands Unit, unique reef habitats support marine biological communities dependent on basalt rock foundations, unlike those throughout the remainder of the Pacific. These reefs and waters are among the most biologically diverse in the Western Pacific and include the greatest diversity of seamount and hydrothermal vent life yet discovered. They also contain one of the most diverse collections of stony corals in the Western Pacific, including more than 300 species, higher than any other US reef area. The submerged caldera at Maug is one of only a few known places in the world where photosynthetic and chemosynthetic communities of life co-exist. The caldera is 0.5 meters wide and 250 meters deep, an unusual depth for lagoons.

The Volcanic Unit (Vents Unit) is an arc of more than 20 undersea mud volcanoes and thermal vents that supports unusual life forms in some of the harshest conditions imaginable. Here species survive in the midst of hydrothermal vents that produce highly acidic and boiling water. The Champagne vent, found at the NW Eifuku volcano, produces almost pure liquid carbon dioxide, one of only two known sites in the world. The Sulfur Cauldron, a pool of liquid sulfur found at the Daikoku submarine volcano is unique in the entire world. The only other known location of molten sulfur is on Io, a moon of Jupiter.

The Trench Unit's Mariana Trench is the deepest point on Earth, deeper than the height of Mount Everest above sea level. It is 940 nautical miles long by 38 nautical miles wide. It is five times longer than the Grand Canyon and includes some 50,532,102 acres of virtually unknown characteristics.

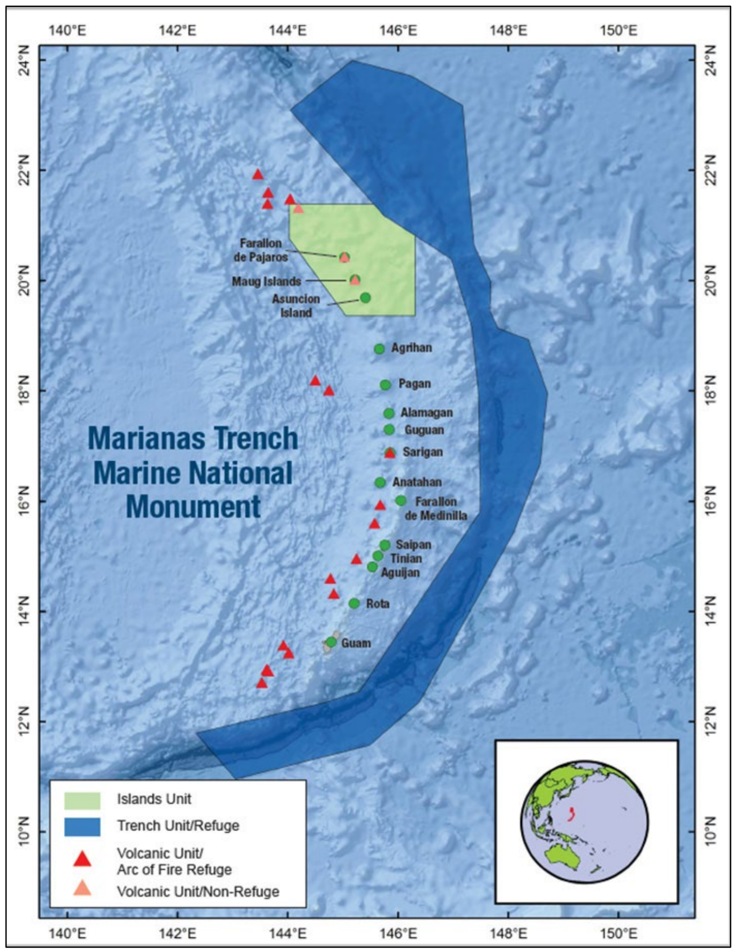


Figure 2.23. Mariana Trench Marine Monument.
Source: NOAA, https://commons.wikimedia.org/w/index.php?curid=69717885.

2.10 Cultural Resources

The term *cultural resources* is used to describe places, objects, sites, oral histories, and traditional practices that are culturally or historically significant to a community or group of individuals. Natural hazard events have the potential to seriously damage or destroy cultural resources and disrupt cultural practices and knowledge. In the CNMI, there is an array of cultural resources that span various time periods. The Historic Preservation Office maintains an inventory of cultural resources in the Commonwealth. These inventories include sites, buildings, structures, objects, or districts. Cultural resources include architecturally significant buildings and sites where significant historic events occurred as well as sites that are culturally significant to Chamorros and Carolinians. These resources provide tangible links to the island's past and has the potential to expand our existing knowledge of the rich history and cultures of the islands (Office of Historic Preservation, 2011). The term *historic properties* are prehistoric or historic districts, sites, buildings, structures, or objects included in, or eligible for inclusion in the National Register of Historic Places (NRHP), including properties of religious and cultural significance (Traditional Cultural Property) that meet the National Register Criteria. Nationally significant sites are designated National Historic Landmarks. The following section provides an overview of the historic preservation review process, historic properties listed on the National Register of Historic Places and the National Historic Landmarks. The locational information for archaeological sites and other historic properties in CNMI is omitted from this report because it is sensitive information and protected under Section 304 of the National Historic Preservation Act and Section 9 of the Archaeological Resources Protection Act, and is excluded from public disclosure under the Freedom of Information Act.

The CNMI Historic Preservation Office is charged with reviewing land-use projects alongside two principal permitting agencies under the BECQ, the DCRM, and the DEQ. In general, there are four categories of project types that require the implementation of a historic preservation review process and include the following:

- Development and activities located within sensitive environmental areas, or which may have a direct adverse impact on APC require a DCRM permit and are subject to survey and mitigation of adverse effects to important historic resources.
- Projects involving mechanized vegetation clearing and earthmoving activities require a DEQ permit and are subject to survey and mitigation of adverse effects to important historic resources.
- Projects that receive federal funding (federal undertaking) are subject to review under Section 106 of the National Historic Preservation Act of 1966, as amended, and associated 36 CFR Part 800. These projects are subject to survey and mitigation of adverse effects as stipulated in formal agreement documents.
- Projects that will affect historic structures or buildings including renovation, removal, and/or demolition of historic resources.

2.10.1 National Register of Historic Places and National Historic Landmarks

The National Park Service's National Register of Historic Places is the official list of the Nation's historic places worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archaeological resources. Since the 2018 SSMP, 38 historic properties in the CNMI are listed on the National Register of Historic Places. Of the 38 historic properties, two are National Historic Landmarks.

2.10.2 Historic Properties on Saipan

Saipan is home to 19 historic properties listed in the National Register of Historic Places (Table 2.18). The Landing Beaches, Aslito-Isley Field, and the Marpi Point in Chalan Kanoa and Marpi, respectively, were listed as a National Historic Landmark on February 4, 1985. This historic district illustrates the heritage of the United States and represents an outstanding aspect of American history and culture dating to World War II.

Table 2.18. Historic properties listed on the National Register of Historic Places located on Saipan.

Property Name	Municipality	Village	Category of Property	Listed Date
Banzai Cliff	Saipan	Marpi	Site	8/27/1976
Brown Beach One Japanese Fortifications	Saipan	Unai Laolao Kattan	Site	2/28/2007
Campaneyan Kristo Rai	Saipan	Garapan	Structure	10/30/1984
Chalan Galaide Latte Site	Saipan	Garapan	Site	10/4/1987
Hachiman Jinja Shrine	Saipan	Kannat Taddong Papago	Site	6/21/2003
Isley Field Historic District	Saipan	I Fadang	District	6/26/1981
Japanese 20mm Cannon Blockhouse	Saipan	Agingan Beach	Building	8/25/1995
Japanese Hospital	Saipan	Garapan	Building	12/19/1974
Japanese Jail Historic and Archeological District	Saipan	Garapan	District	4/8/2011
Japanese Lighthouse	Saipan	Navy Hill	Structure	12/19/1974
Sugar Dock, Landing Beaches, Aslito-Isley Field, and Marpi Point	Saipan	Chalan Kanoa/Marpi	District	2/4/1985
Laulau Kattan Latte Site	Saipan	Kagman III	Site	10/30/2000
Mañagaha Island Historic District	Saipan	Mañagaha	District	11/5/1984
Sabanetan I Toro Latte Site	Saipan	Marpi	Site	11/8/1984

Table 2.18. Historic properties listed on the National Register of Historic Places located on Saipan (*cont'd*).

Property Name	Municipality	Village	Category of Property	Listed Date
Suicide Cliff-Laderan Banadero	Saipan	Marpi	Site	9/30/1976
Tachogña	Saipan[1]	Tachogña	Site	2/13/1986
Unai Achugao Archaeological Site	Saipan	Punton Achugao	Site	8/8/1996
Unai Lagua Japanese Defense Pillbox	Saipan	San Roque	Structure	6/1/1984
Unai Obyan Latte Site	Saipan	Obyan	Site	2/5/1985
Waherak Maiher[2]	Saipan	Chalan Kanoa	Structure	1/31/1978

[1]The Tachogña site is currently listed on Saipan in the National Register of Historic Places. The site is actually located on the island of Tinian.

[2] In the 2018 SSMP update, the whereabouts of the Waherak Maiher structure in Chalan Kanoa was reported as unknown and it was believed to have been destroyed in a fire. The Waherak Maiher canoe was severely damaged during a fire in 1991/1992, adversely affecting the integrity of the canoe. Following this incident, the canoe was relocated to the Northern Mariana Islands Museum of History & Culture, where it is currently stored. The Historic Preservation Office is exploring options to preserve this significant piece of history. As of 2024, Waherak Maihair is still listed as a historic property on the National Register of Historic Places.

Seven properties are under final review at the CNMI Historic Preservation Office for National Register eligibility before submission to the National Parks Service. These properties include the German Stairway, Hōan-den, Liyang Kalabera Rock Art Site, Tanapag Lagoon, Chacha Latte Site, and the Garapan Japanese Coastal Defense Pillbox North and South. The CNMI Historic Preservation Office is working diligently to complete the eligibility review for these properties.

2.10.3 Historic Properties on Rota

Since the 2018 SSMP, the National Park Service has 10 historic properties located on Rota that are listed on the National Register of Historic Places (Table 2.19). The majority of these historic properties are located in Songsong Village.

Table 2.19. Historic properties listed on the National Register of Historic Places located on Rota.

	Municipality	Village	Category of Property	Listed Date
Chudang Palii Japanese World War II Defensive Complex	Rota	Sinapalu	District	5/1/2012
Chugai Pictograph Site	Rota	Chugai	Site	8/31/1998
Commissioner's Office	Rota	Songsong	Building	4/17/1981
Dugi Archeological Site	Rota	Songsong	District	2/11/1985
Japanese Coastal Defense Gun	Rota	Songsong	Structure	11/2/1984
Japanese Hospital	Rota	Songsong	Building	4/16/1981
Mochong Archaeological District	Rota	Songsong	Site	9/11/1985
Nanyo Kohatsu Kabushiki Kaisha Sugar Mill	Rota	Songsong	Building	4/16/1981
Rectory	Rota	Songsong	Building	4/16/1981
As Nieves Latte Stone Quarry	Rota	Songsong	Site	12/23/1974

2.10.4 Historic Properties on Tinian

According to the National Park Service, there are six historic properties on Tinian that are listed on the National Register of Historic Places (Table 2.20). This list of historic properties differs slightly from the 2018 SSMP. On December 30, 1985, the Tinian Landing Beaches, Ushi Point Field, and North Fields were collectively designated the Tinian North Field National Historic Landmark. The Island of Tinian played a pivotal role in the Pacific Theatre during World War II. The North Field National Historic Landmark is composed of more than 20 sites (Table 2.21). The Tinian National Historic Landmark is the largest heritage tourism site on the island and is visited by thousands of tourists each year. The interactive story map available on the virtual site tour was developed as part of a broader effort to formally document, survey, and map the sites and boundaries of the Tinian North Field Historic Landmark (see Tinian North Field National Historic Landmark [arcgis.com]). The Tachogña site should be included in the list of historic properties on Tinian. Currently, the National Register lists this site on the island of Saipan (Table 2.18).

Table 2.20. Historic properties listed on the National Register of Historic Places located on Tinian.

Property Name	Municipality	Village	Category of Property	Listed Date
House of Taga	Tinian	San Jose	Site	12/19/1974
House of Taga Boundary Increase and Additional Documentation	Tinian	San Jose	Site	9/5/1997
Japanese Structure	Tinian	San Jose	Building	4/16/1981
Nanyo Kohatsu Kabushiki Kaisha Ice Storage Building	Tinian	San Jose	Building	4/17/1981
Nanyo Kohatsu Kabushiki Kaisha Laboratory	Tinian	San Jose	Building	4/16/1981
Unai Dangkulo Petroglyph Site	Tinian	Unai Dangkulo	Site	10/27/1999
Tinian Landing Beaches, Ushi Point Field, Tinian Island	Tinian	Tinian Village	District	12/30/1985

Table 2.21. Tinian North Field National Historic Landmark sites.

Property Name	Municipality	National Historic Landmark
Unai Chulu Latte Site	Tinian	North Field
Ushi Field	Tinian	North Field
Runway Able	Tinian	North Field
Shinoto American Memorial	Tinian	North Field
107th US Naval Monument	Tinian	North Field
Old Japanese Communication Center	Tinian	North Field
Hinode Shinoto Shrine	Tinian	North Field
White Beach Landing, Unai Chulu Beach, and Unai Babui	Tinian	North Field
Chulu Bunkers	Tinian	North Field
Hagoi - Lake Hagoi	Tinian	North Field
Lennox Avenue	Tinian	North Field

Table 2.21. Tinian North Field National Historic Landmark sites (*cont'd*).

Property Name	Municipality	National Historic Landmark
374th Army Hospital	Tinian	North Field
Mt. Lasso Homing Beacon	Tinian	North Field
Bomb Loading Pits	Tinian	North Field
Atom Bomb Assembly Area	Tinian	North Field
1st Ordnance Facility	Tinian	North Field
Broadway Roundabout	Tinian	North Field
B-29 Service Apron	Tinian	North Field
Fuel Bunker	Tinian	North Field
Air-Raid Shelters and Bomb-proof Power Plant	Tinian	North Field
Hagoi Air Dome	Tinian	North Field
Air Control Building - Japanese American Control Tower	Tinian	North Field
Japanese Headquarters	Tinian	North Field
Mt. Lasso Japanese Highground	Tinian	North Field
Nanyo Kohatsu Kabushiki Kaisha Administration Building	Tinian	North Field

2.10.5 Religious Centers

While the people of the CNMI are predominantly Christian (81%) of various denominations, there are a wide variety of other religions practiced in the Northern Mariana Islands including Buddhism (11%), Folk (5%), Hinduism (> 1%), Judaism (> 1%), and Islamic (> 1%) faiths (Pew Research Center, 2015). The following is a list of identified religious centers within the CNMI:

- Calvary Baptist Church
- Marianas Baptist Church
- China Mission Church of God
- Church of Jesus Christ
- Church of Jesus Christ of Latter Day Saints
- Immanuel Methodist Church
- Jae II Presbyterian Church
- Jehovah's Witness Missionary (Saipan and Rota)
- Korean Presbyterian Church
- Kristo Rai Catholic Church
- Mount Carmel Chancery/Rectory
- Saipan Bible Fellowship Church

- Saipan Community Church
- San Roque Catholic Church
- Santa Remedio Catholic Church
- San Jose Catholic Church, Saipan
- San Antonio Catholic Church
- Santa Soledad Catholic Church
- San Vincente Catholic Church
- Seventh-Day Adventist Church
- Somang Baptist
- Saint Jude Parish
- Upper Room International Fellowship
- San Jose Catholic Church, Tinian
- San Francisco De Borja Catholic Church, Rota
- San Isidro Chapel, Rota

2.10.6 Cemeteries & Traditional Burial Grounds

According to Public Law No. 11-117, H.B. No. 11-512, HD1 of the Eleventh Northern Marianas Commonwealth Legislature, there are three burial sites on Saipan in which the deceased may be interred. These include the Chalan Kanoa Catholic Cemetery (private), the Wireless Hill Public Cemetery located at Capitol Hill, and the Tanapag Cemetery. These sites are at capacity and could pose an environmental hazard to underground water resources. A new cemetery, called the Marpi Public Cemetery was designed by the Department of Public Health, in coordination with DLNR and DPW. A new Veterans Cemetery in Marpi was completed in 2006. Saipan's first crematory was permitted and began operations in 2015.

On the island of Tinian, the public cemetery is situated within the village of San Jose. To the north lies the former American Military Cemetery that contains the remains of US Marines from the 4th Marine Division that died during World War II.

According to S.L.B. No. 13-13 of the Rota Legislative Delegation, Thirteenth Northern Marianas Commonwealth Legislature, Third Regular Session, 2003, a local bill for an act was introduced by the delegation which found that the historical and cultural heritage of Rota permits and encourages the interment of deceased family members on private properties so that the memories of the lives of such loved ones may be honored and respected. The Rota Legislative Delegation further found that the CNMI has enacted legislation authorizing the internment and burial of deceased persons but restricting such interment and burial to permitted cemeteries. The Rota Legislative Delegation notes that legislation such as Public Law 11-117 does not preclude the enactment of local legislation when such local legislation comports with the spirit and intent of the law. Accordingly, the Rota Legislative Delegation found that it is necessary to authorize the interment and burial of deceased persons on private properties in the First Senatorial District, provided however, that such interment and burial complies with the applicable Commonwealth Rules and Regulations governing the internment and burial of deceased persons. On the Island of Rota, the public cemetery is situated within the village of Songsong.

References

Amidon, F., Metevier, M., & Miller, S. E. (2017). *Vegetation Mapping of the Mariana Islands: Commonwealth of the Northern Mariana Islands and Territory of Guam* (p. 94). US Pacific Fish and Wildlife Service.

ARI, Ltd. (2022). *Tourism Analysis Report: Economic Research and Data Analysis February 2022* (Tourism Analysis Report 2; p. 7). ARI Ltd. https://mva.mymarianas.com/reports/tourism-analysis-report/

Brainard, R. E., Asher, J., Blyth-Skyme, V., Coccagna, E. F., Dennis, K., Donovan, M. K., Gove, J. M., Kenyon, J., Looney, E. E., Miller, J. E., Timmers, M. A., Vargas-Angel, B., Vroom, P. S., Vetter, O., Zgliczynski, B., Acoba, DesRochers, A., Dunlap, M. J., Franklin, E. C., … Withall, R. D. (2012). *Coral Reef Ecosystem Monitoring Report of the Mariana Archipelago, 2003-2007* (SP-12-01; PIFSC Special Publications, p. 1019). National Oceanic and Atmospheric Administration, Fisheries, Pacific Islands Fisheries Science Center.

[BECQ] Bureau of Environmental and Coastal Quality. (2019). *Value of Ecosystem Services from Coral Reefs and Seagrass Habitats in the Commonwealth of the Northern Mariana Islands*. Division of Coastal Resources Management.

[BECQ-DCRM] Bureau of Environmental and Coastal Quality (BECQ)–Division of Coastal Resources Management (DCRM). (2020). *Talakhaya Integrated Watershed Management Plan (TWMP)-2020*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/Talakhaya-2020-WMP_final-internal.signed.pdf

Camp, R. J., Leopold, K. W., Brink, K. W., & Joula, F. A. (2015). *Farallon de Medinilla Seabird and Tinian Moorhen Analyses* (HCSU-060; p. 45). Hawaii Cooperative Studies Unit, University of Hawaii-Hilo.

Carruth, R. L. (2003). *Ground-water resources of Saipan, Commonwealth of the Northern Mariana Islands* (Water-Resources Investigations Report 03–4178). US Department of the Interior and US Geological Survey.

Cash, H., Shai, H. I., Shirriff, V., & Haanschoten, E. (2021). *Availability of Street-Level Supports for Walking in Saipan*. Commonwealth Healthcare Corporation.

[CDC-ATSDR] Centers for Disease Control and Prevention and Agency for Toxic Substances and Disease Registry. (2024). *CDC/ATSDR Social Vulnerability Index (CDC/ATSDR SVI) 2022* [Place-based index, database, and mapping application]. US Department of Health and Human Services. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

Central Statistics Division. (2023a). *Economic Indicator: Building Permits* (Quarterly Report 1st Quarter 2023; p. 47). CNMI Department of Commerce. https://ver1.cnmicommerce.com/wp-content/uploads/2023/07/2023.1-Economic-Indicator-06152023.pdf

Central Statistics Division. (2023b). *Economic Indicator: Visitor Arrivals*. CNMI Department of Commerce. https://ver1.cnmicommerce.com/ei-visitor-arrivals/

Central Statistics Division. (2023c). *The Prevailing Wage Study, Commonwealth of the Northern Mariana Islands* (p. 137). CNMI Department of Commerce.

[HSEM] CNMI Homeland Security and Emergency Management. (2023). *Stakeholder Preparedness Review (SPR) 2023 Report Commonwealth of the Northern Mariana Islands* (p. 101). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024). *2023 CNMI Threats and Hazards Identification Risk Assessment (THIRA)*. CNMI Homeland Security and Emergency Management.

Commonwealth Economic Development Strategic Planning Commission. (n.d.). *2016-2021 Comprehensive Economic Development Strategy* (p. 41). CNMI Department of Commerce.

[CHC] Commonwealth Healthcare Corporation. (2022a). *Availability of Street-Level Supports for Walking in Rota* (p. 30). Commonwealth Healthcare Corporation.

[CHC] Commonwealth Healthcare Corporation. (2022b). *Availability of Street-Level Supports for Walking in Tinian* (p. 31). Commonwealth Healthcare Corporation.

[DPL] Department of Public Lands. (2019a). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

[DPL] Department of Public Lands. (2019b). *FY 2019 Citizen Centric Report*. CNMI Office of the Governor.

[DPL] Department of Public Lands. (2020). *FY 2020 Citizen Centric Report*. CNMI Office of the Governor.

[DPL] Department of Public Lands. (2021). *FY 2021 Citizen Centric Report*. CNMI Office of the Governor. https://dev.publiclands.cnmi.gov/assets/docs/reports/ccr/2021-dpl-ccr.pdf

[DPL] Department of Public Lands. (2023). *FY 2023 Citizen Centric Report*. CNMI Office of the Governor. https://www.opacnmi.com/oockuvoa/2023/10/DPL-FY-2023-CCR.pdf

Dewitz, J. (2014). *National Land Cover Database (NLCD) 2011 Land Cover Conterminous United States* [dataset]. [object Object]. https://doi.org/10.5066/P97S2IID

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[FEMA] Federal Emergency Management Agency. (2021). *Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities*. https://www.fema.gov/sites/default/files/documents/fema_riskmap-nature-based-solutions-guide_2021.pdf

[FEMA] Federal Emergency Management Agency. (2022). *State Mitigation Planning Policy Guide* (FP 302-094-2; p. 115). US Department of Homeland Security.

Food and Nutrition Service. (2022). *Summary of Nutritional Program Assistance—Commonwealth of the Northern Marianas (NAP)*. U.S. Department of Agriculture. https://www.fns.usda.gov/nap/cnmi-nutrition-assistance-program-summary

GHD. (2023). *CNMI 20-Year Highway Master Plan, Final Report* (p. 200). CNMI Department of Public Works.

[HWG-HEC] Horsley Witten Group, Inc. & Hofschneider Engineering Corporation. (2017). *Saipan Lagoon Use Management Plan Update—2017 Final* (p. 409). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Liske-Clark, J. (2015). *Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands 2015-2025* (p. 292). CNMI, Division of Fish and Wildlife.

Liu, Z., & Fischer, L. (2006). *Commonwealth of the Northern Mariana Islands Vegetation Mapping Using Very High Spatial Resolution Imagery*. USDA Forest Service, Pacific Southwest Region, Forest Health Protection. McClellan, California. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046396.pdf

Marianas Visitors Authority. (2024). *Marianas Visitor Arrivals Up 92% In January 2024* [Press Release]. Marianas Visitors Authority. https://www.mymarianas.com/

McKinnon, J. F. (2015). *Memorialization, Graffiti and Artifact Movement: A Case Study of Cultural Impacts on WWII Underwater Cultural Heritage in the Commonwealth of the Northern Mariana Islands* (pp. 11–27). Journal of Maritime Archaeology. http//www.jstor.og/stable/43551414

McKinnon, J. F., & Carrell, T. L. (2014). *Management Plan and Public Outreach for WWII Submerged Resources in Saipan* (p. 231). National Park Service. https://www.researchgate.net/publication/277709319_Management_Plan_and_Public_Outreach_for_WWII_Submerged_Resources_in_Saipan

Mora, C., Frazier, A. G., Longman, R. J., Dacks, R. S., Walton, M. M., Tong, Sanchez, J. J., Kaiser, L. R., Stender, Y. O., Anderson, J. M., Ambrosino, C. M., Silva, I. F., Giuseffi, L. M., & Giambelluca, T. W. (2013). The Projected Timing of Climate Departure from Recent Variability. *Nature*, *502*, 183–187. https://doi.org/10.1038/nature12540

[NOAA] National Oceanic and Atmospheric Administration Office for Coastal Management. (2024). *C-CAP Land Cover Atlas*. Digital Coast. https://coast.noaa.gov/digitalcoast/tools/lca.html

Office of Historic Preservation. (2011). *CNMI Historic Preservation Plan 2011-2015* (p. 36) [Preservation CNMI: Caring for the Past in an Uncertain Future]. Department of Community and Cultural Affairs.

[OPD] Office of Planning and Development. (2019). *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (p. 204). CNMI Office of the Governor.

[OPD] Office of Planning and Development. (2021). *2021-2030 CNMI Comprehensive Sustainable Development Plan (CSDP) for the CNMI*. CNMI Office of the Governor. https://opd.gov.mp/assets/2021-2030_cnmi_csdp.pdf

[OPD] Office of Planning and Development. (in prep.). *Draft—2023 Resources Report* (p. 687) [Planning for Sustainability in the Commonwealth of the Northern Mariana Islands]. CNMI Office of the Governor.

Paulay, G. (2003). *Marine biodiversity of Guam and the Marianas: Overview*.

Pew Research Center. (2015, April 2). *The Future of World Religions: Population Growth Projections, 2010-2050* [Pew-Templeton Global Religious Futures Project]. Database Religious Composition by Country, 2010 - 2050. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.pewresearch.org%2Freligion%2Fwp-content%2Fuploads%2Fsites%2F7%2F2015%2F04%2FReligious_Composition_by_Country_2010-2050.xlsx&wdOrigin=BROWSELINK

Reinman, F. M. (1977). *An archaeological survey and preliminary test excavations on the island of Guam, Mariana Islands, 1965-1966* (p. 197). Micronesian Area Research Center, University of Guam.

Starmer, J. (Ed.). (2005). The state of coral reef ecosystems of the Commonwealth of the Northern Mariana Islands. In *The state of coral reef ecosystems of the United States and Pacific Freely Associated States* (pp. 399–441). National Oceanic and Atmospheric Administration Technical Memorandum NOS NCCOS II. NOAA/NCCOS Center for Coastal Monitoring and Assessments Biogeography Team.

Torani, S., Majd, P. M., Maroufi, S. S., Dowlati, M., & Sheikhi, R. A. (2019). The importance of education on disasters and emergencies: A review article. *Journal of Education Health Promotion*, *8*, 85. https://doi.org/10.4103/jehp.jehp_262_18

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

US Bureau of Economic Analysis. (2023). *Gross Domestic Product for the Commonwealth of the Northern Mariana Islands, 2020*. GDP for the Commonwealth of the Northern Mariana Islands (CNMI). https://www.bea.gov/data/gdp/gdp-commonwealth-northern-mariana-islands-cnmi#:~:text=Real%20gross%20domestic%20product%20(GDP,decreasing%2011.3%20percent%20in%202019

US Census Bureau. (2024). *2020 Island Areas Censuses: Commonwealth of the Northern Mariana Islands (CNMI)* [dataset]. https://www.census.gov/data/tables/2020/dec/2020-commonwealth-northern-mariana-islands.html

US Department of Commerce. (2021). *U.S. Department of Commerce Invests $21.2 Million to Support Growth of Tourism Sector in the Northern Mariana Islands* [Press Release]. US Economic Development Administration. https://www.eda.gov/archives/2022/news/press-releases/2021/06/03/cnmi.htm#mainContent

[GAO] US Government Accountability Office. (2022). *Commonwealth of the Northern Mariana Islands, Recent Workforce Trend and Wage Distribution.* (GAO-22-105271; p. 44). US Government Accountability Office.

Vecchi, G. A., Soden, B. J., Wittenberg, A. T., Held, I. M., Leetmaa, A., & Harrison, M. J. (2006). Weakening of tropical Pacific atmospheric circulation due to anthropogenic forcing. *Nature*, *441*(7089), 73–76. https://doi.org/10.1038/nature04744

Vogt, S. R., & Williams, L. L. (2004). *Common flora and fauna of the Mariana Islands*. S.R. Vogt & L.L. Williams; WorldCat.

Willsey, T., Kwon, J. A., Reeves, M. K., Amidon, F., & Miller, S. E. (2020). Mariana Islands Forest. In *Encyclopedia of the World's Biomes* (pp. 373–402). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.12012-3

Yuknavage, K., Iriarte, I., Maurin, L., & Perez, D. (2022). *2022 Commonwealth of the Northern Mariana Islands 305(b) and 303(d) Water Quality Assessment Integrated Report*. Bureau of Environmental and Coastal Quality.

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 3.0 Planning Process

28 July 2024

Table of Contents

List of Tables

List of Figures

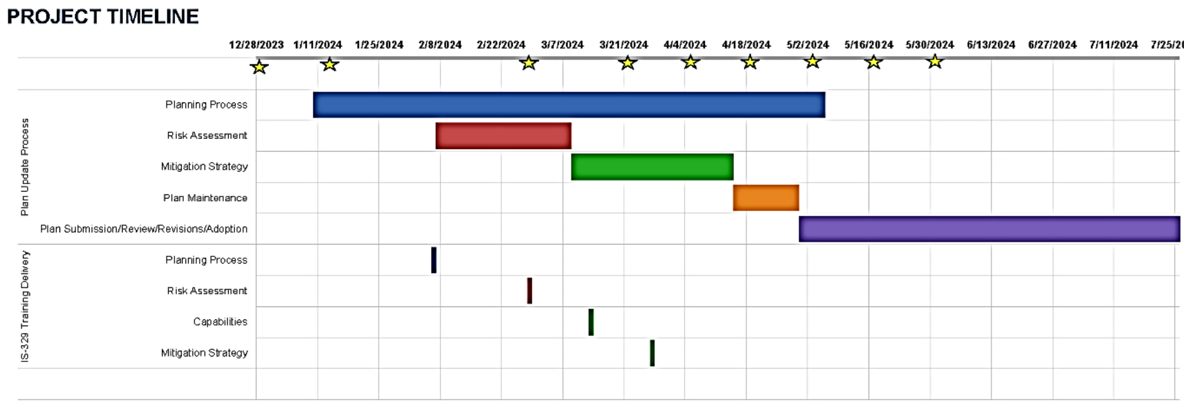
3.0 Planning Process

3.1 Purpose and Goals

The purpose of the Federal Emergency Management (FEMA) planning process is to set the foundation for the development of an effective hazard mitigation plan. It provides guidelines for an organized and coordinated plan update that are used to establish goals and actions to reduce or minimize the loss of human life and property; major economic disruption; degradation of ecosystems and critical habitats; and the destruction of cultural and historical resources from natural disasters. The 2024 State Hazard Mitigation Plan (SHMP) update planning process involves consultation and collaboration with agencies and non-governmental organizations (NGOs) with expertise to provide information, strategies, and solutions to create a mitigation plan that can implement risk reduction. The goals of the planning process for disaster mitigation in the Commonwealth include the following:

- To promote sustainable development by reducing the vulnerability to natural hazards in the existing and planned development.
- To improve public awareness and decision-making for land use planning by accurately mapping hazard-prone areas.
- To improve hazard risk management by the insurance industry and help maintain adequate protection against any catastrophe for the region; and
- To promote community-based disaster preparedness and prevention activities with support from both the public and private sectors.

The following section describes how the 2024 SHMP Update was prepared; which stakeholder agencies and groups were invited to and participated in the mitigation planning process; and how each section was reviewed, analyzed, and revised. Figure 3.1 summarizes key planning milestones during the 2024 SHMP Update planning process. Additional planning process meetings, milestones, participants, and supporting documents are contained in Appendix A (Planning Process Documentation).



Project Start 12/20/23

columns used to create the chart

CATEGORY	TASK	START	END	COLOR	Start	Blue	Red	Green	Brown	Orange	Purple
Plan Update Process	Planning Process	1/10/24	5/5/24	Blue	1/10/24	117	0	0	0	0	0
	Risk Assessment	2/7/24	3/8/24	Red	2/7/24	0	31	0	0	0	0
	Mitigation Strategy	3/9/24	4/14/24	Green	3/9/24	0	0	37	0	0	0
	Plan Maintenance	4/15/24	4/29/24	Orange	4/15/24	0	0	0	0	15	0
	Plan Submission/Review/Revisions/Adoption	4/30/24	7/26/24	Purple	4/30/24	0	0	0	0	0	93
IS-329 Training Delivery	Planning Process	2/6/24	2/6/24	Blue	2/6/24	1	0	0	0	0	0
	Risk Assessment	2/28/24	2/28/24	Red	2/28/24	0	1	0	0	0	0
	Capabilities	3/13/24	3/13/24	Green	3/13/24	0	0	1	0	0	0
	Mitigation Strategy	3/27/24	3/27/24	Green	3/27/24	0	0	1	0	0	0
	Insert new rows above this one										

Figure 3.1. 2024 SHMP Update planning process schedule.
Source: FEMA Region 9 Pacific Office [Note: Stars symbolize planning process meetings].

3.2 Description of the Planning Process

Element S1 and 44 CFR §§ 201.4(b) and 201.4(c)(1): Does the plan describe the planning process used to develop the plan? Was the planning process integrated with other state planning efforts?

The 2018 Standard State Mitigation Plan (SSMP) planning process was coordinated largely by the Grants Management Section of the CNMI Homeland Security and Emergency Management. For 2024, the Hazard Mitigation Grant Program (HMGP) coordinated the SHMP update planning process under the direction of the State Hazard Mitigation Officer (SHMO). The COVID-19 pandemic from January 2020 through May 2023 led to operational challenges in plan maintenance as outlined in the 2018 SSMP Update. Typhoon *Mangkhut* in September 2018 and Super Typhoon *Yutu* in October 2018, followed by Typhoon *Hagibis* in October 2019, and Typhoon *Mawar* in 2023 required the Commonwealth to redirect attention to disaster response and recovery, which diverted attention away from the 2018 SSMP plan maintenance process. Chapter 7.0 (Plan Implementation and Maintenance) details the successes and challenges of maintaining the 2018 SSMP.

The SHMO's vision for the 2024 SHMP Update is to coordinate the plan with other planning documents, and support partnerships and alliances through increased collaboration and participation from a variety of stakeholders to promote community resiliency and plan maintenance. In late November 2023, the HMGP secured planning consulting services from Nimbus Environmental Services to facilitate the 2024 SHMP Update with a schedule to submit the updated plan for review to FEMA Region 9 by the beginning of May 2024. Organization of the planning process and resources required to prepare the 2024 SHMP Update began in earnest in December 2023. In-person stakeholder meetings were held in January and February 2024 to discuss the purpose of the SHMP, its importance to the Commonwealth, and the update process required of states and territories every five years.

Due to the compressed timeline for the 2024 SHMP Update, convening in-person meetings on a regular basis proved challenging, both in time and resources. Therefore, in addition to the in-person meetings, there was a great deal of communication between the HMGP, Nimbus Environmental, FEMA Region 9, subject matter experts and stakeholders through collective and individual virtual meetings and email. At the beginning of the planning process, a cross-section of stakeholders and subject matter experts were provided with the project timeline. Subject matter experts and stakeholders from across various sectors with mitigation capabilities and community lifelines were identified to ensure a robust planning process, risk assessment, thorough update of capabilities and mitigation progress, and comprehensive mitigation strategies.

Throughout the planning process, the SHMO and the HMGP met regularly with the Nimbus Environmental team and FEMA Region 9 for plan updates and guidance. Key stakeholders and subject matter experts reviewed the 2018 SSMP, provided first-hand knowledge of past natural hazard events and response systems, assessed hazard risks, assisted to prioritize hazards, updated critical facilities and capabilities, reported progress on mitigation actions and priorities, assisted in updating and developing new mitigation goals and strategies, as well as provided continuity throughout the planning process. The roles of the key stakeholders, subject matter experts, and the public are discussed later in this section.

The 2024 SHMP Update integrated information and data derived from archival resources, current plans, assessments, and authoritative references. The US Census Bureau completed the decennial census in 2020. Changes in the demographic profile of the Commonwealth are incorporated into this SHMP. Assessments such as the *Climate Change Vulnerability Assessment for the Island of Saipan* (Greene & Skeele, 2014) produced by the CNMI Division of Coastal Resource Management in partnership with the CNMI Climate Change Working Group, and the *Climate Vulnerability Assessment for the Islands of Rota & Tinian* (BECQ, 2015) look at projected impacts from a changing climate on the islands of Saipan, Tinian, and Rota. These studies involved community vulnerability assessments, workshops, local narratives about historic climate extremes and regular Planning Committee meetings. These resources are indispensable in assessing the social vulnerability of the community to natural hazard events.

Other examples of critical preparedness literature used in this SHMP update include the *Mariana Islands Maritime Transportation System Recovery Plan* (Guam/CNMI Maritime Transportation System Advisory Group, 2014), *2017 CNMI Catastrophic Typhoon Plan* (HSEM, 2018), *Community Development Block Grant – Disaster Recovery (CDBG-DR) Program Action Plan* (NMHC, 2023), Threat and Hazard Identification Risk Assessment (THIRA), *2023 Report* (HSEM, 2024b), *Stakeholder Preparedness Review (SPR),* and the *2023 Report CNMI* (HSEM, 2024a). Additionally, the *Comprehensive Sustainable Development Plan for the CNMI* (OPD, 2021) includes a safety element that offers guidelines and priority actions to reduce natural hazard risks to people, the economy, and the environment. As future preparedness plans and assessments are developed and updated, the 2024 SHMP Update will be an integral source of information.

3.3 Coordination and Engagement with Stakeholders

Element S2 and 44 CFR §§ 201.4(b)and 201.4(c)(1): Does the plan describe how the state coordinated with other state agencies, appropriate federal agencies, and stakeholders, and how they were involved in the process?

Hazard mitigation activities within the Commonwealth are coordinated at the federal, Commonwealth, and local government levels. For the Commonwealth, local government means the four Mayoral jurisdictions of Saipan, Tinian, Rota, and the Northern Mariana Islands. To ensure effective risk reduction it is essential that all levels of government work together to maximize the benefits of hazard mitigation. The updated 2024 SHMP and all related documents will become part of the CNMI's *All-Hazards Emergency Operations Plan* (HSEM, 2021) planning documents that serve as guidance during hazard events. The goal of this plan is to standardize emergency management activities at the Commonwealth level, ensuring that activities and information are managed in a coordinated and efficient manner and allows for the provision of standardized support for local island communities.

One of the priorities for the 2024 SHMP Update is to ensure increased outreach and collaboration amongst a wide-range of stakeholders and subject matter experts to ensure a comprehensive update. The Office of the Governor issued a press release on January 30, 2024, to announce the SHMP update, invite participation in the planning process, provide information on public meeting dates, and a link to the online survey. Public service announcements were published in the Marianas Variety News & Views (Figure 3.2) and the Saipan Tribune. The HMGP collaborated with partners across the Commonwealth and local government agencies with mitigation capabilities, private sector, and the public (see Table 3.1). Following the recommendation from the 2018 SSMP Update, the Office of Planning and Development and the Department of Public Lands were included as stakeholders in this SHMP update planning process. NGOs focused on disaster mitigation and recovery such as Commonwealth Advocates for Recovery Efforts (CARE), the American Red Cross Northern Mariana Chapter, and the Salvation Army Saipan Corps were invited to participate in the 2024 SHMP Update planning process. For future SHMP updates, inclusion of these organizations as additional stakeholders will continue to be pursued.

Figure 3.2. Public service announcement.

Table 3.1. Planning process agency stakeholders.

Agency	Sector/Area of Expertise	Community Lifeline
Office of the Mayor Northern Islands	Emergency Management	Safety and security, Hazardous Materials, Food, Water, Shelter
Office of the Mayor of Rota	Emergency Management	Safety and security, Hazardous Materials, Food, Water, Shelter
Office of the Mayor Saipan	Emergency Management	Safety and security, Hazardous Materials, Food, Water, Shelter
Office of the Mayor Tinian & Aguiguan	Emergency Management	Safety and security, Hazardous Materials, Food, Water, Shelter
Bureau of Environmental & Coastal Quality	Land Use and Development	Water Systems
Coastal Resource Management	Natural Resources; Coastal Hazards; Climate Change	--
Commonwealth Healthcare Corporation	Health and Social Service	Health and medical
Commonwealth Ports Authority	Infrastructure	Transportation
Commonwealth Utilities Corporation	Infrastructure	Energy, Communications, Water Systems
Department of Public Lands	Land Use and Development	--
Department of Community & Cultural Affairs	Health and Social Service; Housing	Health and medical, Food, Water, Shelter
Historic Preservation Office	Cultural Resources	--
Division of Disabilities	Health and Social Services	Health and medical
Dept. of Fire & Emergency Medical Services	Emergency Management	Safety and security, Hazardous Materials, Food, Water, Shelter
Dept. of Land & Natural Resources	Natural and Cultural Resources	--
Division of Fish & Wildlife	Natural Resources	--
Department of Public Safety	Infrastructure	Safety and security
Department of Public Works	Infrastructure; Floodplain Administration & Land Use	Transportation
Homeland Security & Emergency Management	Emergency Management	Safety and Security, Communications, Hazardous Materials, Food, Water, Shelter
Marianas Alliance of Non-Governmental Organizations	Social Services	Food, Water, Shelter
Marianas Visitors Authority	Economic Development	--
Northern Marianas College	Economic Development	Food, Water, Shelter
Northern Marianas Housing Corporation	Housing	Food, Water, Shelter
Office of Planning and Development	Land Use and Development	--
Public School System	Health and Social Services; Emergency Management	Food, Water, Shelter
Pacific Coastal Research and Planning	Natural Resources; Climate Change	--
Pacific Rist Management ‘Ohana (PRiMO)	Risk management	--
Planning and Development Advisory Council	Economic Development	--

3.3.1 Federal Agency

The SHMO and HMGP coordinated with the FEMA Region 9 Pacific Area Office throughout the planning process. This included consultation and training events to ensure the planning process approach and hazard risk assessment and analysis met FEMA requirements. The SHMO provided Region 9 Pacific Area Office with periodic updates on milestones achieved during the SHMP update work.

3.3.2 Commonwealth Agencies

The FEMA National Mitigation Framework emphasizes the valuable role of collaboration among community sectors with lifeline capabilities to ensure that mitigation capabilities continually develop, and that comprehensive mitigation includes strategies for all community systems. The HMGP coordinated with government agency stakeholders throughout the 2024 SHMP Update. The following sectors were engaged throughout the planning process and were provided opportunities to provide plan input: emergency management; economic development; flood plain administration and building standard enforcement, land use and development; housing; health and social services; infrastructure; natural and cultural resources; transportation, private and public sectors (see Table 3.1).

In April 2014, the Special Assistant to Homeland Security and Emergency Management, by order of the Governor, formed the Statewide Emergency Response Commission (SERC) to serve as an advisory board to mitigate the effects of hazardous material incidents as enacted under the Emergency Planning and Community Right-To-Know Act (EPCRA). In 2023, the SERC was renamed the Multi-Agency Coordination (MAC) Group, composed of appointed members from the Governor’s Cabinet staff and private sector partners. The MAC is convened by the Special Assistant to Homeland Security and Emergency Management to provide essential management decisions for Commonwealth coordination of disaster operations.

Representatives from each of the government agency stakeholders were invited to engage in individual in-person meetings from January 29 through February 15, 2024. The COVID-19 pandemic demonstrated that people could efficiently work together in a virtual and hybrid meeting setting.

Multi-agency hybrid meetings (recorded) were held on Tinian (February 6), Rota (February 8), and Saipan (February 13) to gather input, share ideas, and assist in defining and enhancing areas of emphasis. Emphasis included critical facilities, infrastructure and community lifeline locations, capabilities that support Commonwealth resilience, understanding high-risk areas and socially vulnerable populations, as well as mitigations actions that improve resiliency.

To assess the risks from natural hazard events, a survey was distributed during the meetings and made available online until March 31, 2024. The survey allowed stakeholders to provide input on natural hazard profiling and assess the risks to critical facilities and lifelines, capabilities, people, and natural and cultural resources. Stakeholders were asked to explore gaps in service and challenges to their programs, and new mitigation goals and strategies were submitted based on discussion outputs from the agency meetings. In-person stakeholder meetings were held May 7-9, 2024 to review the draft plan and mitigation priorities, concurrent with FEMA Region 9 plan review. All comments were considered by the HMGP and incorporated into the draft where appropriate. A summary of the sectors engaged in the SHMP update planning process and details on coordination efforts including meeting agendas, sign-in sheets, and survey results is found in Appendix A (Planning Process Documentation).

3.3.3 Local Government

Under Article VI, Section 3(f) of the Commonwealth Constitution, the Office of the Mayor for each of the island municipalities of the Northern Islands, Rota, Saipan, Tinian (includes Aguiguan) is the principal local authority for coordinating activities with the Hazard Mitigation Grant Program for the purpose of mobilizing resources and addressing emergency conditions that occur within each jurisdiction.

Hazard mitigation projects have the greatest effect on the community where they occur, making coordination essential between the Commonwealth and local governments. Mitigation activities are performed by various Commonwealth local government agencies and non-profit organizations as part of respective areas of responsibility. These include:

- **Homeland Security and Emergency Management (HSEM)** – prepares for, prevents, responds to, and recovers from all threats, crimes, hazards, and emergencies through coordinated efforts of the first response community.
- **Bureau of Environmental and Coastal Quality (BECQ**) – regulatory responsibilities to protect water and air quality (DEQ) as well as coastal resources (DCRM); enforcement of waste management, fuel storage, and related rules and regulations to support resource protection; GIS mapping of hazard-prone areas; and development of climate change adaptation strategies.
- **Commonwealth Office of Transportation Authority (COTA)** – provides Emergency Support Function 1 (ESF 1), transportation to coordinate resources (human, technical, equipment, facility, materials, and supplies) of member agencies to support emergency transportation needs during an emergency or disaster in the Commonwealth.
- **Division of Fire and Emergency Medical Services (DFEMS)** – structural and wildfire firefighting.
- **Public School System (PSS)** – coordinates emergency sheltering and transportation.
- **Department of Community and Cultural Affairs (DCCA)** – supports emergency sheltering and transportation.

- **Historic Preservation Office (HPO)** – identifies, protects, and educates citizens on significant archaeological, cultural, and historic resources that contribute to social, economic, or cultural growth.
- **Mayor Offices** – mitigate property damage and reduce risks of injury and loss of life through the removal of hazardous debris in villages.
- **American Red Cross (ARC)** – supports emergency sheltering and feeding as well as recovery efforts, as needed.
- **Office of Zoning** – enforces land-use policies to preserve natural and cultural resources and to promote economic growth.
- **Office of Planning and Development (OPD)** – develop the Comprehensive Sustainable Development Plan to guide future government and private development actions to ensure projects and initiatives are sustainable, serves as a clearinghouse for information related to development, planning, and resource use, and provides a basis for determining priorities and allocating resources. Closely involved with federally funded natural and built environment investment projects. Established a Planning and Development Advisory Council (PDAC).
- **Commonwealth Utilities Corporation (CUC)** – sole utilities corporation for the Commonwealth; manages, protects, and restores critical power, water, and wastewater infrastructure.
- **Department of Public Works (DPW)** – enforcement of building standards, maintenance of public roadways and drainage system, and technical design for public construction activities, including mitigation projects.
- **Department of Land and Natural Resources (DLNR)** – protects and enhances natural resources in the Commonwealth through resource and land use management. This includes marine and land ecosystems and their respective wildlife.
- **Office of Management and Budget (OMB**) – administers capital improvement funds to various Commonwealth agencies to construct, improve, or rehabilitate existing critical facilities and infrastructure.
- **Department of Public Lands (DPL)** – periodically adopts comprehensive land use planning.

Figure 3.3. Stakeholder engagement.

The 2024 SHMP Update outlines Commonwealth-wide hazard mitigation goals whereupon each mayoral office shall coordinate within their respective island community to decide which mitigation measures are the most important and appropriate that may require assistance from federal and other Commonwealth agencies. Local circumstances should be the primary determinant in developing mitigation measures for each local island community. By participating in the development of this SHMP update, each local island government and community can determine which mitigation goals and tools will help them achieve their goals while incorporating them in the development of Capital Improvement Program (CIP) projects. It is important to note that when projects are being prioritized at the Commonwealth level, it is imperative that local communities have the opportunity to address any concerns or competing interests. In the Commonwealth, this is achieved through the CIP Committee representing each senatorial district.

3.3.4 Public Engagement

The SHMO and the HMGP expanded public involvement in the planning process for the 2024 SHMP Update. HMGP emphasized the importance of providing multiple opportunities for residents on all the islands to participate in the process. In February 2024, a total of six recorded public hybrid meetings were held two each on Tinian (February 6), Rota (February 8) and Saipan (February 13) to discuss the 2024 SHMP Update. Meeting locations and times were promoted through the Office of the Mayor for each island municipality. Public service announcements were published in the Marianas Variety News & Views and the Saipan Tribune.

Two meetings on each island were held at the Northern Marianas College campuses. A daytime meeting was held at 13:30–15:30 that targeted government agency employees. An evening meeting from 18:30–20:30 was held to target the general public. Either target group was welcomed at either meeting. The Office of Information Technology provided media services that allowed for flexible hybrid meetings. The COVID-19 pandemic demonstrated that virtual and hybrid meeting settings are an effective tool for people to work together. The hybrid meeting format was designed to increase attendance and improve equity and accessibility by allowing people to participate in ways that worked for them. Audio and visual equipment and closed captioning ensured community members with physical and sensory disabilities could access meeting content, thereby achieving greater public collaboration in the planning process.

A free online survey that met accessibility standards was released prior to the community meetings to gauge awareness of natural hazards risks and current hazard mitigation preparedness programs such as StormReady® and TsunamiReady®. The meetings dates and survey link were advertised in the public service announcement to give the community the opportunity to provide input on the planning process. In-person meeting attendees were provided with a printed survey. The survey tool allowed the public to share their ideas for mitigation actions, success stories and lessons learned from past natural hazard events. The survey was made available from January 30 through March 31, 2024. Refer to Appendix A (Planning Process Documentation) for further details public engagement efforts and the results of the public stakeholder survey.

For future SHMP updates, a hybrid meeting format with closed captioning and language interpreting services is recommended. Interpreting services were not secured during this update due to the compressed project time limit. Online meeting formats have been normalized since social distancing was encouraged during COVID-19. Continued use of hybrid meetings will make attendance open to the entire community. Free transportation to the meeting venue may be available for community members with no transportation through the Office of the Mayor for each island municipality. Coordination for this service should be initiated early in the planning process with each mayoral office. Video recordings are useful for making public engagement more accessible and inclusive for all participants. The 2024 SHMP hybrid meetings are available but are not hosted for the public to access. Recommend hosting video recording of the meetings in a publicly available location for community members who may have missed the meeting or who had difficulty hearing or understanding what was said during the live meeting.

3.3.5 Summary of Planning Process

The 2024 SHMP Update commenced by organizing the planning process and resources. Information and data were gathered from recently published federal, Commonwealth, local government, and NGO sources beginning in December 2023. In January and February 2024, individual government agency stakeholder and multi-agency meetings were held on Tinian, Rota, and Saipan. Stakeholder and subject matter experts provided information and identified data gaps. Stakeholders were asked to review data and assets listed on the Facilities Assessment Matrix (FAM) related to the facilities that fell under their areas of responsibility and asked to indicate whether any notable changes have occurred since the previous SSMP update in 2018.

The FAM tool was implemented and administered by the Emergency Management Office in 2004. Approximately 36 agencies, organizations, and associations participated in the FAM in 2004, which identified the services, structures, infrastructure, and population within their purview. In the 2010 update, new additional facilities were listed, existing ones were updated, and those that have ceased operations, particularly the garment factories and hotels, were removed. Agency response to the data requests in the FAM provided an overview of structures and infrastructure that could be potentially vulnerable to a particular hazard type given certain geographical or functional features of the facility or utility. The FAM information was integrated into a database record that was used in subsequent SSMP updates for asset identification and loss estimates.
The SSMP update in 2018 focused on facility information requiring updating while the Community Vulnerability Assessment (CVA) completed in 2014 was carried forward. During the 2024 SHMP Update the Hazard Grant Mitigation Program and Nimbus Environmental collaborated extensively with Commonwealth and local government stakeholders to verify owned or operated built environment assets listed on the FAM for facility closures and relocation. The parent

facilities/critical facility assets were identified, geolocated, and ground-truthed. Spatial coordinates were assigned to general building assets and merged with the FAM critical facilities and the Emergency Management Office critical facilities into a single GIS layer.

Stakeholders and subject matter experts collaborated in identifying current Geographic Information System (GIS) information for natural hazards (e.g., flooding, winds, wildfires, etc.) and identified recent and authoritative datasets for natural hazards and climate change. Data were compiled from environmental studies, socioeconomic reports, inventory of facilities, and other types of archived historical material. The data was reviewed to evaluate and analyze existing and known geographical and meteorological conditions to determine the extent, magnitude, duration, and future probability profile of each hazard. This included a review of archival resources of past hazard events that documented the associated damage assessments for response and recovery actions. Digital data sources were compiled for the purpose of integrating available information in a format that could be used with Geographic Information System (GIS) software. New census data became available during this reporting cycle allowing for social vulnerability assessments and hazard maps to be updated from the 2018 SSMP.

Mitigation action strategies and plans were developed in partnership with stakeholders based on past actions, recommended future actions, and Smart, Safe Growth framework to ensure the growth of communities and infrastructure resilient to natural disasters (OPD, 2021). Stakeholders identified underserved communities and socially vulnerable populations most at risk from natural hazard events. In-person stakeholder meetings were held between May 7 and 9, 2024 to review the draft plan and mitigation priorities, concurrent with FEMA Region 9 plan review. All comments were considered by the HMGP and incorporated into the draft where appropriate.

The SHMO encourages ongoing partnerships and alliances amongst stakeholders to keep the SHMP current. Plan maintenance relies on ongoing mitigation actions, and participation in mitigation and resilience coordination.

3.4 Opportunities for Improving the Planning Process

FEMA provided recommendations for improvements to the SHMP (Appendix G FEMA Review of the 2024 SHMP Update). The recommendation to associate stakeholders with the community lifeline they support was completed in this 2024 SHMP Update (Table 3.1). The other recommendation to grow the external stakeholder outreach to other federal agencies that the CNMI has or could partner with in the future for mitigation activities will be incorporated into 2029 SHMP Update.

References

[BECQ-DCRM] Bureau of Environmental and Coastal Quality (BECQ), Division of Coastal Resources Management (DCRM). (2015). *Climate vulnerability for the Islands of Rota and Tinian, Commonwealth of the Northern Mariana Islands* (p. 106). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2018). *2017 CNMI Catastrophic- Typhoon Plan, Annex to the FEMA Region IX All-Hazards Plan* (p. 417). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2021). *Commonwealth of the Northern Mariana Islands Emergency Operations Plan* (p. 132). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024a). *2023 CNMI SPR Pre-Submission* (p. 210). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024b). *2023 CNMI THIRA Pre-Submission* (p. 46). CNMI Homeland Security and Emergency Management.

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Guam/CNMI Maritime Transportation System Advisory Group. (2014). *The Mariana Islands Maritime Transportation System Recovery Plan* (p. 62). Guam/CNMI Maritime Transportation System Advisory Group.

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

[OPD] Office of Planning and Development. (2021). *2021-2030 CNMI Comprehensive Sustainable Development Plan (CSDP) for the CNMI*. CNMI Office of the Governor. https://opd.gov.mp/assets/2021-2030_cnmi_csdp.pdf

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.1 Overview

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.1 Risk Assessment Overview

44 CFR §201.4(c)(2): States are required to undertake a risk assessment that provides "…the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview."

2024 State Hazard Mitigation Plan (SHMP) Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, all the information on the risk assessment is provided in Chapter 4.0, Section 4.1 through Section 4.11 as well as the referenced appendices.
- Hazards are reorganized and new hazards added including Health Risks (Section 4.6) and Extreme Heat and Heatwave (Section 4.8) and to reflect new information and conditions. Section 4.4 (Flood) combines chronic coastal flooding and event-based flooding.
- An analysis of community lifelines was added.
- A geodatabase was developed for Commonwealth buildings and general building stock.
- Data from the 2020 US Census Bureau was used to update and map vulnerable populations in each island jurisdiction. However, census track-level data was not available until mid-February 2024 and was not incorporated into this update.
- Natural resources were updated to include habitats of species listed under the Endangered Species Act, federally designated critical habitat and other occupied habitat and managed watersheds.
- Specific changes for each hazard are presented in each Hazard Section 4.2–4.10.

The risk assessment is a process by which the Commonwealth determines which hazards are of concern and addresses the potential impacts of those hazards Commonwealth-wide. It helps communicate vulnerabilities, develop priorities, and inform decision-making for the hazard mitigation plan and other emergency management efforts.

The risk assessment for the 2024 SHMP Update provides the factual basis for developing a territory-wide mitigation strategy. It makes the connection between vulnerability and the proposed hazard mitigation actions.

4.1.1 Hazard Identification and Risk Assessment Methods

S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state? [44 CFR § 201.4(c)(2(i)]

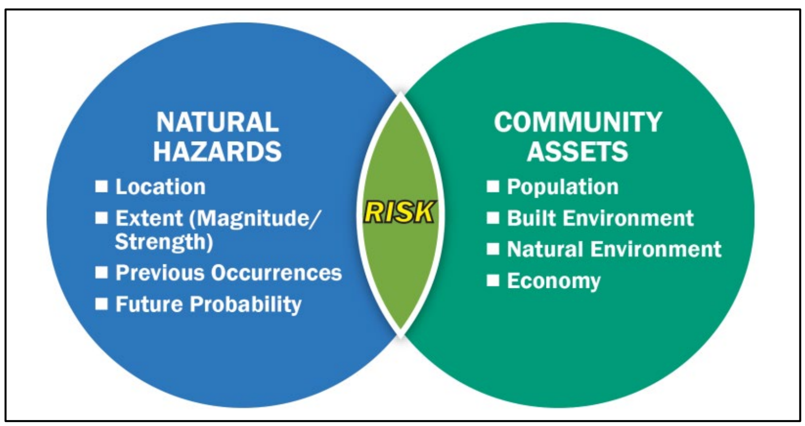
S4. Does the risk assessment provide an overview of the probabilities of future hazard events? [44 CFR § 201.4(c)(2(i)]

FMAG1. Does the plan address wildfire risks? [44 CFR § 201.4(c)(2); 44 CFR § 204.51(d)(2)]

Islands within the Commonwealth of the Northern Mariana Islands (CNMI) are subject to a multitude of regularly recurring hazards, including typhoons, earthquakes, tsunamis, floods, and drought. Although little can be done to eliminate most of these hazards, it is possible to reduce or eliminate their destructive effects on people and infrastructure through the application of appropriate hazard mitigation measures. To select measures that reduce the long-term vulnerability to natural hazards, it is critical to understand the characteristics of the hazard (e.g., magnitude and frequency of occurrence of the hazard) and to identify locations that are at high risk to their effects.

The Federal Emergency Management Agency (FEMA) defines risk as the potential for damage or loss when a hazard interacts with an asset. Assets can be people, buildings, infrastructure, the economy, or natural and cultural resources.

The risk assessment for the 2024 SHMP Update provides factual data-based information to assess community vulnerabilities, develop priorities, and informs mitigation strategies to reduce risk to CNMI communities and infrastructure. The risk assessment is the link between identified vulnerabilities and proposed mitigation actions.



Source: FEMA Planning for a Resilient Community. https://www.fema.gov/sites/default/files/documents/fema_planning-resilient-communities-slide-visuals.pdf

The 2024 SHMP Update is a revision of the information presented in the 2018 CNMI Standard State Mitigation Plan (SSMP) and builds on hazards identified in previous SSMPs. In January and February 2024, meetings were held with Commonwealth agency staff to review the hazards proposed for the 2024 SHMP Update. Surveys were developed for agency staff and the general public to rank hazards for the CNMI including new hazards not previously evaluated for the CNMI. See Chapter 3.0 (Planning

Process) for more information about agency and public outreach efforts to refine the hazards list and Appendix A (Planning Process Documentation) for survey results.

This update aims to make the risk assessment more easily understood by a person without a technical background, while paralleling the structure of the requirements outlined in 44 CFR 201.4 and FEMA's State Mitigation Planning Policy Guide (FEMA, 2022b) as well as the State Mitigation Planning Key Topics Bulletins: Risk Assessment (FEMA, 2022a). Mitigation capabilities and mitigation strategy elements are included in Chapter 5.0 (Mitigation Capabilities) and Chapter 6.0 (Mitigation Strategy).

A key step in preventing disaster losses in the Commonwealth is developing a comprehensive understanding of the hazards that pose risks to its communities. The following definitions will be applied throughout the 2024 SHMP Update:

- **Hazard:** Event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, other types of harm or loss.
- **Risk:** Potential for damage or loss when a hazard interacts with an asset and its consequences to society; the estimated impact that a hazard would have on people, services, facilities, and structures in a community.
- **Vulnerability:** Degree of susceptibility to physical injury, harm, damage, or economic loss; depends on an asset's construction, contents, and economic value of its functions.

In essence, the risk assessment evaluates potential loss from hazards by assessing the vulnerability of the Commonwealth's population, built environment, critical facilities, and other assets. Environmental and social impacts are also taken into consideration wherever possible. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities and infrastructure, natural and cultural resources, and other community assets at risk to the profiled hazards, as well as the potential impacts to the economy and future development trends of the planning area.

For the 2024 SHMP Update, Chapter 4.0 (Risk Assessment) is divided into Sections 4.1 through 4.11 with a section for each hazard divided into two parts: 1) the hazard profile and 2) the vulnerability assessment. The risk assessment for each hazard (Sections 4.2–4.10) is arranged in the following order:

Hazard Profile

- Hazard description: This section consists of a general description of the hazard and the general impacts it may have on a community.
- Location: This section describes the geographic coverage, or location, of the hazard in the planning area.

- Extent: This section summarizes the extent or magnitude/severity of a hazard event. Extent is classified in the following manner:
    - Catastrophic: Multiple deaths; property destroyed and severely damaged; and/or interruption of essential facilities and service for more than 72 hours.
    - Critical: Isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24–72 hours.
    - Limited: Minor injuries and illnesses; minimal property damage that does not threaten structural stability; and/or interruption of essential facilities and services for less than 24 hours.
    - Negligible: No or few injuries or illnesses; minor quality of life loss; little or no property damage; and/or brief interruption of essential facilities and services.
- Previous occurrences of hazard: This section includes information on historic incidents.
- Probability of future hazard events: The frequency of past events is used to gauge the likelihood of future occurrences. Based on historical data, the Probability of Future Occurrence is categorized as follows:
    - Highly Likely: Near 100% chance of occurrence next year or happens every year.
    - Likely: 10–100% chance of occurrence in the next year or has a recurrence interval of 10 years or less.
    - Occasional: 1–10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
    - Unlikely: Less than 1% chance of occurrence in next year or has a recurrence interval of greater than every 100 years.

  The probability, or chance of occurrence, was calculated where possible based on existing data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percentage chance of the event happening in any given year. An example would be three wildfires occurring over a 30-year period, which suggests a 10% chance of a wildfire occurring in any given year.
- Climate change considerations: This sub-section will discuss the known or potential impacts of climate change on specific hazards.

<u>Vulnerability Assessment</u>

The vulnerability assessment further defines and quantifies buildings, critical facilities and infrastructure, populations, natural and cultural resources, and other community assets at risk to the profiled hazards, as well as the potential impacts to the economy and future development trends of the planning area. The vulnerability assessment includes these sub-sections for each applicable hazard:

- Assessment of Commonwealth building vulnerability and potential losses, including community lifelines.
- Assessment of general vulnerability and potential losses to the general building stock, socially vulnerable populations, and natural and cultural resources.
- Future changes to hazard risks that may impact the vulnerability of these assets.

4.1.2 Local Jurisdiction Risk Assessments and Losses

S6. Does the risk assessment include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses? [44 CFR §§ 201.4(c)(2(ii) and 201.4(c)(2(iii)]

There are no local jurisdiction risk assessments to incorporate, thus local losses were not incorporated. However, efforts were made to identify risk by island (or municipality) as data permits.

4.1.3 Hazard Identification Methodology and Results

The 2024 SHMP Update characterizes the impacts of hazards on Commonwealth assets and allows for comparison of potential loss and determination of priorities for mitigation measures. To summarize vulnerability, the identified hazards were evaluated based on factors related to the risks faced. These risk factors include the probability of occurrence, impacts, location (i.e., spatial extent), extent (i.e., magnitude/severity), duration, and warning time, per the FEMA State Planning Key Topics Bulletin: Risk Assessment (2022a). For the 2024 SHMP Update, hazard duration and warning time were combined into the extent factor. The criteria used are listed and defined in Table 4.1-1. Adaptive capacity and changing future conditions were also integrated into the final hazard ranking to ensure these important factors were considered. Refer to Section 4.11 (Vulnerability Summary) for the final hazard ranking results.

4.1.4 Overall Hazard Significance Summary

The overall hazard significance, based on a combination of geographic area, probability of future occurrence and potential magnitude/severity is summarized below. The individual ratings are based on or interpolated from the analysis of the hazards in the sections that follow. During the 2024 SHMP Update, the individual ratings and significance of the hazards were revisited and updated. Public concern was also considered via input at the public meetings and the online survey.

Table 4.1-1. Summary of Commonwealth hazard significance by hazard ranking.

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Typhoon	Likely	Extensive	Catastrophic	High
Tsunami	Occasional	Significant	Catastrophic	Medium
Drought	Likely	Extensive	Significant	Medium
Flood: Event based	Occasional	Significant	Critical	Medium
Flood: Coastal Erosion	Likely	Limited	Significant	Medium
Health Risks	Occasional	Extensive	Critical	Medium
Extreme Heat and Heatwave	Occasional	Extensive	Negligible	Low
Wildfire	Occasional	Limited	Significant	Low
Earthquake	Occasional	Extensive	Significant	Low
Volcanic Activity	Occasional	Limited	Negligible	Low
Flood: Chronic Coastal	Likely	Limited	Negligible	Low

Frequency of Occurrence

- Highly Likely: Near 100% probability in next year.
- Likely: 10–100% probability in next year or at least one chance in ten years.
- Occasional: 1–10% probability in next year or at least one chance in next 100 years.
- Unlikely: Less than 1% probability in next 100 years.

Hazard Spatial Extent

- Limited: Less than 10% of planning area
- Significant: 10–50% of planning area
- Extensive: 50–100% of planning area

Potential Severity

- Catastrophic: Multiple deaths, complete shutdown of facilities for 30 days or more, more than 50% of property is severely damaged
- Critical: Multiple severe injuries, complete shutdown of facilities for at least 2 weeks, more than 25% of property is severely damaged
- Significant: Some injuries, complete shutdown of critical facilities for more than one week, more than 10% of property is severely damaged
- Negligible: Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10% of property is severely damaged.

Overall Significance

- Low: minimal potential impact
- Medium: moderate potential impact
- High: widespread potential impact

4.1.5 CNMI Disaster Declaration History

Evaluating the CNMI disaster history in conjunction with built and natural assets highlights the significance of these events to the Commonwealth. Of the 26 federal disaster declarations in the CNMI since 1976, 19 were major disaster declarations and 7 were emergency declarations (Table 4.1-2). Disaster declarations between 2018 and 2023 are described in greater detail below.

Table 4.1-2. Major Disaster and Emergency Declarations for the CNMI 1976 to 2023.

Incident Type	Date Declared	Disaster Number	Declaration Type
Tropical Storm *Bolaven*	8 October 2023	EM-3602-MP	Emergency
Typhoon *Mawar*	2 June 2023	DR-4716-MP	Major Disaster
Typhoon *Mawar*	22 May 2023	EM-3593-MP	Emergency
Health–Covid-19 Pandemic	1 April 2020	DR-4511-MP	Major Disaster
Health–Covid-19 Pandemic	13 March 2020	EM-3463-MP	Emergency
Typhoon *Bualoi*	20 October 2019	EM-3425-MP	Emergency
Typhoon *Hagibis*	7 October 2019	EM-3424-MP	Emergency
Super Typhoon *Yutu*	26 October 2018	DR-4404-MP	Major Disaster
Super Typhoon *Yutu*	23 October 2018	EM-3408-MP	Emergency
Typhoon *Mangkhut*	29 September 2018	DR-4396-MP	Major Disaster
Typhoon *Mangkhut*	10 September 2018	EM-3402-MP	Emergency
Super Typhoon *Soudelor*	5 August 2015	DR-4235-MP	Major Disaster
Typhoon *Nabi*	8 November 2005	DR-1611-MP	Major Disaster
Super Typhoon *Chaba*	26 August 2004	DR-1541-MP	Major Disaster
Typhoon *Tingting*	29 July 2004	DR-1532-MP	Major Disaster
Super Typhoon *Pongsona*	11 December 2002	DR-1447-MP	Major Disaster
Typhoon *Chata'an*	6 August 2002	DR-1430-MP	Major Disaster
Super Typhoon *Paka*	24 December 1997	DR-1194-MP	Major Disaster
Super Typhoon *Keith*	8 December 1997	DR-1192-MP	Major Disaster
Typhoon *Koryn*	5 February 1990	DR-854-MP	Major Disaster
Typhoon *Roy*	20 January 1988	DR-811-MP	Major Disaster
Typhoon *Lynn*	3 November 1987	DR-800-MP	Major Disaster
Typhoon *Kim*	10 December 1986	DR-783-MP	Major Disaster
Typhoon *Dinah*	27 November 1980	DR-634-MP	Major Disaster
Tropical Storm *Carmen*	18 August 1978	DR-562-MP	Major Disaster
Typhoons *Pamela, Therese*	17 June 1976	DR-508-MP	Major Disaster

Source: FEMA, Disasters & Assistance (https://www.fema.gov/disaster/declarations).

Major Disaster Declarations since 2018

Typhoon *Mangkhut*—September 2018

Per FEMA's preliminary damage assessment report for Typhoon *Mangkhut*, on September 20, 2018, Governor Torres requested a major disaster declaration due to Typhoon *Mangkhut* during the period of September 10–11, 2018. The Governor requested a declaration for Individual Assistance and Public Assistance, including direct federal assistance for the islands of Rota, Saipan, and Tinian and Hazard Mitigation for the entire Commonwealth. During the period of September 13–17, 2018, joint federal, Commonwealth, and local government Preliminary Damage Assessments (PDAs) were conducted in the requested areas and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the Commonwealth and the affected local governments, and that federal assistance is necessary.

On September 29, 2018, President Trump declared that a major disaster existed in the Commonwealth of the Northern Mariana Islands. This declaration made Individual Assistance requested by the Governor available to affected individuals and households on the islands of Rota, Saipan, and Tinian. This declaration also made Public Assistance requested by the Governor available to Commonwealth and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by Typhoon *Mangkhut* on the islands of Rota, Saipan, and Tinian. Finally, this declaration made Hazard Mitigation Grant Program (HMGP) assistance, requested by the Governor, available for the entire Commonwealth.

According to FEMA's preliminary damage report, 738 residences were affected with 17 destroyed and 53 with major damage. About 46% of the affected households were low income. The total individual and household program dollars approved for the disaster was $1,011,549.70 and the total public assistance grant dollars obligated was $5,656,856.10 (Table 4.1-3).

Table 4.1-3. Typhoon *Mangkhut* FEMA funding obligations.

Individual Assistance	Amount
Total housing assistance approved	$628,323.13
Total other needs assistance approved	$383,226.57
Total individual and household program dollars approved	**$1,011,549.70**
Individual assistance applications approved	395
Public Assistance	
Emergency work (Categories A–B)—Dollars obligated	$888,204.12
Permanent work (Categories C–G)—Dollars obligated	$4,174,999.00
Total Public Assistance grant Dollars obligated	**$5,656,856.10**

Source: FEMA Typhoon *Mangkhut* (DR-4396-MP) web page.

Super Typhoon *Yutu*—October 2018

Per FEMA's preliminary damage assessment report for Super Typhoon *Mangkhut*, on October 26, 2018, Governor Torres requested an expedited major disaster declaration for Super Typhoon *Yutu* during the period of October 24–26, 2018. The Governor requested a declaration for Individual Assistance and Public Assistance, including direct federal assistance for six islands and Hazard Mitigation for the entire Commonwealth. This event was of such severity and magnitude that the need for supplemental federal assistance was determined to be necessary prior to the completion of joint federal, Commonwealth, and local government PDA. Per 44 CFR § 206.33(d) and § 206.36(d), the requirement for a joint PDA may be waived for those incidents of such unusual severity and magnitude that formal field damage assessments are not required to establish the need for supplemental federal assistance under the Stafford Act.

On October 26, 2018, President Trump declared that a major disaster existed in the CNMI. This declaration made Individual Assistance requested by the Governor available to affected individuals and households in the municipalities of Rota, Saipan, Tinian, and the Northern Islands. This declaration also made assistance for emergency protective measures (Category B), including direct federal assistance, under the Public Assistance program available to Commonwealth and eligible local governments for the municipalities of Rota, Saipan, Tinian, and the Northern Islands (Table 4.1-3). Finally, this declaration made HMGP assistance requested by the Governor available for hazard mitigation measures for the entire Commonwealth (Table 4.1-4).

Table 4.1-4. Super Typhoon *Yutu* FEMA funding obligations.

Individual Assistance	Amount
Total housing assistance approved	$24,304,428.07
Total other needs assistance approved	$17,752,928.67
Total individual and household program dollars approved	**$42,057,356.74**
Individual assistance applications approved	6,960
Public Assistance	**Amount**
Emergency work (Categories A–B)—Dollars obligated	$56,712,367.68
Permanent work (Categories C–G)—Dollars obligated	$203,758,528.30
Total Public Assistance grant Dollars obligated	**$283,570,457.35**
Hazard Mitigation Assistance	**Amount**
Hazard Mitigation Grant Program (HMGP)—Dollars obligated	**$10,632,948.01**

Source: FEMA Super Typhoon *Yutu* (DR-4404-MP) web page.

In October 2019, FEMA released an update regarding on-gong efforts to recover following Super Typhoon *Yutu*. During the first year of recovery, 6,958 applications for Individual Assistance were approved for $40.5 million in the Individual and Household program. There was $131 million for Public Assistance. The US Small Business Administration provided $97.4 million for 564 temporary emergency roof repairs and 2,744 temporary tents. Other actions included construction of 66 temporary classrooms, hazardous waste management including 193 shipping containers of debris removal (215,879 cubic yards) and installation of 2,144 resilient concrete utility poles.

Recovery efforts are ongoing as of 2024. For a complete list of ongoing projects related to Super Typhoon *Yutu*, see Appendix E.

Coronavirus Disease 2019 (COVID-19)—January 2020 to May 2023

Per FEMA's preliminary damage assessment report, on March 23, 2020, Governor Torres requested a major disaster declaration due to the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020, and continuing. The Governor requested a declaration for all Individual Assistance programs for the islands of Rota, Saipan, and Tinian and Public Assistance (Categories A–G) and Hazard Mitigation for all islands in the Commonwealth of the Northern Mariana Islands. This event was of the severity and magnitude that the need for supplemental federal assistance was determined to be necessary prior to the completion of joint federal, Commonwealth, and local government PDA. Per 44 CFR § 206.33(d) and § 206.36(d), the requirement for a joint PDA may be waived for those incidents of such unusual severity and magnitude that formal field damage assessments are not required to establish the need for supplemental federal assistance under the Stafford Act.

On April 1, 2020, President Trump declared that a major disaster existed in the CNMI. This declaration made emergency protective measures (Category B) not authorized under other federal statutes, including direct federal assistance, under the Public Assistance program requested by the Governor, available to the Commonwealth and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for all areas in the Commonwealth of the Northern Mariana Islands (Table 4.1-5).

Table 4.1-5. Coronavirus Disease 2019 FEMA funding obligations.

Individual Assistance	Amount
Total other needs assistance—dollars approved	$113,742.88
Total individual and household program dollars approved	**$113,742.88**
Public Assistance	**Amount**
Emergency work (Categories A–B)—Dollars obligated	$121,208,528.75
Total Public Assistance grant Dollars obligated	**$126,019,088.29**

Source: FEMA Coronavirus Disease 2019 (DR-4511-MP) web page.

Typhoon *Mawar*—May 2023

Per FEMA's preliminary damage assessment report, on May 30, 2023, Governor Palacios requested an expedited major disaster declaration due to Typhoon *Mawar* beginning on May 22, 2023, and continuing. The Governor requested a declaration for emergency protective measures (Category B), including direct federal assistance for the island of Rota. This event was of the severity and magnitude that the need for supplemental federal assistance was determined to be necessary prior to the completion of joint federal, Commonwealth, and local government PDA. Per 44 CFR§ 206.33(d) and § 206.36(d), the requirement for a joint PDA may be waived for those incidents of such unusual severity and magnitude that formal field damage assessments are not required to establish the need for supplemental federal assistance under the Stafford Act.

On June 2, 2023, President Biden declared that a major disaster existed in the CNMI. This declaration made assistance for emergency protective measures (Category B), including direct federal assistance, under the Public Assistance program available for the island of Rota (Table 4.1-6).

Table 4.1-6. Typhoon *Mawar* FEMA funding obligations.

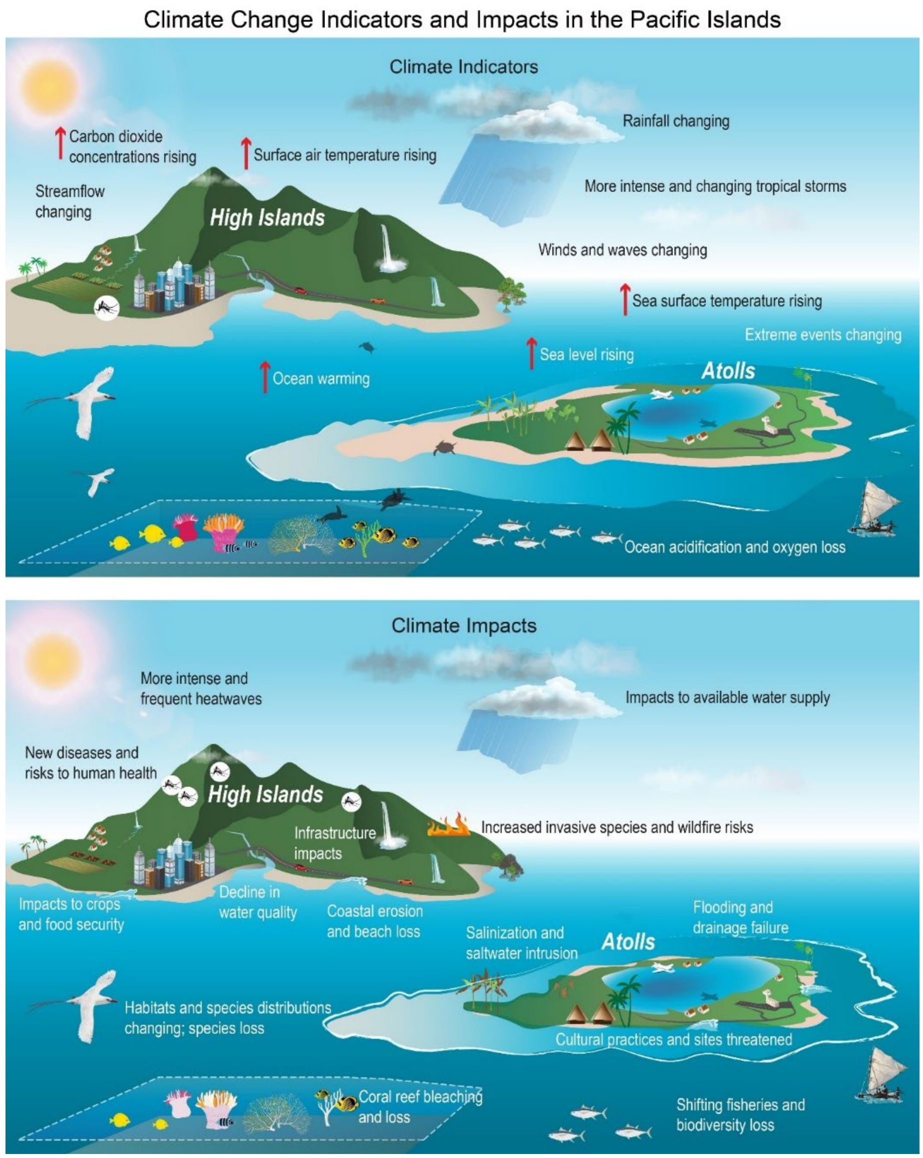
Public Assistance	Amount
Emergency work (Categories A–B)—Dollars obligated	$539,384.39
Permanent work (Categories C–G)—Dollars obligated	$791,654.06
Total Public Assistance grant Dollars obligated	**$1,419,774.38**

Source: FEMA Typhoon Mawar (DR-4716-MP) web page.

4.1.6 Climate Change Profile

According to the US Fifth National Climate Assessment (USGCRP, 2023), the Pacific Island region continues to face climate change-related challenges, including geographic isolation and reliance on imports, critical dependence on local natural resources, such as fresh water and fisheries, and vulnerabilities to drought, seal level rise (SLR), and natural disasters. The USGCRP authors note that missing data to evaluate climate change and populations and infrastructure at risk is representative of ongoing exclusion on data collection efforts and perpetuates historical social injustices that are reinforced by colonial and postcolonial governance systems. In the Pacific Islands, this has led to sparse and discontinuous climate data records, the absence of coastal hazard modeling and detailed SLR exposure mapping for most islands, a lack of downscaled future climate projections in most locations, insufficient information about groundwater and surface water resources, and limited data on ecosystem response. Similar gaps are apparent in the socioeconomic and health data. Although recent efforts have improved some climate-related information for the CNMI, especially SLR modeling for Tinian and Rota (NMHC, 2023; USACE, 2022), missing data from national databases and tools (e.g., Hazus, National Drought Monitor, National Risk Index, etc.) continues to challenge hazard risk assessment, vulnerability analyses, and loss evaluations for the CNMI.

Globally, the most recent climate models and projections suggest a wide range of changes to climate systems over the next century and beyond (Calvin et al., 2023). The potential impacts of these changes vary greatly across space and time and are by no means geographically uniform.



Source: US Global Change Research Program, 2023.

However, there is a high level of confidence that the Western North Pacific will experience changes such as:

- Increase in mean surface air temperature
- Increase in frequency of heavy precipitation and proportion of mean annual rainfall
- Rise in mean sea level
- Enhanced wave energy level and more extreme ocean wave environments
- Increase in sea surface temperature and ocean acidification

These changes constitute a deviation from the atmospheric and oceanic conditions that the CNMI has built its economy, infrastructure, and natural heritage upon. The Commonwealth, and Saipan in particular, should expect implications from these changes. For example, coastal hazards, increased projected duration and magnitude of storm surge flooding and costal erosion, can damage infrastructure that underpins the local economy.

Climate change is a threat to human well-being and planetary health. Widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere have occurred over the past half century. Human-caused climate change already affects many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damage to nature and people. Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected.

Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 34.7°F in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards. Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within approximately two decades, and also to discernible changes in atmospheric composition within a few years.

For any given future warming level, many climate-related risks are higher than assessed in the Fifth Assessment Report (AR5), and projected long-term impacts are up to multiple times higher than currently observed. Risks and projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming. Climatic and non-climatic risks will increasingly interact, creating compound and cascading risks that are more complex and difficult to manage.

Indicators of Climate Change in the CNMI

For the 2024 SHMP Update, this subsection draws information primarily from the following documents: the *State of Environmental Conditions in Hawai'i and the US Affiliated Pacific Island Under a Changing Climate: 2017* (Marra & Kruk, 2017), the *Climate Change in the Commonwealth of the Northern Mariana Islands* (Grecni et al., 2021), and the US *Fifth National Climate Assessment* (USGCRP, 2023).

The key climate change indicators included in the 2024 SHMP Update were identified through engagement with a variety of public and private stakeholders and members of the scientific community (Marra & Kruk, 2017).

Air Temperature

Indicator	How has it changed?	Projected Future Change
Hot days	↑	↑
Cool nights	↓	↓
Average air temperature	↑	↑

Source: (Grecni et al., 2021)

Change in air temperature is a key indicator of climate change. Temperatures continue to increase globally and in the Western North Pacific. Observed temperatures over the past 60 years have been characterized by increasing trends (Keener et al., 2013; Lander & Guard, 2003) (Figure 4.1-1). Although temperature records for Saipan, Tinian, and Rota do exist, they are mostly short and discontinuous. A continuous record of 30 years or more is generally considered suitable for climate studies. However, since 2006, air temperature measurements at the Francisco C. Ada Saipan International Airport also show an increasing trend in the annual number of hot days, 90°F or warmer (Figure 4.1-2). Also, the number of cool nights in Saipan declined from 2006 to 2020 (Figure 4.1-3).

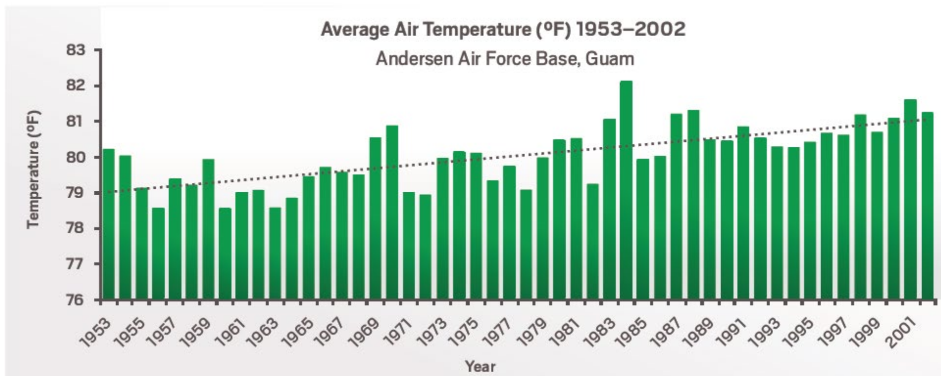


Figure 4.1-1. Average annual air temperature at Anderson Air Force Base in Guam 1953-2002. The long-term linear trend indicated by the black, dotted line shows an increase over time.
Source: Grecni et al. (2021). Original figure by Abby Fraizer, using data from the National Oceanic and Atmospheric Administration (NOAA) Global Historic Climatology Network (GHCN)-Daily database for 1953–2002.

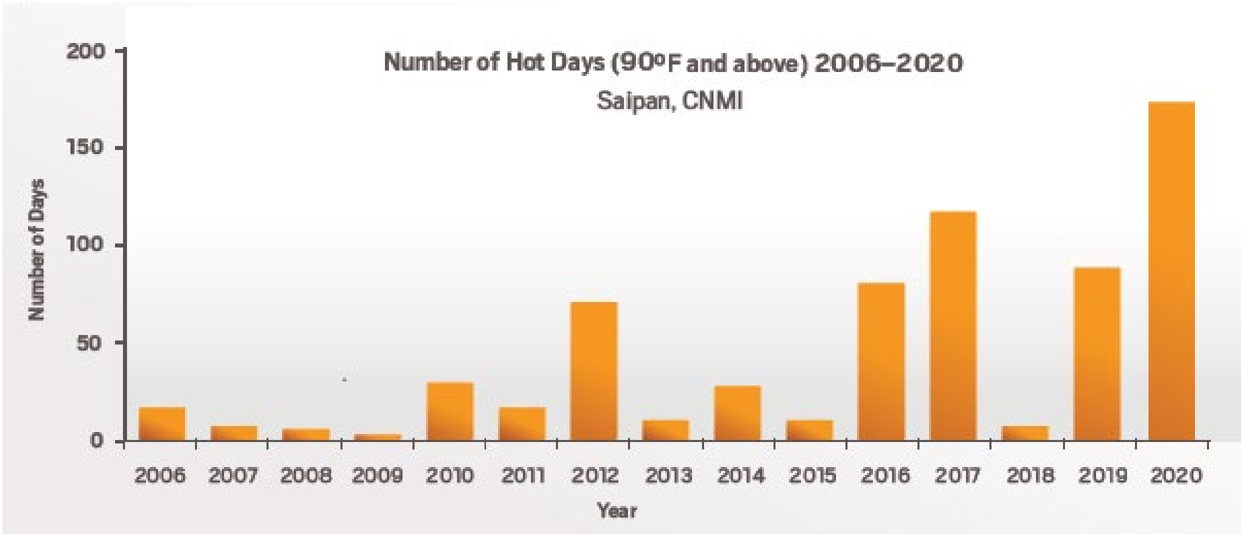


Figure 4.1-2. Annual number of days with maximum temperatures at or above 90°F—the 95th percentile of data record—at the Franscisco C. Ada Saipan International Airport from 2006–2020.
Source: Grecni et al. (2021). Original figure by Abby Frazier, using data from the NOAA GHCN-Daily database.

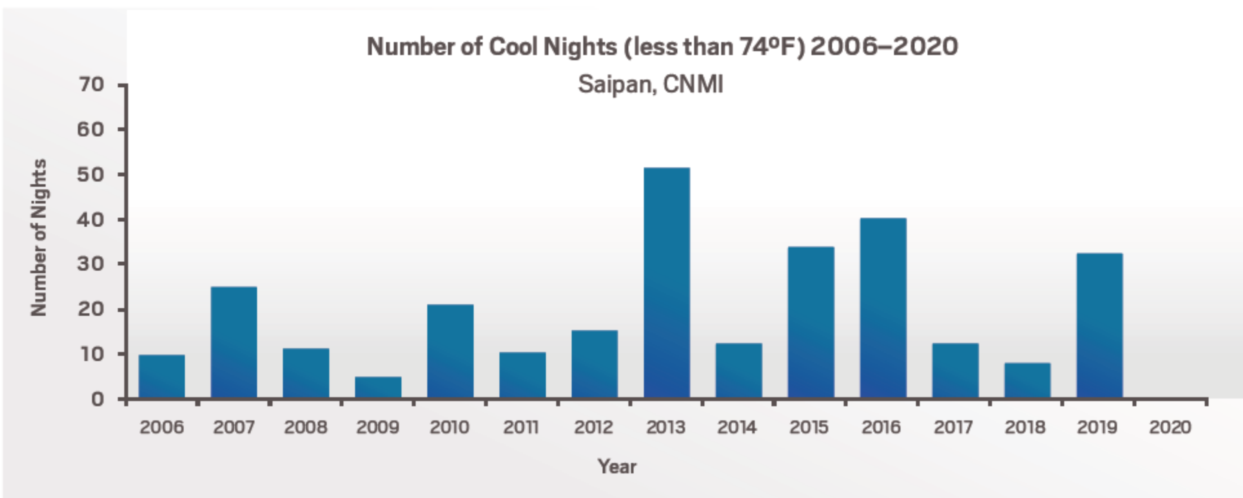


Figure 4.1-3. Annual number of days with maximum temperatures less than 74°F—the 10th percentile of data record—at the Franscisco C. Ada Saipan International Airport from 2006–2020. There were zero nights with minimum temperatures below 74°F in 2020.
Source: Grecni et al. (2021). Original figure by Abby Frazier, using data from the NOAA GHCN-Daily database.

Rainfall and El Niño-Southern Oscillation

Indicator	How has it changed?	Projected Future Change
Average Rainfall	No Change	?
Extreme rainfall days	No Change	⬆
Drought frequency and intensity	?	?

Source: Grecni et al. (2021)

In the Marianas rainfall patterns are strongly associated with the monsoons of the Eastern Hemisphere and the El Niño-Southern Oscillation (ENSO) making annual rainfall highly variable. Long-term, consistent rainfall data for the CNMI, necessary for climate studies, is lacking. The closest available data is from Anderson Airforce Base on Guam. Since precipitation patterns are consistent between Guam and CNMI, which can be attributed to both regions reacting similarly to ENSO (Figure 4.1-4), the rainfall data set from Guam can be used as a proxy for anticipated changes in the CNMI.

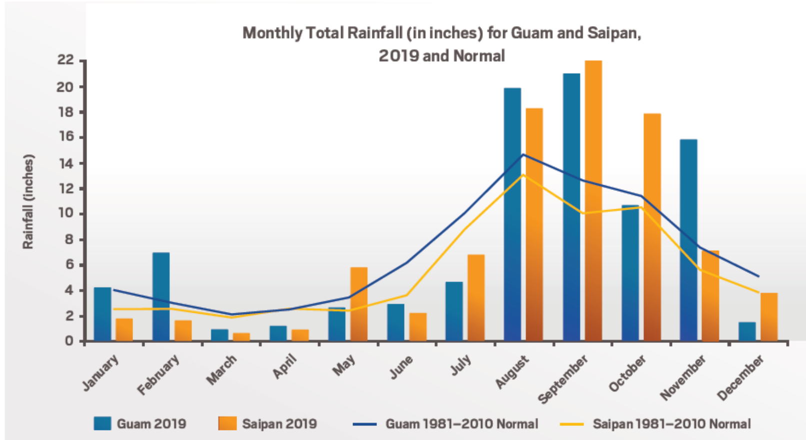


Figure 4.1-4. Monthly rainfall totals at Guam's international airport (blue) and Saipan's international airport (yellow) in 2019 (bars) and normal year (lines). During El Niño, including the 2018–2019 event, rainfall responds similarly in Guam and Saipan, with drier-than-normal- first half of the year following the onset of El Niño.

Source: Grecni et al. (2021). Figure adapted from NOAA NCEI.

During ENSO events climate conditions change dramatically over the Pacific Basin. Sea surface temperatures warm during ENSO events and disrupt normal trade wind patterns, which leads to drier conditions in the Western Pacific. ENSO conditions can sometimes last a year or more and can start as early as March and peak in December. Associated with ENSO events are droughts, flash floods from severe storms, food and water shortages, and increased health risks (Pacific ENSO Applications Climate Center, n.d.). ENSO events are expected to increase as the climate continues to warm (Cai et al., (2014) in Mycoo et al., 2022).

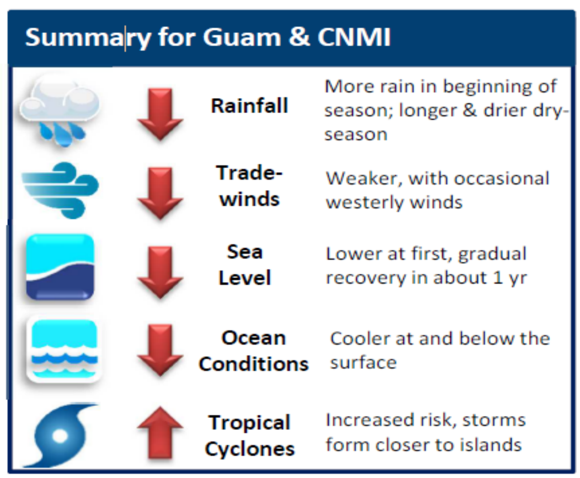


Figure 4.1-5. Possible environmental changes from El Niño events.

Source: PEACC (n.d.)

Global climate models project a 2–8% increase in average annual precipitation for the Western Pacific by the end of the 21st century (Sa'adi et al., 2017 in Mycoo et al., 2022). However, a subset of models downscaled to the island level for Guam project an average decrease in annual rainfall (7% overall) under the higher scenario for late this century relative to 1990 to 2009 (Zhang et al., 2016 in Grecni et al., 2021). The projections for Guam indicate reduced wet season rainfall (July to December), while dry season rainfall (January to June) is projected to increase slightly (Zhang et al., 2016 in Grecni et al., 2021). The frequency of extreme rainfall has changed little on average at the Saipan international airport and Anderson Airforce Base over the period of records. However, in the future, the frequency and intensity of extreme rainfall events is expected to increase with global warming (McGlasson, 2023). Increased heavy rainfall events will result in increased runoff and increased potential for flooding and erosion.

The *Climate Change Vulnerability Assessment for the Island of Saipan* notes that, according to IPCC Assessment Reports and the 2012 Pacific Islands Regional Climate Assessment, there is medium confidence that rainfall variability could lead to both water shortages and temporary flood scenarios (Greene & Skeele, 2014). Due to these changes freshwater resources and groundwater will likely become a focus area for adaptation efforts in many areas. While changes in precipitation will impact these resources, long-term shifts in sea level may alter salinity and the chemistry of coastal aquifers and groundwater, threatening water security especially in tropical islands such as the CNMI.

According to Grecni et al. (2021), future projections for drought frequency and intensity are not available for the Commonwealth. However, since 2015 the National Weather Service (NWS) has issued drought information statements for the Marianas for below-normal rainfall in every year except 2018. The frequency of days with no rainfall at Saipan's international airport (Figure 4.1-6) was above average in recent years. In the first half of 2020, the Marianas experienced exceptional drought. Saipan's international airport had the second driest January to May on record in 2020 (NOAA NCEI, 2023). Downscaled climate projections for nearby Guam indicate drought conditions (defined here as more than 20% below mean annual historic rainfall) are projected to occur in 4 out of 10 years on average 2080–2099 under a high emissions scenario. This is an increase from the historic rate of 1.6 years out of 10 years on average (Gingerich et al., 2019; Zhang et al., 2016).

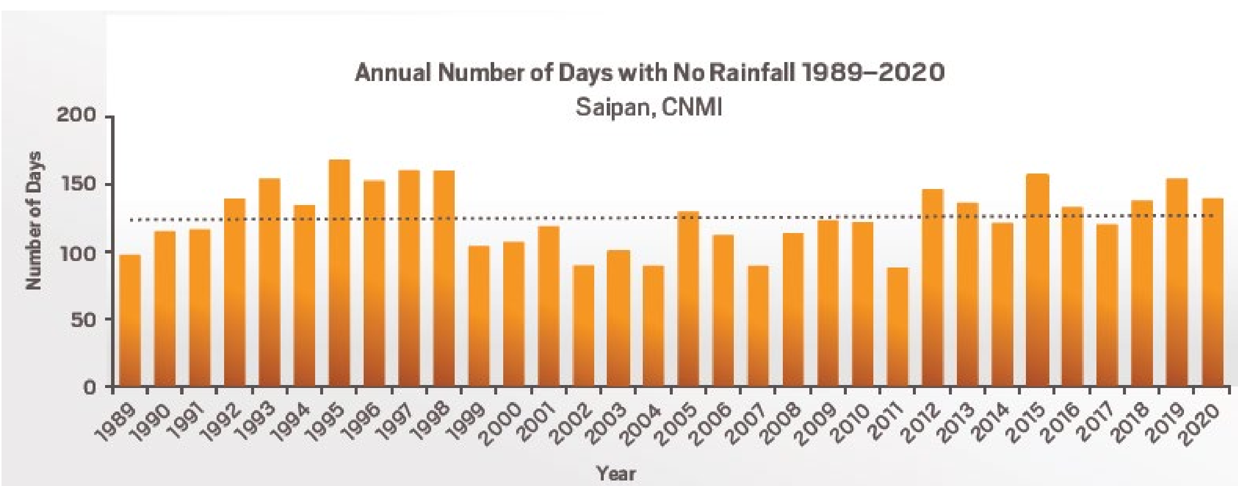
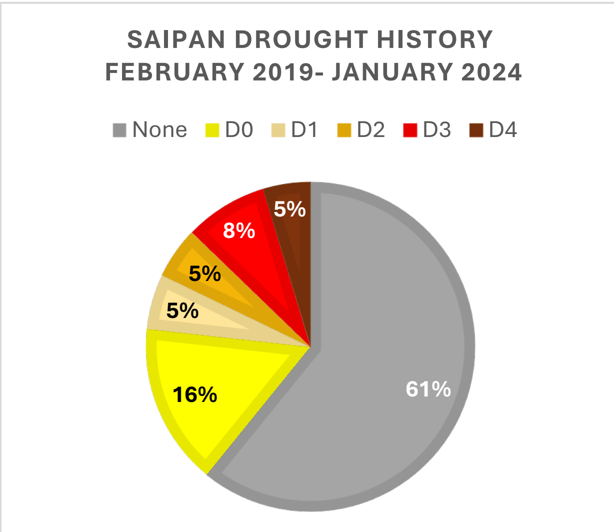


Figure 4.1-6. Annual number of days with no rainfall from 1989 to 2020 at the international airport in Saipan, CNMI. The black, dotted trend line shows no significant linear trend, upward or downward, over time.
Source: Grecni et al. (2021). Original figure by Abby Frazier, using data from the NOAA GHCN-Daily database.

Also, between 2019 and 2023, data from the US Drought Monitor showed that Saipan experienced drought on 23% of days (Figure 4.1-7, D1–D4), with 13% of days in extreme or exceptional drought (D3 and D4). Over the same period, Rota experienced drought on 18% of days (Figure 4.1-7, D1–D4), with 10% of days of extreme or exceptional drought (D3 and D4).



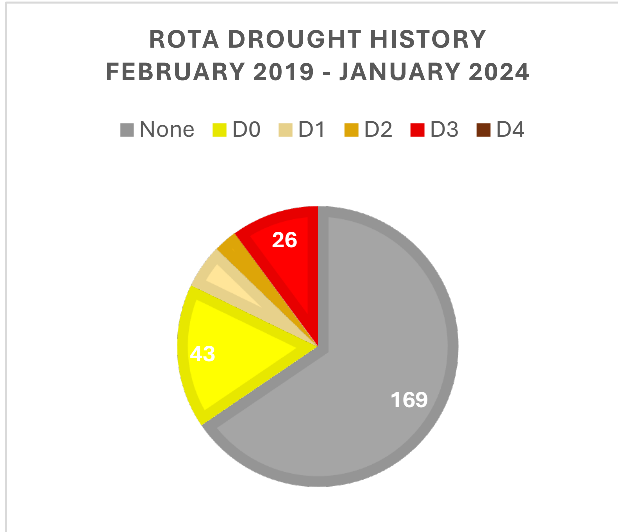


Figure 4.1-7. Patterns of drought in Saipan (left) and Rota (right) between 2019 and 2023 as reported by the US Drought Monitor.
D0, Abnormally Dry; D1, Moderate Drought; D2 Severe Drought; D3 Extreme Drought; D4 Exceptional Drought.

Tropical Cyclones and Storms

Indicator	How has it changed?	Projected Future Change
Tropical cyclone intensity	No Change	↑
Tropical cyclone frequency	No Change	↓

Source: Grecni et al., 2021

The number of named tropical storms and typhoons affecting the Marianas has remained constant on average over the long-term record (Lander, 2004; Marra & Kruk, 2017). The CNMI and Guam have historically expected two to eight storms in any given year on average. In the Northwestern Pacific basin, including the CNMI, the overall frequency of tropical cyclones decreased 15% from 1980 to 2013 (Lin & Chan, 2015) and storm tracks generally shifted northward. As a result, tropical cyclone exposure decreased in the Marianas region during 1992 to 2013 compared to previous decades (Kossin et al., 2016; Lin & Chan, 2015). Wind speeds in the CNMI are mostly low (11–23 mph) except in and near typhoons and storms. Energetic wave action generated by tropical cyclones and storms can lead to severe coastal erosion in the CNMI and lead to infrastructure and economic damage.

Tropical cyclone intensity will likely increase in a warmer climate for most regions, including the Marianas (Kossin et al., 2020; Marra & Kruk, 2017; Mycoo et al., 2022; Widlansky et al., 2019; Zhang et al., 2016). The change in tropical cyclone intensity is projected to affect stronger storms the most (resulting in increased maximum intensities), which would amplify the potential for severe damage (Widlansky et al., 2019).

Fewer tropical cyclones are projected to occur by the end of this century, both globally and around the CNMI (Kossin et al., 2016; Zhang et al., 2016). Compared to the historical 2–8 tropical cyclones yearly tracking near Guam and the Northern Mariana Islands, in the future, the occurrence is likely to decrease to 1–6 storms per year (Widlansky et al., 2019). Thus, the likely overall outlook for the Northern Mariana Islands is for fewer but stronger storms in the future.

Sea Level Rise

Indicator	How has it changed?	Projected Future Change
Sea level	↑	↑
High water frequency	↑	↑

Source: Grecni et al. (2021)

Sea level is rising around the CNMI and Saipan's tide gauge for measuring long-term sea level trends recorded an average rise of 0.07 inches per year since 1978 (NOAA 2020b in Grecni et al., 2021). In the CNMI, sea levels fluctuate on timescales from weeks to years to decades. The largest year-to-year variability in sea level is associated with El Niño and La Niña events (lower or higher than average by as much as 1 ft, respectively). Furthermore, sea levels vary annually due to the seasonal cycle of ocean temperature and on shorter timespans due to abrupt changes in the winds and atmospheric pressure (for example, storm surges).

The rate of SLR is projected to accelerate in the future. To help communities plan for an uncertain future, the US Interagency Sea Level Rise Task Force established five future SLR scenarios that span the range of plausible SLR amounts by 2100 using the latest scientific consensus from the Intergovernmental Panel on Climate Change (IPCC) and other scientific bodies (USGCRP, 2023). The five SLR scenarios represent the range on a global scale, with projected SLR amounts in 2100 and scenarios defined as follows:

- Low, 1 ft rise in global mean sea level relative to year 2000 baseline
- Intermediate-Low, 1.5 ft
- Intermediate, 3 ft
- Intermediate-High, 5 ft ; and
- High, 6.5 ft (Figure 4.1-8)

There is very high confidence in the lower bounds of these projections, and it is extremely likely that global sea levels will continue to rise after 2100 (Sweet et al., 2017). Moreover, if warming continues above 3.6°F, SLR projections of 3.5 to 7.5 ft by 2100 are increasingly possible (USGCRP, 2023).

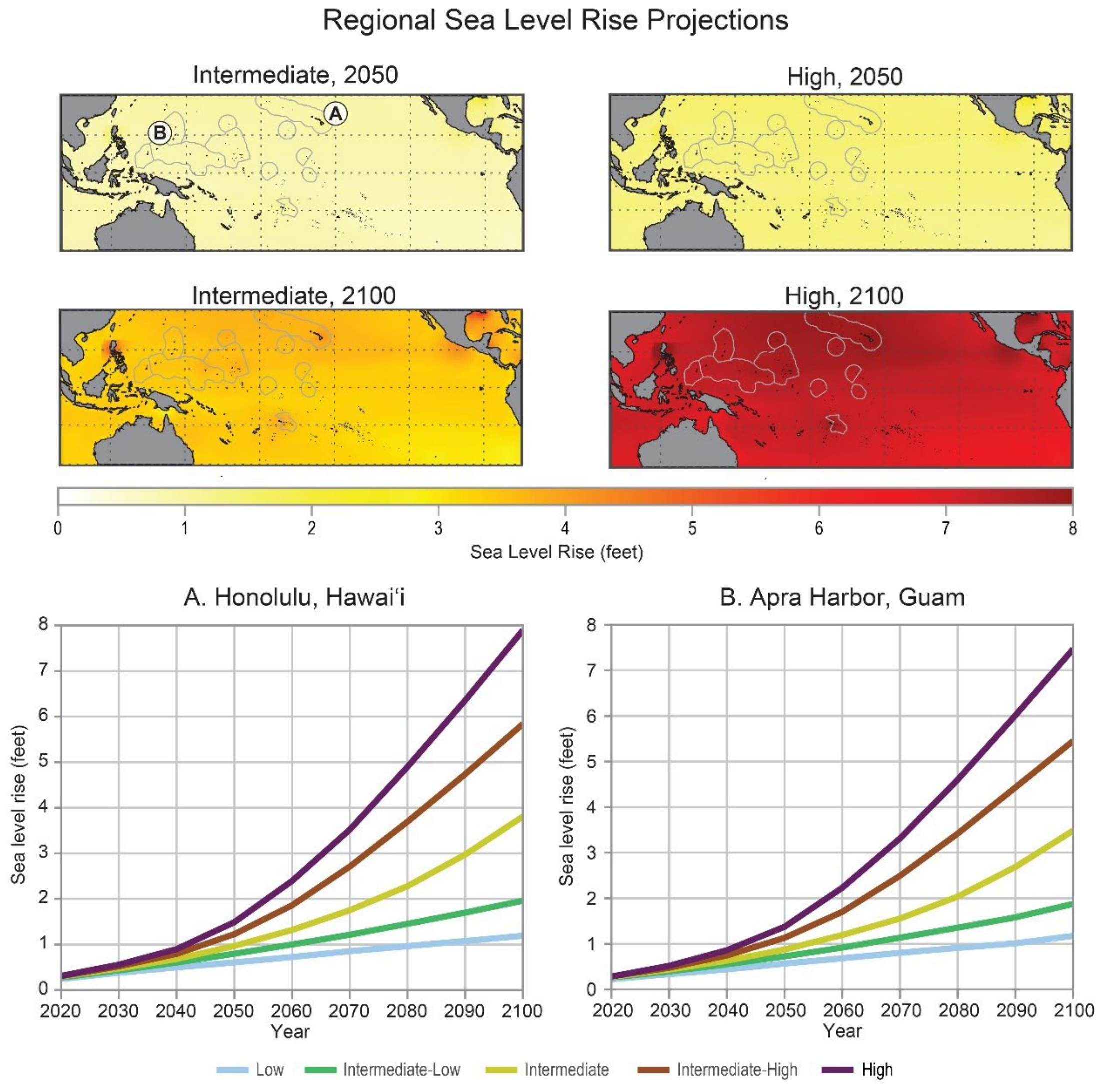


Figure 4.1-8. Sea level rise (SLR) projections for different scenarios. Maps display regional variations in projected SLR by 2050 (top row) and 2100 (center row) in the Pacific under Intermediate (left) and High (right) scenarios. In general, sea levels are relatively higher in the northern and western Pacific than in the southern and eastern Pacific. Although patterns vary spatially due to various processes such as thermal expansion and subsidence, the greatest sources of variability are time and the scenario (bottom two front panels). SLR scenarios are shown for 2020–2100 at Honolulu, Hawai'i (A), and Apra Harbor, Guam(B).

Source: USGCRP (2023). Figure credit: US Geological Survey, University of Guam, Arizona State University, and NASA Jet Propulsion Laboratory.

For the Marianas and tropical Pacific Islands, sea level rise is expected to be higher than the global average (Kopp et al., 2014; Sweet et al., 2017; USGCRP, 2023). For example, if Global Mean Sea Level rises 1 ft, the CNMI is expected to see 1.2 ft of SRL. With 3.3 ft of Global Mean SLR by 2100 relative to historical levels, the CNMI is expected to see 3.8 ft of SLR by 2100. However, the ENSO and Pacific Decadal Oscillation will continue to drive decadal variability in SLR, with rates that are above or below Global Mean Sea Level (USGCRP, 2023). Sea level rise will cause coastal flooding to become more frequent and severe, which could be exacerbated by future increasing sea level variability associated with more extreme El Niño and La Niña events (Widlansky et al., 2015).

The 2018 SSMP presented nine coastal flooding and inundation models for Saipan that incorporated various SLR estimates and 10-year and 50-year storms (see Appendix C) for a summary of the 2018 Saipan SLR flooding scenarios). The 2018 SSMP did not include SLR models for Rota or Tinian because bathymetry data were not available, and the Northern Islands were not analyzed for SLR. Now, SLR models for Saipan, Tinian , and Rota are available through NOAA's Digital Coast for various emission scenarios and time frames. However, SLR models are still not available for the Northern Islands. The NOAA digital Coast data does not incorporate wave driven flooding or elevated rainfall associated with storms. To evaluate future impacts from SLR and storm wave driven flooding, flood mask data developed by Storlazzi et al. (2019) was combined with SLR data in the Geographic Information System (GIS) and the boundaries between the polygons dissolved. The Special Flood Hazard Area (A-zones and V-zones for the current Flood Insurance Rate Map [FIRM]) was also included in the analysis to at least account for current elevated rainfall hazards associated with a 1% annual chance storm. While this hybrid data-source approach provides best-available insight into potential hazards, optimally a cohesive modelling-based approach would be implemented. Future updates would benefit from additional data, model, and assessment platform availability.

Other data sources for SLR in the CNMI include NOAA Office for Coastal Management Sea Level Rise Inundation Database (Saipan coverage only), US Army Corp of Engineers SLR Curves, and special flood layers for Saipan (Greene, 2017). Various reports have used these different data sources to evaluate the impacts to assets (buildings, infrastructure, lifelines, economy, vulnerable populations, natural resources, and cultural resources). Reports include 1) *CNMI Coastal Resilience Assessment* (Dobson et al., 2020a), 2) *The CNMI Final Post Disaster Watershed Plan* (USACE, 2022), and 3) *CNMI Community Development Block Grant Mitigation Initial Action Plan* (NMHC, 2023). For the 2024 SHMP Update, the intermediate emission scenario of 3 ft of SLR by 2100 from the US Fifth National Climate Assessment (USGCRP, 2023) listed above will be used.

Coastal erosion, as a naturally occurring process, has always been a paramount concern for Pacific Islands, and the impacts of SLR are likely to increase the impacts of coastal erosion processes (Fletcher & Richmond, 2010; M. Mimura et al., 2007; N. Mimura, 1999). Many low-lying islands and atolls in the WNP have already reported issues with erosion and occasional inundation. While the islands of the CNMI are significantly higher than atolls, many of the considerations for low islands apply to the nearshore and coastal portions of high islands. In fact, impacts to lowest lying portions of high islands can be quite similar to those experienced on low islands (Marra et al., 2012). For Saipan's western coastal plain, impacts from SLR may be similar to impacts described for low islands.

Nature-based solutions such as coral reef restoration have been proposed at the federal (DARPA Reefense Program), state (e.g., State of Hawai'i, 2021), and territorial levels. Such solutions are potentially cost effective for protecting coastal infrastructure and habitats, sustaining ecosystem services such as fisheries, and supporting tourism and recreation (Figure 4.1-9).

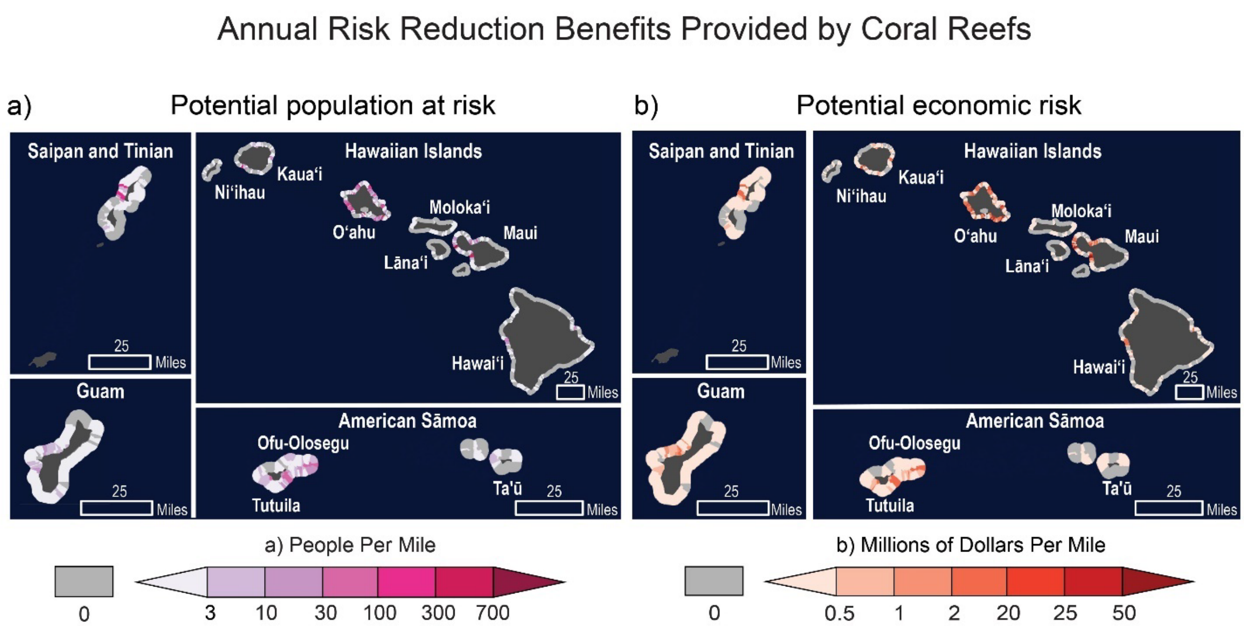


Figure 4.1-9. The maps show coastal flood protection that the top-most 3.28 ft (1 m) of coral reefs provide annually in American Sāmoa; Guam; Saipan and Tinian; and Hawai'i. The maps display (a) the number of people per mile at risk and (b) the potential economic losses (in millions of dollars per mile) from direct building damage and indirect economic disruption from flooding.
Source : USGCP (2023), Adapted from Storlazzi et al. (2019).

Ocean Changes

Indicator	How has it changed?	Projected Future Change
Sea surface temperature	↑	↑
Frequency and intensity of heat stress on coral	↑	↑
Ocean acidification	↑	↑

Source: Grecni et al. (2021).

Sea Surface Temperature

The US *Fifth National Climate Assessment* (USGCRP, 2023) states that climate change is significantly altering US marine ecosystems at a pace, magnitude, and extent that is unprecedented over millennia. Changes in species locations, productivity, and seasonal timing are cascading through ecosystems, threatening critical connections between people and the ocean, especially for Indigenous Peoples. Rising ocean temperatures, declining dissolved oxygen concentrations, and marine heatwaves are projected to impact the structure and composition of marine ecosystems.

Rising sea surface temperatures and associated changes in ocean chemistry will undoubtedly have a large impact on the CNMI. While recreational, subsistence, and commercial fisheries are threatened with possible shifts in marine species range and behavior, the overall integrity of the CNMI's coral ecosystems may also be compromised by the end of the century. This degradation could have a severe impact on the CNMI's tourism resources, which rely on overall marine ecosystem health. In 2019, Storlazzi et al. (2019) estimated that for a 10-year storm the coral reefs around Tinian and Saipan could reduce damages on both islands by an estimated $9,576,285. In 2006 the Bureau of Environmental and Coastal Quality (BECQ) Division of Coastal Resources Management (DCRM) estimated the total economic value of CNMI's coral reefs at over $61 million per year. The DCRM currently monitors CNMI's coral, shorelines, seagrass, and wetlands.

Frequency and Intensity of Heat Stress on Coral

Rising sea surface temperatures and marine heatwaves continue to be the most pressing climate change impacts facing Pacific reefs leading to more frequent and severe bleaching events with less recovery time (USGCRP, 2023). Bleaching-induced mortality has reduced coral cover and decreased available habitat for reef-associated species.

According to Grecni et al. (2021), the frequency of heat stress, which is responsible for coral reef bleaching, is increasing in the Northern Mariana Islands. The number of days per year that at least some coral reefs were exposed to accumulated heat stress, as categorized by the NOAA Coral Reef Watch, has risen from 12 days per year (in 1982–1991) to 43 days per year (in 2007–2016) on average, a 258% increase (Marra & Kruk, 2017). The intensity of heat stress has also increased indicating that ecologically significant bleaching will also increase.

Grecni et al., (2021) also states that high sea surface temperatures produced severe, widespread bleaching of CNMI reefs in 2013, 2014, and 2017, during a global bleaching event. In 2017, the most severe coral bleaching event ever recorded occurred across the region, impacting coral in Saipan down to 66 ft in depth (Maynard et al., 2018). Data indicate that 90% of Acropora corals and 70% of Pocillopora corals died on Saipan's shallow reefs from the 2017 event (The Nature Conservancy, 2019). Between 2012 and 2018, coral cover declined 67% on average across 35 sites surveyed in Saipan (Figure 4.1-10).

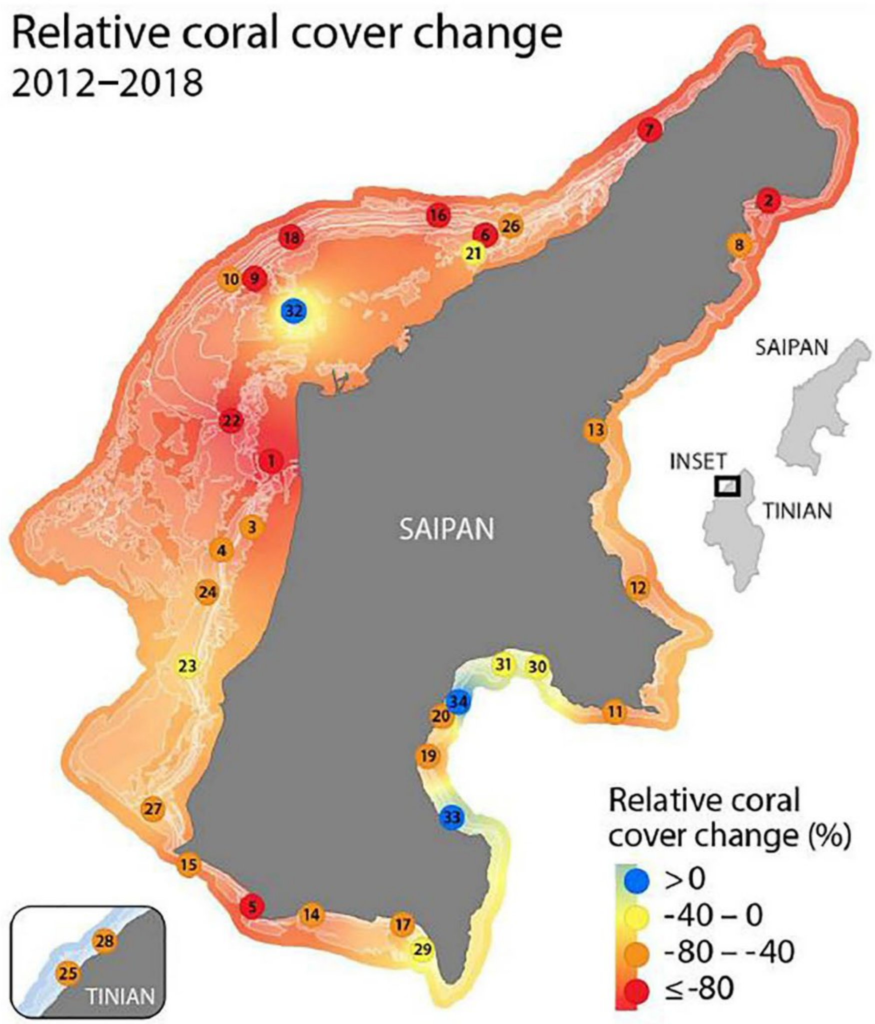


Figure 4.1-10. Coral cover change around Saipan between 2012 and 2018. The May 2018 surveys and analysis were led by Steven McKagan and Jeff Maynard, and were funded by the NOAA Coral Reef Conservation Program under a domestic grant to the Marine Applied Research Center (www. symbioseas.org). Numbers on the map refer to specific sites.
Source: Maynard et al. (2018).

Ocean Acidification

Data collected over 30 years north of O‘ahu, Hawai‘i, are considered the best available documentation of ocean acidity for the western and central Pacific and show that ocean acidification has been slowly increasing (roughly by 9%) since records began in 1988 (Marra & Kruk, 2017). Ocean chemistry will continue to change, and under a high warming scenario, all coral reefs are projected to exist in acidified conditions that will impede their ability to grow by the end of the century (Australian BOM & CSIRO, 2014).

Risk Reduction and Climate Change Action and Education

The United States has adopted and implemented disaster risk management strategies in line with the Sendai Framework for Disaster Risk Reduction. Locally, the CNMI has adopted and is implementing disaster risk reduction strategies in line with national disaster risk reduction strategies; however, beyond renewable energy standard goals, CNMI has not established or operationalized an integrated policy, strategy, or plan which increases their ability to adapt to the adverse impacts of climate change and foster climate resilience.

Figure 4.1-11. Students from the Tinian Ridge to Reef Eco-Camp display their Eco-art.
Source: DCRM Outreach in the Schools webpage 2024.

To improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning, the DCRM has developed public outreach materials and events that are accessible online via the DCRM website. Specifically, DCRM has worked in partnership with the Public School System to integrate climate-specific curriculum for sixth and ninth graders. DCRM staff give presentations about special ecosystems such as coral reefs, wetlands, and mangroves, as well as the importance of watersheds and career opportunities in the environmental field.

Overall Probability of Climate Change

An uncomfortable truth is that emissions are the result of economies that are rich in manufactured goods and energy use. These economies are part of desired lifestyles. Changing economies will require a change in lifestyles. Unfortunately, humankind shares a common desire for material goods and abundant available energy. The haves want to continue as such. The have-nots want to become haves. Until this paradigm shifts to an appropriate have-not, meaning a reduction in economic activity (and therefore reduction in lifestyle), emissions reductions will remain elusive.

The CNMI is currently experiencing the impacts of climate change. Terrestrial surface temperatures are rising, days with no rainfall are increasing, rain intensity is increasing, sea level and sea surface temperatures have increased, and the ocean is acidifying. These trends are expected to continue or accelerate, causing further increases in temperature, extreme variation in precipitation (resulting in droughts or flooding), potential changes in storm systems (possibly less frequent, but increased magnitude), and continued rise in sea levels.

As global temperatures continue to increase, sea level will rise at increasing rates. The rate of future carbon dioxide emissions and future climate change determines how much the sea level will rise. The speed at which it rises depends mostly on the rate of glacier and ice sheet melting (Sweet et al., 2022). As discussed earlier, in the Western Pacific, sea level is projected to rise 3 ft by 2100 (USGCRP, 2023). Sea level rise impacts are assessed further in the vulnerability assessments for flood and typhoons. The consequences of sea level rise for the CNMI are considerable as the majority of the population, public infrastructure, and economic sectors exist on low-lying coastal areas, which are highly susceptible to coastal hazards.

Climate Change Impacts

Surface temperatures are expected to continue to increase, and the number of extreme heat days (> 90°F) is also expected to increase. The increase in temperatures may be amplified in low lying urban areas with a diminished tree canopy such as along Saipan's western coastal plain.

Wildfires amplified by climate change are anticipated to degrade air quality, degrade watersheds, and increase erosion and runoff. Increases in sea surface temperatures will cause increasingly irregular patterns of drought, heavy rainstorms, and intense typhoons. Warmer ocean water will continue to degrade and destroy coral reefs, which will leave coastal areas unprotected from coastal flooding hazards.

SLR is driven by climate change. As the planet warms, land ice melts and flows into the ocean. The volume of the ocean also expands as the water temperature increases (Lindsey & Dahlman, 2023; Sweet et al., 2022). Together these phenomena influence a 3 ft SLR by 2100 according to the selected scenario.

As the climate continues to change, the risks of some hazards are expected to increase. For the hazards that will likely be affected by future climate change conditions, projected impacts are assessed further in the individual hazards section in the vulnerability assessments.

4.1.7 Asset Inventories

S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§ 201.4(c)(2(ii) and 201.4(c)(2(iii)]

According to the US Fifth National Climate Assessment (USGCRP, 2023), missing data to evaluate infrastructure at risk is representative of ongoing exclusion on data collection efforts and perpetuates historical social injustices. Data regarding Commonwealth owned and operated facilities and other buildings are largely absent from national databases and tools such as the US Army Corps of Engineers 2022 National Structure Inventory and FEMA's Hazus. Some data is available in tabular form from Hazus 6.0, but the information could not be used within the tool to evaluate hazards.

To improve the vulnerability assessments in the 2024 SHMP Update, geodatabases were created for Commonwealth owned and operated buildings and infrastructure and the Commonwealth general building stock.

Commonwealth Buildings and Infrastructure

The CNMI HMGP provided a list of Commonwealth owned/operated buildings and infrastructure as identified in the Facilities Assessment Matrix (FAM). The list of Commonwealth facilities was originally developed for the 2010 SSMP via a FAM tool, which was a form that asked detailed questions about each facility or infrastructure each agency managed. Data was input to a database and a list of facilities was included in each subsequent SSMP update through 2018. For the 2024 SHMP Update, the FAM was updated by consulting with agency personnel and is as complete as practical given the compressed project timeline; this data will be referred to as buildings in the 2024 SHMP Update. The data set did not have attributes to determine the number of owned versus leased buildings. The list of facilities was geocoded to generate a spatial layer with the attributes needed for the analyses. Not all facilities had sufficient location data for geocoding. Of the total 478 facilities, 456 had sufficient data to be successfully geocoded and included in the spatial analyses reported in Sections 4.2–4.10. The data set included various structural attributes used for the analyses, including 2022 replacement cost values from Hazus 6.0, agency that owns or leases the building, use description, year built, number of stories, and square footage. For buildings missing values for these attributes and for additional attributes required for the analyses, default values were used.

For each entry in the identified facilities list initial geospatial locations were assigned using best available information from sources including google maps, OpenStreetMap, and high-resolution orthoimagery. An ESRI Field Maps project was created and loaded to mobile devices which enabled each facility to be marked as ground-truthed and allowed the dataset to be enrich and correct with additional fields such as the current tenant (some facilities had changed organizations since the last update) and building construction. An additional 279 Commonwealth facilities (not all critical facilities) were identified, which were not included in the previous dataset.

Each facility was spatially joined to the nearest point entry in the Hazus database. Most facilities had a direct match but for those that did not, an adjacent point was used to assign a limited number of fields such as replacement value per square foot etc. Due to the extremely large scale that the Hazus dataset must cover, it uses a generalized model for assigning values of structures and their contents that uses building type and occupancy to assign a standardized building footprint size and replacement value to all buildings of that type. Over large areas these errors likely average and are of little consequence. However, for the 2024 SHMP Update, a slightly different approach was used to calculate replacement values for structures. Building footprints derived from OpenStreetMap for each building in the CNMI were multiplied by replacement value per square foot provided in Hazus 6.0 for CNMI structures and the number of floors to calculate the replacement value for structures.

The analysis of Commonwealth buildings is categorized by municipality and by the agency that uses the structure. Total building counts and replacement cost values for each municipality are shown in Table 4.1-7 and the same information is shown by agency in Table 4.1-8. Individual hazard sections show the number and value of the buildings that may be impacted by the hazard.

Table 4.1-7. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by municipality.

Municipality	Total No. of Bldgs.	Building Replacement Costs	Contents Replacement Costs	Total Replacement Cost Value	% of Total RCV
Saipan	246	$457,936,891	$251,007,607	$708,944,498	73%
Tinian	83	$93,625,578	$46,721,891	$140,347,469	14%
Rota	58	$73,898,816	$49,133,860	$123,032,676	13%
Total	**387**	**$625,461,285**	**$346,863,358**	**$972,324,643**	

Table 4.1-8. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by agency.

Agency	Total No. of Bldgs.	% of Total Bldgs.	Building Replacement Cost	Contents Replacement Costs	Total Replacement Cost Value	% of Total RCV
Commonwealth Healthcare Corporation	14	4%	$133,102,318	$48,361,941	$181,464,259	19%
Commonwealth Legislature	1	0%	$3,494,990	$1,747,495	$5,242,485	1%
Commonwealth Utilities Corporation	63	16%	$72,585,268	$80,798,643	$153,383,911	16%
Council on Developmental Disabilities	1	0%	$346,423	$173,212	$519,635	0%
Dept. of Commerce	5	1%	$2,333,379	$1,088,589	$3,421,968	0%
Dept. of Community and Cultural Affairs	28	7%	$16,054,472	$7,960,962	$24,015,434	2%
Dept. of Finance	8	2%	$5,438,587	$2,476,473	$7,915,060	1%
Dept. of Fire and Emergency Services	14	4%	$6,105,756	$3,789,878	$9,895,634	1%
Dept. of Labor	8	2%	$4,233,123	$2,295,625	$6,528,748	1%
Dept. of Lands and Natural Resources	30	8%	$63,416,323	$32,400,338	$95,816,661	10%
Dept. of Public Lands	2	1%	$745,807	$372,903	$1,118,710	0%
Dept. of Public Safety	24	6%	$11,595,466	$13,528,738	$25,124,204	3%
Dept. of Public Works	11	3%	$36,527,954	$11,585,905	$48,113,859	5%
Judiciary	2	1%	$3,443,869	$1,721,935	$5,165,804	1%
Mariana Public Land Trust	1	0%	$987,468	$493,734	$1,481,202	0%
Marianas Visitors Authority	3	1%	$454,400	$77,464	$531,864	0%

Table 4.1-8. Commonwealth buildings and infrastructure and estimated replacement cost values (structure and contents) by agency (*cont'd*).

Agency	Total No. of Bldgs.	% of Total Bldgs.	Building Replacement Cost	Contents Replacement Costs	Total Replacement Cost Value	% of Total RCV
Mayor's Offices	17	4%	$14,249,183	$3,705,038	$17,954,221	2%
Northern Marianas College	1	0%	$2,840,000	$4,970,000	$7,810,000	1%
Office of the Attorney General	4	1%	$1,278,000	$1,164,400	$2,442,400	0%
Office of the Governor	15	4%	$12,484,100	$6,242,051	$18,726,151	2%
Office of Homeland Security & Emergency Management	10	3%	$6,948,067	$3,332,033	$10,280,100	1%
Office of the Public Auditor	3	1%	$1,376,355	$688,178	$2,064,533	0%
Ports Authority	44	11%	$69,688,936	$64,560,775	$134,249,711	14%
Private Entity	6	2%	$7,354,522	$3,677,262	$11,031,784	1%
Public Library	2	1%	$3,686,526	$1,843,262	$5,529,788	1%
Public School System	55	14%	$134,606,300	$43,899,827	$178,506,127	18%
Women's Association	1	0%	$987,468	$493,734	$1,481,202	0%
Other	14	4%	$9,096,225	$3,412,964	$12,509,189	1%
Total	**387**		**$625,461,285**	**$346,863,358**	**$972,324,643**	

Roads

The Department of Public Works is responsible for the primary road network throughout the Commonwealth. GIS information for the roads was obtained through OpenStreetMap, an open-source application. The economic impact of hazard events on road infrastructure has not been monetized, although exposure is identified and discussed.

Critical Facilities and Community Lifelines

A critical facility provides services and functions essential to a community, especially during and after a disaster. Examples of critical facilities include emergency operations centers, public shelters, disaster recovery centers, police stations, fire stations, hospitals, and health clinics.

In 2019, FEMA introduced community lifelines in the 4th edition of the National Response Framework. Lifelines are the most fundamental services in a community that support all other aspects of the community to function. The lifeline construct helps to increase the effectiveness of disaster operations, and initial response should focus on stabilizing community lifelines. When stable, lifelines enable all other aspects of society to function. Efforts to mitigate impacts to lifelines are critical to building resilience and improving response following disasters. For the 2024 SHMP Update, the critical facilities identified by the HMGP, and the Office of Homeland Security and Emergency Management (HSEM) were classified according to the eight lifeline categories and in the risk assessments for each hazard, vulnerable lifelines were identified, and losses estimated.

In the 2018 SSMP, agency staff identified critical facilities that were listed in the FAM; however, geospatial information for each facility was largely lacking from this dataset. For the 2024 SHMP Update, work with experts at each agency provided the necessary updates for the facilities listed in the FAM, identified new or missing facilities, and confirmed critical facilities. In addition, another list of critical facilities was provided by HSEM staff. The facilities provided by the HSEM were cross-checked and missing facilities were added to the FAM. Once the updated list of Commonwealth owned/operated facilities was completed, a new geospatial database was developed within Esri ArcGIS Pro.

For the 2024 SHMP Update, the vulnerability analysis of critical facilities buildings is categorized by community lifeline. Total critical facility counts and replacement cost values for each municipality are shown in Table 4.1-9. Individual hazard sections show the number and value of the facilities that may be impacted by the hazard.

Table 4.1-9. Commonwealth community lifelines and critical facilities and estimated replacement cost values by lifeline category.

Category	Total No. of CLF	% of Total No. CLF	Building Replacement Costs	Contents Replacement Costs	Total Replacement Cost Value	% of Total RCV
Communications	4	2%	$576,345	$288,172	$864,517	0%
Energy	46	19%	$63,727,619	$77,123,932	$140,851,551	23%
Food, Water, Shelter	24	10%	$22,811,048	$14,545,051	$37,356,099	6%
Hazardous Material	9	4%	$36,214,273	$11,876,888	$48,091,161	8%
Health and Medical	19	8%	$137,455,477	$50,188,335	$187,643,812	30%
Safety and Security	35	15%	$25,364,963	$13,274,629	$38,639,592	6%
Transportation	48	20%	$59,910,421	$60,015,246	$119,925,667	19%
Water Systems	52	22%	$33,882,617	$16,169,445	$50,052,062	8%
Total	**237**		**$379,942,763**	**$243,481,698**	**$623,424,461**	

General Building Stock and Infrastructure

General building stock data for the CNMI are not available via the US Army Corps of Engineers 2021 National Structure Inventory and information and buildings are not geospatially represented in Hazus. Therefore, for the 2024 SHMP Update, a new geodatabase was created by combining GIS data developed for the *CNMI Community Development Block Grant–Mitigation (CDGB-MIT) Program Initial Action Plan* (NMHC, 2023) and building data from OpenStreetMap, an open-source application. Information for the general building stock was enriched with information from FEMA Hazus 6.0 and GIS data obtained from the CDBG-MIT program.

Table 4.1-10. General building stock and estimated replacement cost values (structure and contents) by municipality.

Municipality	Total No. of Bldgs.	Building Replacement Costs	Contents Replacement Costs	Total Replacement Costs Value	% of Total RCV
Saipan	12,761	$4,119,562,188	$2,059,781,087	$6,179,343,275	89%
Tinian	908	$266,590,040	$133,295,018	$399,885,058	6%
Rota	1,261	$229,061,059	$114,800,500	$343,861,559	5%
Total	**14,930**	**$4,615,213,287**	**$2,307,876,605**	**$6,923,089,892**	

Population and Socially Vulnerable

Despite growing interest in promoting equity and environmental justice throughout the US, the CNMI and other US-Affiliated Pacific Islands are not included in the Center for Disease Control (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI) since the last update in December 2022. As such, relevant data points to determine SVI via this tool were not available.

The 2020 Island Areas Census of CNMI collected detailed demographic, social, economic, and housing characteristics using a long-form questionnaire. For CNMI, this equates to island-level data and the means to downscale these data to census tract or village geographies. On February 14, 2024, the US Census Bureau released 95 demographic, social, economic, and housing characteristics tables at the census tract level based on the 2020 Island Areas Censuses data. Although the data became available, analysis and summary of the information was not included in the 2024 SHMP Update due to the compressed project timeline. It is suggested that the population vulnerability assessments for the CNMI be updated in the next SHMP update in 2029.

Because the 2020 US Census Bureau data was not available at the census tract or village geography until February 2024, previously developed indices for social vulnerability to natural hazards were used for the 2024 SHMP Update. To assess vulnerable populations for the 2024 SHMP Update, social vulnerability index scores for a given census tract were assigned based on the approaches used in the *Climate Change Vulnerability Assessment for Saipan* (Greene & Skeele, 2014) for Saipan and the *CNMI Coastal Resilience Assessment* (Dobson et al., 2020a) for Tinian and Rota (Figure 4.1-12). According to Greene and Skeele (2014), 22 socio-economic variables were used to develop the social vulnerability index. The 22 variables and a brief explanation of each is provided in Appendix D (CNMI Profile and Risk Assessment Supplement). Greene and Skeele (2014) used GIS to analyze data from the 2010 US Census and the 2005–2009 American Community Surveys for villages on Saipan. Data values for each variable were grouped into five classes, using a natural break method, and reclassed in values from 0 (low vulnerability) to 5 (high vulnerability). The variables were weighted according to the relative contribution to vulnerability and overlaid to reflect cumulative vulnerability.

Residential-level datasets for population from the 2020 Census were not yet available at the time of the analysis for the 2024 SHMP Update. For this reason, 2020 Census population counts per census tract were used to evenly spread the population of a given tract across the total number of residential buildings (as classified by FEMA's Hazus Program) in that tract. The SVI values (which are also calculated at a tract level) generated by Green and Skeele (2014) and Dobson et al. (2020a) for a given tract were applied to each of the residential buildings. These SVU values were based on 2010 Census information.

Hazard risk to the population was estimated by overlaying the hazard areas to the processed census tracts. The number of residences by census within each hazard boundary was used to estimate the number of persons in each SVI category at risk for each hazard.

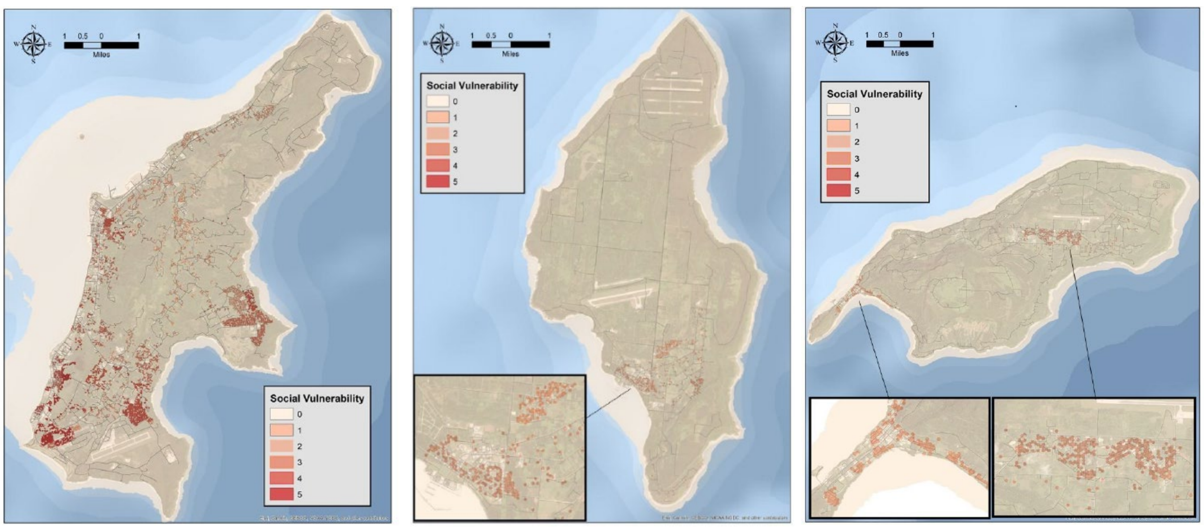


Figure 4.1-12. Mapped social vulnerability on Saipan (left) Tinian (center) and Rota (right).
Source: NMHC (2023).

Natural and Cultural Resources

The Commonwealth contains an abundant array of onshore and offshore environmental assets, including many species that are endemic to the CNMI. Recently, as part of the *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (Dobson et al., 2020a), terrestrial and marine indices that reflect habitat suitability models were developed. These terrestrial and marine indices allow for a greater understanding of important habitat and fish and wildlife resources in the CNMI. The CNMI assessment included only species of concern with federal-or state-level protected status and/or those species included in resources management plans. For a detailed description of how the indices were developed see the associated *Regional Coastal Resilience Assessment: Methodology and Data Report* (Dobson et al., 2020b).

According to Dobson et al. (2020a), the terrestrial index was created relative to the habitat preferences and needs of the species of greatest conservation concern in the region, which were identified using the *2015–2025 State Wildlife Action Plan for the Commonwealth of the Northern*

Mariana Islands (Liske-Clark, 2015) and species listed as threatened or endangered under the Endangered Species Act. Broad taxonomic groupings were used to model species' habitat preferences throughout the region including birds, reptiles, and terrestrial mammals. Several land cover datasets were used to identify habitats and International Important Bird Areas (IBAs) from BirdLife were also included. The index shows areas of relative concentrations of wildlife assets and is classed from 1 (low concentration of assets) to 5 (high concentration of assets).

A similar approach was used by Dobson et al., (2020a) to develop the marine index. The marine index aimed to identify areas capable of supporting significant biodiversity. Three important habitats were included: coral reefs, seagrass beds, and mangroves. A number of datasets were used to generate the marine index including benthic habitat maps, coral cover data, mangrove extent, presence of coral nurseries, and Marine Protected Areas. See Dobson et al., (2020a) for details. The index shows areas of relative concentrations of marine assets and is classed from 1 (low concentration of assets) to 5 (high concentration of assets).

To assess exposure and vulnerability to natural hazards, the terrestrial and marine indices were overlaid with hazards in GIS to determine the area of terrestrial and marine assets within the hazard area. The proportion of terrestrial and marine index classes within the hazard region is reported. Refer to Chapter 2.0 (CNMI Planning Area Profile) for a more detailed description of the terrestrial and marine assets in the Commonwealth.

Cultural resource asset information in the Commonwealth is managed by the CNMI Historic Preservation Office within the Department of Community and Cultural Affairs (DCCA). The location of cultural resources was obtained from the CNMI Data Portal and verified by the Historic Preservation Office as the most current information. Cultural resource assets include archaeological sites, burial sensitivity areas, historic buildings and structures, historic districts, and objects. Coordination with Historic Preservation Office personnel clarified historic properties listed on the National Register of Historic Places and National Historic Landmarks. Sensitive locational information for archaeological sites and other historic properties is omitted from this report because it is protected under Section 304 of the National Historic Preservation Act and Section 9 of the Archaeological Resources Protection Act and is excluded from public disclosure under the Freedom of Information Act. To the extent possible, the spatial hazard layers were overlaid with cultural resource asset area polygon data in GIS to determine the area of land located in the impact area of the hazard. Refer to Chapter 2.0 (CNMI Planning Area Profile) for a more detailed description of cultural resources assets in the Commonwealth.

4.1.8 Recent and Projected Development in Hazard-Prone Areas

In addition to summarizing the current vulnerability, additional factors can affect CNMI's vulnerability to hazards: 1) changes in population; 2) changes in development, and 3) other identified conditions as relevant and appropriate, including the impacts of climate change. Identifying these changes and integrating them into the risk assessment ensures they are considered when developing the mitigation strategy to reduce these vulnerabilities in the future.

As summarized in Chapter 2.0 (CNMI Planning Area Profile), the CNMI has experienced changes in development over the performance period of the 2018 SSMP; and new development, population demographic changes, and increases in visitors/tourists are anticipated in the future. There is no Commonwealth-wide system that tracks where this development has occurred or is anticipated to occur. Therefore, it proves challenging to conduct a Commonwealth-wide assessment to determine whether development has occurred in hazard prone areas.

The number of Commonwealth owned/operated buildings and infrastructure increased from the 2018 SSMP assessment, but this was largely due to the identification of buildings and facilities that were not included in the 2018 SSMP, not to new development. Replacement cost values were brought forward from the previous estimates to 2024 values. In addition, the general building stock was analyzed for the first time in the 2024 SHMP Update. A structure-level general building stock dataset allows for more consistent comparisons of structures at risk to hazards and to estimate the replacement cost value of at-risk structures.

The pace of development has slowed in the Commonwealth since 2019 and has shifted towards more government projects and fewer commercial projects. Information for Commonwealth owned/operated buildings and general building stock was updated in 2024 although some of the enriched metadata sourced from Hazus is current through 2022 (Hazus 6.0). Therefore, any buildings considered general building stock that were constructed following 2024 or any projects under construction are not included in the general building stock risk assessment results. Damages and losses because of hazard events are generally associated with older existing infrastructure and buildings rather than new development. This is because building codes and land use regulations, described in Chapter 5.0 (Mitigation Capabilities), limit development in hazard areas or require construction to meet higher building standards within those hazard areas, which serves to reduce risks in areas where new development or redevelopment is occurring.

In an attempt to understand if projected new development may be impacted by hazards, when possible, an exposure analysis was conducted using land use designations from the Department of Public Lands. The spatial hazard layers were overlaid with land use that is likely to support future development to determine the area of land located within an area likely to be affected by a hazard. These results are reported at the end of each hazard in Sections 4.2–4.10. A qualitative discussion regarding other factors of change is also included, as appropriate.

4.1.9 Overview of Risk Assessment Methods

To assess vulnerability, three different levels of analysis were used depending upon the data available for each hazard and for each asset as described below. Table 4.1-11 summarizes the types of analyses performed for each hazard followed by a discussion of each approach.

- **Historic Occurrences and Qualitative Analysis.** This analysis includes an examination of historic impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using a best-available data and professional judgment approach.

- **Exposure Assessment.** This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets may be affected by the hazard. If the center of each asset is located in the hazard area, it is deemed exposed and potentially vulnerable to the hazard. A centroid is used when there are multiple structures for an asset.
- **Loss estimation.** Loss estimations are derived differently for each hazard. For hazards such as wildfire and coastal erosion, when an asset is within the hazard impact area, full loss of the building and content is assumed. For some hazards such as earthquakes, floods, tropical cyclone, and tsunami, percent damage ratios for buildings and their contents were applied to assets within the hazard impact areas. For other hazards such as drought, heatwave, health risks, and volcanic activity loss estimates were qualitatively assessed.

Table 4.1-11. Risk Assessment methods used to evaluate vulnerabilities for each hazard and asset class.

	Assets Analyzed						
Hazard	CNMI Buildings	Roads	Community Lifelines	General Building Stock	Vulnerable Population	Natural Resources	Cultural Resources
Drought	Q	Q	Q	Q	Q	Q	Q
Earthquake	Q	Q	Q	Q	Q	Q	Q
Flood: Event-based	E	E	E	E	E	E	E
Flood: Chronic Coastal	E	E	E	E	E	E	E
Flood: Coastal Erosion	Q	Q	Q	Q	Q	Q	Q
Flood: SLR Event-based	E	E	E	E	E	E	E
Flood: SLR Chronic Coastal	E	E	E	E	E	E	E
Health Risks	Q	Q	Q	Q	Q	Q	Q
Heatwave	Q	Q	Q	Q	Q	Q	Q

Table 4.1-11. Risk Assessment methods used to evaluate vulnerabilities for each hazard and asset class (*cont'd*).

	Assets Analyzed						
Hazard	**CNMI Buildings**	**Roads**	**Community Lifelines**	**General Building Stock**	**Vulnerable Population**	**Natural Resources**	**Cultural Resources**
Tropical Cyclone: Wind	Q	Q	Q	Q	Q	Q	Q
Tropical Cyclone: Flood	E	E	E	E	E	E	E
Tsunami	E	E	E	E	E	E	E
Volcanic Activity	E/Q	Q	E/Q	Q	Q	Q	Q
Wildfire	E	E	E	E	E	E	E

E= Exposure Analysis; Q= Qualitative Analysis

Commonwealth hazard subject matter experts were consulted to obtain the best-available data and methodologies to assess the risks (refer to Chapter 3.0 [Planning Process] and Appendix A [Planning Process Documentation]). The following summarizes the data and analysis conducted to evaluate each hazard of concern. Sections 4.2–4.11 summarize the vulnerability assessment results. Appendix B (Map Atlas) includes additional maps gathered or generated to support the risk assessment.

Typhoon

The tropical cyclone hazard was evaluated for Category 5 typhoon conditions. To estimate the flood hazard associated with a tropical cyclone, the National Flood Hazard Layer Digital Flood Insurance Rate Map (DFIRM) data (effective April 2006) for V-zones were used to assess exposure from the 1% annual-chance flood event. An exposure analysis was conducted to assess the vulnerability of Commonwealth owned and operated buildings, primary roads, community lifelines, and the general building stock. The 2018 SSMP assumed a 70% damage ratio to vulnerable buildings and their contents within the V-zone. This damage ratio was derived from the V-zone Flood Contents Loss Estimate Table provided in the FEMA Benefit-Cost Analysis Coastal V-zone Module (1999) and was adopted for the 2024 SHMP Update. Refer to Section 4.2 (Typhoon) for more information about typhoon hazard.

Category 5 typhoon conditions were used to determine displaced households and shelter needs. Data from the CNMI 2023 Threats and Hazard Identification Assessment (THIRA) (HSEM, 2024) for Super Typhoon *Yutu* was used to estimate the number of people needing to evacuate and requiring shelters.

Tsunami

The recently developed GIS layer for tsunami evacuation zone (maximum inundation) for Rota, Saipan, and Tinian was provided through the CNMI Tsunami Hazard and Evacuation Application website. To assess exposure and vulnerability of Commonwealth assets on these islands to tsunami hazard, an exposure analysis was completed. The tsunami risk to the Northern Islands has not been quantitatively assessed therefore the risk to these communities is assessed qualitatively. Refer to Section 4.3 (Tsunami) for more information about tsunami hazard.

Drought

Because rainfall patterns are generally similar throughout the Commonwealth (Grecni et al., 2021), it was assumed patterns of drought would affect the islands similarly. No data exists to model areas within the islands that are more exposed to drought conditions. Therefore, drought impacts were assessed on an island-wide scale.

To characterize the recent drought history, tabular data for Saipan and Rota were extracted from the Outside the Continental US (OCONUS) Drought Status webpage within the US Drought Monitor website (National Drought Mitigation Center, 2024) and data were charted to display the number of days classified as drought.

To assess the vulnerability of the Commonwealth to drought and its associated impacts, a qualitative assessment was conducted. Refer to Section 4.4 (Drought) for more information about the drought hazard.

Drought is expected to intensify in the CNMI as the climate continues to change. A qualitative analysis was conducted to evaluate additional future vulnerabilities due to climate change and other conditions.

Flood

Because flood risks for the Commonwealth cannot be evaluated via Hazus, the 2024 SHMP Update continues to use previous methods to evaluate vulnerability and loss estimates for all types of flood risks evaluated below as well as flood risks related to tropical cyclones and tsunami. In previous SSMPs, the FEMA Benefit-Cost Analysis Full Data Module (1999) was used to evaluate potential damage to buildings and infrastructure. Specifically, facilities situated within the coastal plain or located within a flood zone were assumed to have a 43% building damage estimate and 65% damage estimate for contents. Refer to Section 4.5 (Flood) for more information about the flood hazard.

<u>Event-based</u>

FEMA defines a Special Flood Hazard Area (SFHA) as the area that will be inundated by a flood event having a 1% change of being equaled or exceeded in any given year (i.e., the 100-year flood). These areas are labeled as A-zones and V-zones in the FIRM. The Commonwealth has adopted the FEMA designated SFHA for the CNMI. To assess exposure of Commonwealth and general assets to a 1% annual-chance flood event, the National Flood Hazard Layer Digital Flood Insurance Rate Map (DFIRM) data (effective April 2006) for A-zones and V-zones were used for Rota, Saipan, and Tinian.

FEMA has not developed Flood Insurance Rate (FIRM) maps for the Northern Islands. A qualitative approach was used to assess vulnerability to event-based flooding in the Northern Islands.

The spatial extent of event-based flooding is expected to increase in the future due to climate change, specifically due to projected SLR. The US Fifth National Climate Assessment (USGCRP, 2023) provides several scenarios for SLR in the Western Pacific by 2100. For the 2024 SHMP Update, intermediate emission scenario with 3 ft of SLR for the Western Pacific was selected. Using the 2100 projection for the Western Pacific, SLR data for the CNMI was downloaded from NOAA's Digital Coast; however, this data does not incorporate storm surge. To account for storm surge, data for wave driven flooding developed by Storlazzi et al. (2019) was used by overlaying the polygons in the GIS and dissolving the boundaries into a single polygon. The resultant polygon was used to conduct an exposure analysis for current Commonwealth assets, projected changes in development and land use, and changes in population. Refer to Section 4.5 (Flood) for more information about event-based flooding.

Chronic Coastal Flooding

Spatial data from the NOAA's Digital Coast for high-tide flood was used to conduct an exposure analysis for passive flooding only. The spatial extent of chronic coastal flooding is expected to increase as sea level continues to rise due to changing climate conditions. Using the 2100 projection for SLR of 3 ft for the Western Pacific, SLR data for the CNMI was downloaded from NOAA's Digital Coast. Refer to Section 4.5 (Flood) for more information about chronic coastal flooding.

Coastal Erosion

Coastal erosion hazards for Saipan were recently mapped in GIS in the *CNMI CDBG-MIT Program Initial Action Plan* (NMHC, 2022). This data layer was used to conduct an exposure analysis for Saipan. Assets within zones for high potential erosion were considered impacted and loss estimates were qualitatively assessed.

For Rota and Tinian, the erodible soils GIS layer developed by the National Fish and Wildlife Foundation and available on the CREST website (*Coastal Resilience Evaluation and Siting Tool (CREST)*, n.d.), was clipped to a 45 m buffer from the shoreline similar to the process develop for the coastal erosion hazard GIS layer for Saipan. An exposure analysis was conducted using the clipped erodible soil layer and assets within the highest class of probable erosion were considered vulnerable. Loss estimates for these assets were qualitatively assessed.

Although coastal erosion is expected to increase in correlation to SLR, increased storm intensity, and increased flooding, there were no readily available models to project future coastal erosion. A qualitative analysis was conducted to describe coastal erosion hazards on future development and changes in population.

Health Risks

The health risks hazard is limited to the discussion and analysis of the COVID-19 pandemic. A qualitative assessment was conducted for the health risks hazard in Section 4.6 (Health Risks). Risks to human health that occur as a result of natural hazard events are discussed throughout Sections 4.2 through 4.10.

Extreme Heat and Heatwave

The number of hot days (< 90°F) are increasing in Commonwealth. To assess the vulnerability of the CNMI to extreme heat and heatwave and its associated impacts, a qualitative assessment was conducted. Refer to Section 4.7 (Extreme Heat and Heatwaves) for more information about the extreme heat and heatwave hazard.

Wildfire

FMAG1-c. Does the risk assessment address the vulnerability of state assets located in wildfire hazard areas and estimate the potential dollar losses to those assets?

A new wildfire map was recently developed for the Commonwealth (Bubb & Williams, 2022). Environmental variables of landcover, elevation, slope, aspect, temperature, and population were used as predictor variables for presence or absence of fire. Gridded map data for these predictors was then compared with the historic fire boundaries to train and validate the wildfire probability model. The results of this work generated a spatial dataset with probability of occurrence values ranging from 0%–100%. For the vulnerability analysis, four classes for the probability of occurrence were defined: 0–24%, 25–49%, 50–74% and < 75%.

An exposure analysis was conducted generating results for the probability of occurrence classes. For the purposes of the 2024 SHMP Update risk assessment, all physical assets in the 75% or greater probability of occurrence class were considered fully lost similar to the analysis for the *CNMI CDBG-MIT Program Initial Action Plan* (NMHC, 2022). Refer to Section 4.8 (Wildfire) for more information about the wildfire hazard.

Earthquake

The earthquake hazard for the Commonwealth was characterized using US Geological Survey data (Muller et al., 2012). Due to the scale of the available data, the earthquake risk was assumed similar for Rota, Saipan, and Tinian. Risk based on soil type and vulnerability to earthquakes was not available to refine exposure analyses within each island geography; therefore, all assets were assumed exposed to the same level of risk. In the 2018 SSMP, building damage ratio was averaged from tables generated from Hazus calculations that derived estimate percentages based on a relationship between building types to peak ground velocity (PGA) values. For the 2024 SHMP Update, an estimated 0.398 PGA value was used to estimate earthquake intensity and the corresponding building damage ratio of 24% was applied to the assets to calculate loss values.

A qualitative analysis was conducted to evaluate earthquake risks to future development and projected changes in population. Climate change is not expected to influence future risks of earthquakes. Refer to Section 4.9 (Earthquake) for more information about the earthquake hazard.

Volcanic Activity

The volcanic activity hazard is limited to the discussion and analysis of the Northern Islands and ash, lava flow, and vog hazards. To assess the vulnerability of the Commonwealth to volcanic activity and its associated impacts, a qualitative assessment was conducted. Refer to Section 4.10 (Volcanic Activity) for more information about the volcanic activity hazard.

4.1.10 Geographic information system data sources used for risk assessment analyses.

Table 4.1-12 summarized the GIS data used for the risk assessment analyses.

Table 4.1-12. Geographic information system data sources used for risk assessment analyses.

Name of Data	Source	Year of Data Update
Commonwealth Owned/Operated Buildings	2018 Facilities Assessment Matrix (FAM), On-site Data Acquisition, Agency Staff Input	2024
Commonwealth Roads	OpenStreetMap	2024
Critical Facilities and Lifelines	2018 FAM, Emergency Management Office	2024
Commonwealth General Building Stock	OpenStreetMap, Hazus 6.0	2024
Socially Vulnerable Populations	General Building Stock with Social Vulnerability Index (SVI) smoothed	SVI 2014 Updated with 2024 General Building Stock
Terrestrial Wildlife Index	National Fish and Wildlife Fund	2022
Marine Index	National Fish and Wildlife Fund	2022
Historic Office Preservation	CNMI BECQ Open Data Portal	2023
Watersheds	CNMI CRMO	2023

Table 4.1-12. Geographic information system data sources used for risk assessment analyses (*cont'd*).

Name of Data	Source	Year of Data Update
Northern Mariana Decent Homesteads	Department of Public Lands	2019
DPL–layers for future development	Department of Public Lands	2019
1% Annual Chance Flood Event	FEMA	2006
Chronic Coastal (High Tide) Flood Event	NOAA Digital Coast	2021
Sea Level Rise for 3 ft	NOAA Digital Coast	2023
Storm-driven Wave Flood-Saipan/Tinian only	Storlazzi et al.	2019
Prime Agricultural Lands	USDA NRCS SSURGO	2022
Coastal Erosion-Saipan	Northern Mariana Housing Corporation	2022
Erodible Soils	NFWF RCRA	2020
Special Wind Maps	FEMA SWR	2020
Tsunami Inundation and Evacuation Zones	HSEM/PCRP	2023
Wildland Fire	CNMI CRMO	2020
Census tracts	US Census Bureau	2010

4.1.11 Limitations

The spatial hazard data used in the 2024 SHMP Update was generated by multiple agencies and organizations. Due to differing processes of data generation between these entities, spatial layer boundaries may not accurately align with the coastline. For example, there are documented issues with the alignment of the 2006 FIRM layers and the CNMI coastline[1]. In addition, information regarding both hazards and assets for the Commonwealth is often not available or is not integrated into national database, models, and tools to help assess risks and vulnerabilities within a consistent framework.

Worst-case scenarios used are for planning purposes only and may not represent the actual worst-case the islands may experience. Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best-available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Caution is urged when interpreting these results as each hazard event is unique, and climate change projections may change over time as technology and science advances.

[1]https://opd.gov.mp/library/reports/region-9-cnmi-discovery-report-risk-map-january-2021/region-9-cnmi-discovery-report-risk-map-january-2021.pdf.

Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard event
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long-term, the Commonwealth will continue to collect additional data, and update and refine existing inventories, to assist in estimating potential losses.

Potential economic loss is based on the present value of the Commonwealth buildings and general building stock utilizing the best available data. Significant impacts may occur to critical facilities and infrastructure (such as roads, airports, harbors, utilities) as a result of these hazard events causing great economic loss not only to one island but potentially cascading impacts throughout the Commonwealth. However, monetized damage estimates to critical facilities and infrastructure and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industries such as tourism and the real estate market were not analyzed.

Limitations notwithstanding, the value of an SHMP is to establish a framework to guide and motivate government and public actions towards hazards mitigation.

References

[Australian BOM & CISRO] Australian Bureau of Meteorology Commonwealth Scientific and Industrial Research Organisation. (2014). *Climate variability extremes and change in the western tropical Pacific: New science and updated country reports.* (Technical Report 358; p. 358). Climate Change Science and Adaptation Planning Program.

Bubb, I. E., & Williams, Z. B. (2022). Spatial and Temporal Patterns of Fire on Saipan, CNMI. *Pacific Science*, *76*(1). https://doi.org/10.2984/76.1.1

Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland.* (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

[HSEM] CNMI Homeland Security and Emergency Management. (2024). *2023 CNMI THIRA Pre-Submission* (p. 46). CNMI Homeland Security and Emergency Management.

Coastal Resilience Evaluation and Siting Tool (CREST). (n.d.). Retrieved July 2, 2024, from https://resilientcoasts.org/#AnalyzeProjectSites

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020a). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020b). *Regional Coastal Resilience Assessments: Methodology and Data Report* (p. 74). UNC Ashville National Environmental Center.

[FEMA] Federal Emergency Management Agency. (2022a). *State Mitigation Planning Key Topics Bulletin: Risk Assessment* (p. 26). US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2022b). *State Mitigation Planning Policy Guide* (FP 302-094-2; p. 115). US Department of Homeland Security.

Fletcher, C. H., & Richmond, B. M. (2010). *Climate change in the Federated State of Micronesia: Food and water security, climate risk management, and adaptive strategies, report of findings 2010* (p. 32). Center of Island Climate Adaptation and Policy, University of Hawaiʻi Sea Grant College Program.

Gingerich, S. B., Adams, A. G., Rosa, S. N., Marineau, M. D., Wright, S. A., Hay, L. E., Widlanski, M. J., Jenson, J. W., Wong, C. I., Banner, J. L., Keener, V. W., & Finucane, M. L. (2019). *Water Resources on Guam-Potential Impacts of and Adaptive Response to Climate Change* (Scientific Investigations Report 2019–5095; Scientific Investigations Report). US Geological Survey.

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

Greene, R. (2017). *BECQ 2017 SLR map layer updates: Methodology for coastal flooding geoprocessing*.

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Jay, A. K., Crimmins, A. R., Avery, C. W., Dahl, T. A., Dodder, R. S., Hamlington, B. D., Lustig, A., Marvel, K., Méndez-Lazaro, P. A., Osler, M. S., Terando, A., Weeks, E. S., Zycherman, A., Crimmins, A. R., Avery, C. W., Easterling, D. R., Kunkel, K. E., Stewart, B. C., & Maycock, T. K. (2023). *Overview. Fifth National Climate Assessment*. US Global Change Research Program. https://doi.org/10.7930/NCA5.2023.CH1

Keener, V. W., Hamilton, K., Izuka, S. K., Kunkel, K. E., Stevens, L. E., & Sun, L. (2013). *Regional climate trends and scenarios for the US National Climate Assessment: Part 8. Climate of the Pacific Islands.* (NESDIS 142-8; p. 52). National Oceanic and Atmospheric Administration.

Kopp, R. E., Horton, R. M., Little, C. M., Mitrovica, J. X., Oppenheimer, M., Rasmussen, D. J., Strauss, B. H., & Tebaldi, C. (2014). Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. *Earth's Future*, *2*(8), 383–406. https://doi.org/10.1002/2014EF000239

Kossin, J. P., Emanuel, K. A., & Camargo, S. J. (2016). Past and Projected Changes in Western North Pacific Tropical Cyclone Exposure. *Journal of Climate*, *29*(16), 5725–5739. https://doi.org/10.1175/JCLI-D-16-0076.1

Kossin, J. P., Knapp, K. R., Olander, T. L., & Velden, C. S. (2020). Global increase in major tropical cyclone exceedance probability over the past four decades. *Proceedings of the National Academy of Sciences*, *117*(22), 11975–11980. https://doi.org/10.1073/pnas.1920849117

Lander, M. A. (2004). *Rainfall climatology for Saipan: Distribution, return-periods, El Nino, tropical cyclones, and long-term variations* (Technical Report 103; p. 60). Water and Environmental Research Institute of the Western Pacific, University of Guam.

Lander, M. A., & Guard, C. P. (2003). *Creation of a 50-Year Rainfall Database, Annual Rainfall Climatology, and Annual Rainfall Distribution Map for Guam* (Technical Report No. 102). University of Guam.

Lin, I.-I., & Chan, J. C. L. (2015). Recent decrease in typhoon destructive potential and global warming implications. *Nature Communications*, *6*(1), 7182. https://doi.org/10.1038/ncomms8182

Lindsey, R., & Dahlman, L. (2023). *Climate Change: Ocean Heat Content | NOAA Climate.gov*. http://www.climate.gov/news-features/understanding-climate/climate-change-ocean-heat-content

Liske-Clark, J. (2015). *Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands 2015-2025* (p. 292). CNMI, Division of Fish and Wildlife.

Marra, J. J., & Kruk, M. C. (2017). *State of Environmental Conditions in Hawaii and the US Affiliated Pacific Islands under a Changing Climate: 2017* (p. 93). NOAA NSDIS National Centers for Environmental Information (NCEI). https://coralreefwatch.noaa.gov/satellite/publications/state_of_the_environment_2017_hawaii-usapi_noaa-nesdis-ncei_oct2017.pdf

Marra, J. J., Merrifield, M. A., & Sweet, W. V. (2012). Sea Level and Coastal Inundation on Pacific Islands. In V. W. Keener, J. J. Marra, M. L. Finucane, & D. Spooner (Eds.), *Climate Change and Pacific Islands: Indicators and Impacts*. Pacific Islands Regional Climate Assessment Center, DC: Island Press.

Maynard, J., McKagan, S., & Johnson, S. (2018). *Assessing resistance and recovery in CNMI during and following a bleaching event to identify and prioritize resilience drivers and action options.* (Final Progress Report for NOAA CRCP Grant N. NA17NOS4820088; p. 32). National Oceanic and Atmospheric Administration, Coral Reef Conservation Program. https://reefresilience.org/wp-content/uploads/CNMI_Saipan_2018_Demonstrated_Resilience_Final_Report.pdf

McGlasson, J. M. (2023). *Regional Fact Sheet Small Islands* (p. 2).

Mimura, M., Nurse, L., McLean, R., Agard, J., Briguglio, L., Lefale, P., Payet, R., & Sem, G. (2007). Small Islands. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Liden, & C. E. Hensen (Eds.), *Climate Change 2007: Impacts, Adaptations and Vulnerability* (pp. 678–716).

Mimura, N. (1999). Vulnerability of island countries in the South Pacific to sea level rise and climate change. *Climate Research*, *12*(2/3), 137–143. JSTOR.

Muller, C. S., Haller, K. M., Luco, N., Peterson, M. D., & Frankel, A. D. (2012). *Seismic Hazard Assessment for Guam and the Northern Mariana Islands* (Open-File Report, p. 56) [Open-File Report]. US Department of the Interior, US Geological Survey.

Mycoo, M., Wairiu, M., Campbell, D., Duvat, D., Golbuu, Y., Maharaj, S., Nalau, J., Nunn, P., Pinnegar, J., & Warrick, O. (2022). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

National Drought Mitigation Center. (2024). *OCONUS Drought Status*. US Drought Monitor. https://droughtmonitor.unl.edu/DmData/OCONUSDroughtStatus.aspx

[NOAA] National Oceanic and Atmospheric Administration. (2023). *Past Weather | National Centers for Environmental Information (NCEI)* [Digital Archive]. https://www.ncei.noaa.gov/access/past-weather/Saipan

[NMHC] Northern Marianas Housing Corporation. (2022). *Commonwealth of the Northern Mariana Islands Community Development Block Grant Mitigation (CDBG-MIT) Program Initial Action Plan* (p. 152). Northern Marianas Housing Corporation.

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

Pacific ENSO Applications Climate Center. (n.d.). *El Niño Impacts on Guam and the Commonwealth of the Northern Marianas Islands*. Pacific ENSO Applications Climate Center.

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

Sweet, W. V., Hamlington, B., Kopp, R. E., Weaver, C. P., Barnard, P. L., Bekaert, D., Brooks, W., Craghan, M., Dusek, G., Frederikse, T., Garner, G., Genz, A. S., Krasting, J. P., Larour, E., Marcy, D., Marra, J. J., Obeysekera, J., Osler, M., Pendleton, M., … Zuzak, C. (2022). *2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along US Coastlines* (NOAA Technical Report NOS 01; p. 111). National Oceanic and Atmospheric Administration, National Oceanic Service.

Sweet, W. V., Horton, R., Kopp, R. E., LeGrande, A. N., & Romanou, A. (2017). *2017: Sea level rise. In Climate Science Specials Report: Fourth National Climate Assessment, Volume I*. US Global Change Research Program.

The Nature Conservancy. (2019). *Commonwealth of the Northern Mariana Islands Coral Reef Management Priorities* (NA16NOS4820106; p. 28). National Oceanic and Atmospheric Administration, Coral Reef Conservation Program. https://dcrm.gov.mp/wp-content/uploads/crm/2019-Coral_Reef_Management_Priorities-Booklet-WEB.pdf

US Army Corps of Engineers. (2022). *The Commonwealth of the Northern Mariana Islands Final Post Disaster Watershed Plan* (p. 166). US Army Corps of Engineers, Honolulu District.

[USGCRP] US Global Change Research Program. (2023). *Fifth National Climate Assessment*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023

Widlansky, M. J., Annamalai, H., Gingerich, S. B., Storlazzi, C. D., Marra, J. J., Hodges, K. I., Choy, B., & Kitoh, A. (2019). Tropical Cyclone Projections: Changing Climate Threats for Pacific Island Defense Installations. *Weather, Climate, and Society*, *11*(1), 3–15. https://doi.org/10.1175/WCAS-D-17-0112.1

Zhang, C., Wang, Y., Hamilton, K., & Lauer, A. (2016). Dynamical Downscaling of the Climate for the Hawaiian Islands. Part I: Present Day. *Journal of Climate*, *29*(8), 3027–3048. https://doi.org/10.1175/JCLI-D-15-0432.1

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.2 Typhoon

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.2 Typhoon

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
High Wind	Likely	Extensive	Catastrophic	High
Storm Surge	Likely	Limited	Critical	High

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, the hazard profile was updated with recent typhoon activity including Typhoon *Mangkhut*, Super Typhoon *Yutu,* and Super Typhoon *Mawar* profile is now expanded to include flooding caused by typhoon for coastal and inland areas.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- New and updated figures and information from federal agencies were incorporated.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to typhoon is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.
- A mitigation success achieved since 2018 was included to demonstrate continuous progress toward lowering the vulnerability of the Commonwealth to typhoons.

4.2.1 Hazard Profile

Description

Two principal types of storms influence the climatic character of the Commonwealth: small-scale storms that consist of thunderstorms and squalls, and large systems of tropical cyclones that can dominate an area over 300,000 square miles and persist for over a week's time. The months of August to mid-December are characterized as the seasonal period for tropical disturbances for the Western Pacific. However, tropical storms and typhoons are known to have occurred every month.

A tropical disturbance is a loosely organized area of low pressure with thunderstorms that maintains its identity for 24 hours or more and originates over ocean waters. A tropical disturbance can evolve into a tropical cyclone of various intensities including:

- **Tropical depression**: A tropical is an organized system of clouds and thunderstorms with defined circulation and maximum sustained winds of 38 miles per hour (mph) that may include localized rain and thunderstorms.
- **Tropical storms**: A tropical storm has defined circulation and maximum sustained winds of 39–73 mph and usually is accompanied by heavy rains and thunderstorms.
- **Typhoon**: A typhoon is a severe tropical cyclone that attains a minimum sustained wind speed of > 74 mph.

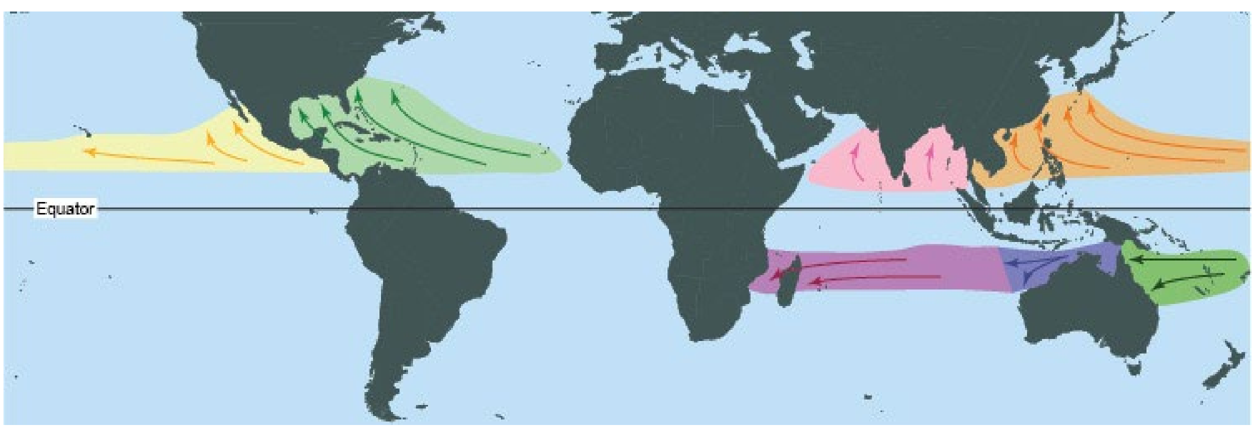


Figure 4.2-1. Global tropical cyclone formation basins.
Source: National Oceanic and Atmospheric Administration (NOAA) (*Tropical Cyclone Classification* | *National Oceanic and Atmospheric Administration*, 2023).

Typhoons are characterized as giant whirlwinds in which air moves around a center of low pressure, reaching maximum velocity in a circular band extending outward 20 or 30 miles from the rim of the eye (center). Typhoons are categorized by their wind speed using the Saffir-Simpson Hurricane Wind Scale. This scale is from 1-5 with 1 being the lowest intensity storm and 5 being the highest. The National Weather Service (2021) defines typhoon categories as:

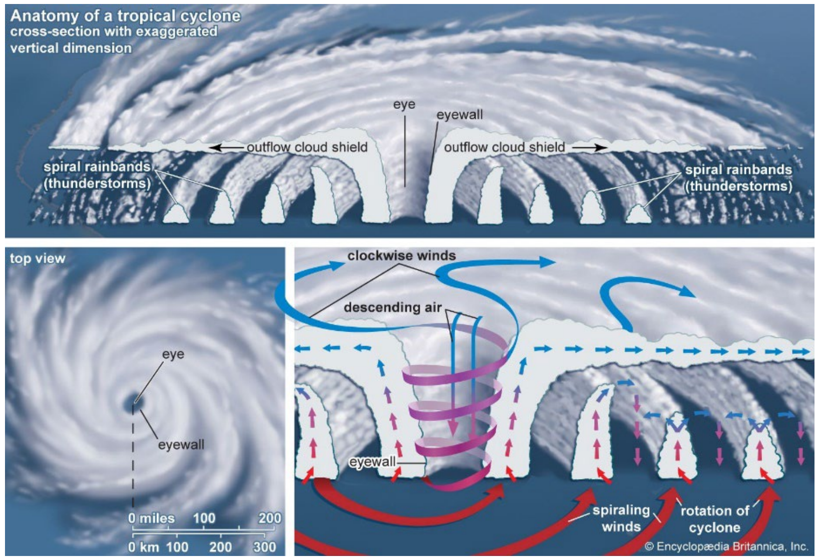
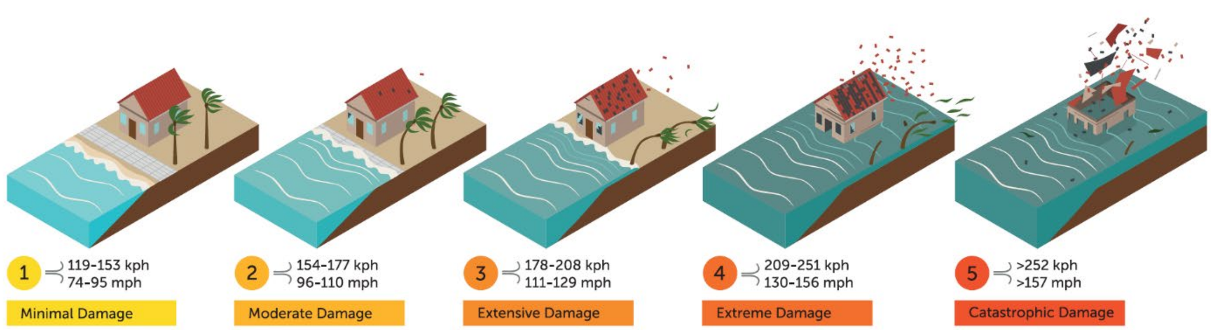


Figure 4.2-2. Anatomy of a tropical cyclone.
Source: Encyclopedia Britanica
(https://www.britannica.com/science/tropical-cyclone)

- **Category 1**: Sustained winds 74–95 mph. Very dangerous winds will produce some damage.
- **Category 2**: Sustained winds 96–110 mph. Extremely dangerous winds will cause moderate damage.
- **Category 3**: Sustained winds 111–129 mph. Extensive will occur.
- **Category 4**: Sustained winds 130–156 mph. Extreme damage will occur.
- **Category 5**: Sustained winds < 157 mph. Catastrophic damage will occur.



Source: Shutter Stock.

Factors Contributing to Damage

During a typhoon, high winds, marine over-wash, storm surge, and small-scale wind bursts may damage or destroy homes, businesses, public buildings, and infrastructure. Termed *microbursts* and *mini-swirls*, these localized winds may reach wind speeds more than 200 miles per hour. In addition to severe winds, typhoons have several other characteristics. During a typhoon, barometric pressure is very low, for example, usually 29 inches of mercury or less. Typhoon winds are directly related to the lowest barometric pressure reading at the center of the storm. Typhoon winds are strongest near the Radius of Maximum Winds, the area within the storm path near the lowest central pressure. The general concept is that the larger the radius, the larger the area of maximum destruction. The strongest winds are usually on the right side of the eye, as one faces the direction the storm is moving. Wind speeds decrease as the distance away from the radius of maximum wind increases. Table 4.2-1 details the impact elements of a typhoon.

Table 4.2-1. Impact elements of a typhoon.

Element	Characteristics
Hazard	• Wind • Rain • Waves • Flooding • Storm surge
Exacerbation	• Local tides • Local coastal configuration
Results	• Wind damage from typhoon and spawned micro-bursts and mini-swirls • Storm surge and wave damage • Coastal stream/wetland flooding • Mudslides/landslides in low-lying areas
Losses	• Structures & contents, including lifeline structures and equipment, such as roads, bridges, and roadway culverts • Lives and injuries • Communications • Beach erosion • Fire • Shipping and fishing • Soil fertility from saline intrusion • Vegetation • Crops • Livestock • Pollution • Infrastructure (e.g., water, electricity, sewer) failure

Strong Winds

Pressure differentials caused by typhoon winds create vacuums within buildings, commonly causing breakage of window glass or failures of overhead doors. The internal pressures add to the external pressures producing more severe pressures on the building components of the structure. The roof is then subjected to tremendous internal pressure building from inside, together with the negative wind pressures lifting the roof from outside. The resulting combined forces may be too intense, even for well-structured roof systems. Subsequent damage from high winds and rain to the interior and contents can result after a roof is torn away from a structure. Damage can also occur from small-scale wind bursts.

Topography can affect localized wind intensities during typhoons. To account for these localized effects, in 2021 The Federal Emergency Management Agency (FEMA) produced Special Wind Region (SWR) maps for the Commonwealth to assist with applying the International Building Code (IBC) that was adopted through Public Law No. 21014 in 2019 (FEMA, 2020).

Based on FEMA's SWR data, the Northern Mariana Housing Corporation had maps of extreme wind zones produced four Saipan, Tinian, and Rota (NMHC, 2023). Figure 4.2-3 shows the expected extreme winds for a 100-year return interval for each island.

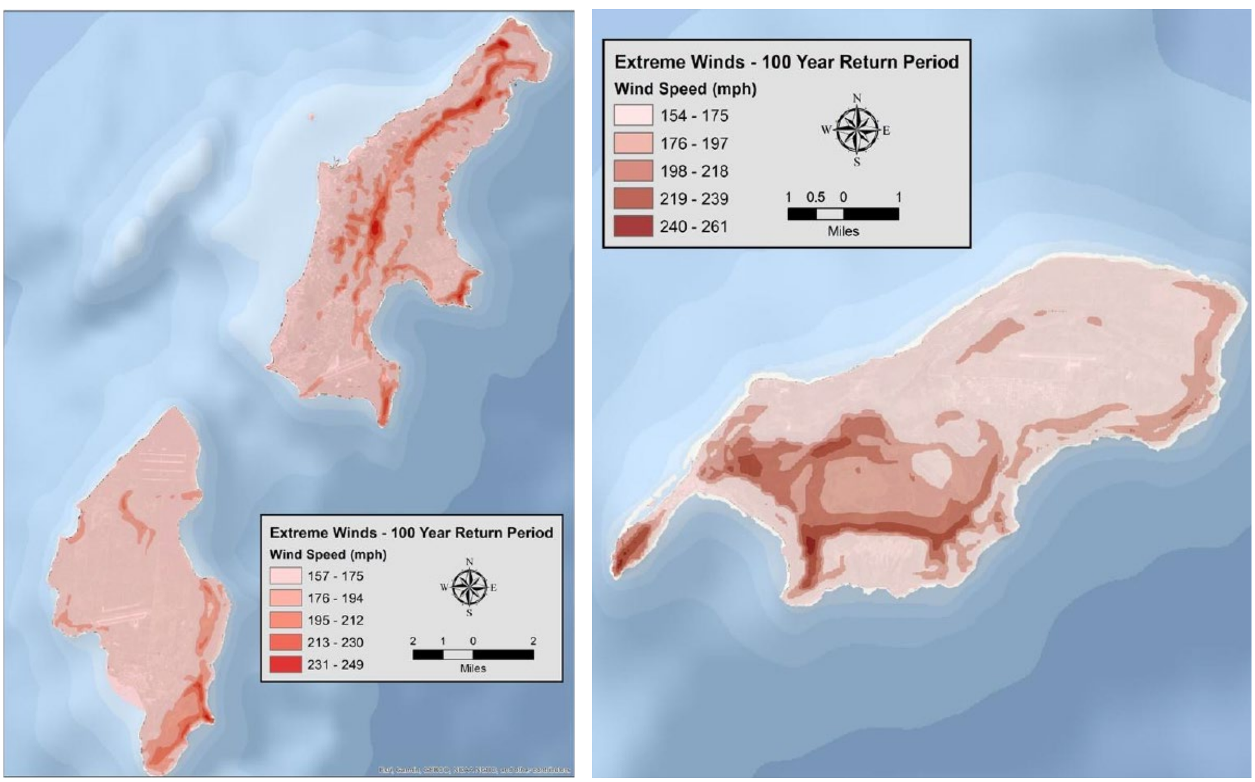


Figure 4.2-3. Special wind zone intensities for Saipan, Tinian (left) and Rota (right).
Source: NMHC (2023).

The American Society of Engineers/Structural Engineering Institute established risk categories for wind speeds. The design wind speed values will increase for a particular location as the risk category number increases from I to IV to provide higher performance of more important buildings and structures. Each risk category is associated with a mean recurrence interval (MRI) for wind speeds, which simply means the average expected period of time between occurrences for that wind intensity. The mean recurrence intervals can also be described in terms of how often the winds will be expected to exceed the design values within a 50-year period. See Table 4.2-2 for a summary of the MRI values and probability of exceedance for each risk category.

Table 4.2-2. Summary of American Society of Engineers/Structural Engineering Institute Risk Categories for wind speeds.

Risk Category	Description	Building Examples	Mean Recurrence Interval (MRI)	Probability of Exceedance in 50 Years
I	Buildings and other structures that represent a low hazard to human life in the event of failure	Agricultural facilities, certain temporary facilities, minor storage facilities	300 years	15%
II	Buildings and other structures except those listed in Risk Categories I, III, IV	1- and 2-family dwellings, office buildings, retail buildings	700 years	7%
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure	Educational facilities, buildings with public assembly loads greater than 300	1,700 years	3%
IV	Buildings and other structures designated as essential facilities	Ambulatory care facilities, fire and police stations, emergency shelters 300	3,000 years	1.6%

Source: FEMA (2020).

According to FEMA, homes that have less protection from the direct wind path will experience higher winds. Thus, homes that are closer to the coast are more exposed to greater wind speeds from open water. Higher wind speeds also can be caused by changes in topography or the shape of the land, such as hills, ridges, and escarpments. The effects of terrain on wind speed for Saipan includes topographic effects. Homes located on ridge lines will experience higher wind speeds than homes on lower, flat terrain (Figure 4.2-4). The topographic speed-up increases wind speed results in extremely high wind loads. Wind forces do not increase linearly, so a doubling in wind speed has a fourfold increase in wind loads. Structures located in high wind intensity zones may be at greater risk during typhoons.

Figure 4.2-4. Homes located on a ridgeline, like these in Saipan (indicated by red arrows), typically experience higher wind speeds than homes on lower, flat terrain.
Source: FEMA, 2020.

Coastal Flooding & Storm Surge

Coastal flooding can be defined as coastal inundation caused by a rise in sea level due to such phenomena as seismic sea waves, high surf, storm surge, or prolonged strong onshore flow of wind and high astronomical tides. Storm surge is a phenomenon caused by the extreme low pressure and strong winds that exist around the eye of a typhoon, which causes a dome of water to form at levels higher than the surrounding ocean surface. Large swells, high surf, and wind-driven waves ride atop this dome as it impacts land areas, causing severe flooding in coastal areas, particularly when storm surge coincides with normal high tides, thereby creating conditions of inundation and flooding to occur in the low-lying coastal areas below elevations of 10 ft.

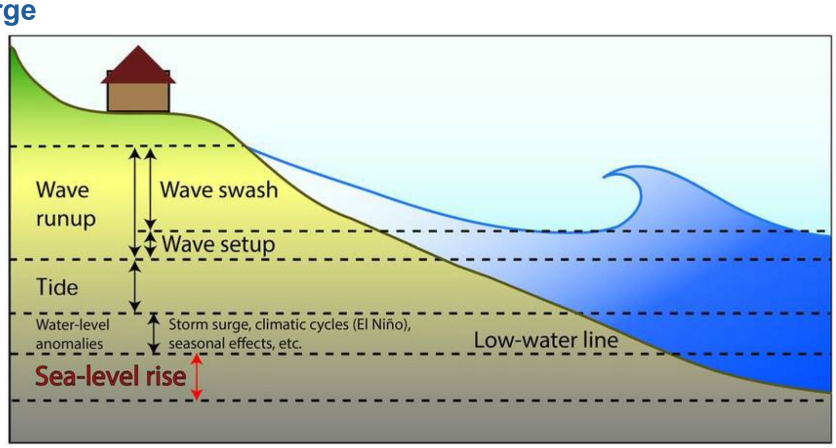


Figure 4.2-5. The water-level components that contribute to coastal flooding.
Source: Storlazzi, n.d. (https://www.researchgate.net/figure/The-water-level-components-that-contribute-to-coastal-flooding_fig1_317006904)

The height of storm surge along the open coast depends on several factors, which include: 1) wind speed and associated barometric pressure, 2) depth of water or shoaling factor, 3) storm trajectory, and 4) speed of the storm. Figure 4.2-6 illustrates how hurricane winds can push a pile of water across the ocean surface in the direction that the hurricane is travelling. The extremely low pressure under the eye of the storm allows the surface of the water to rise a few feet (*What Is a Storm Surge? Video, Photos, Information and More.*, n.d.).

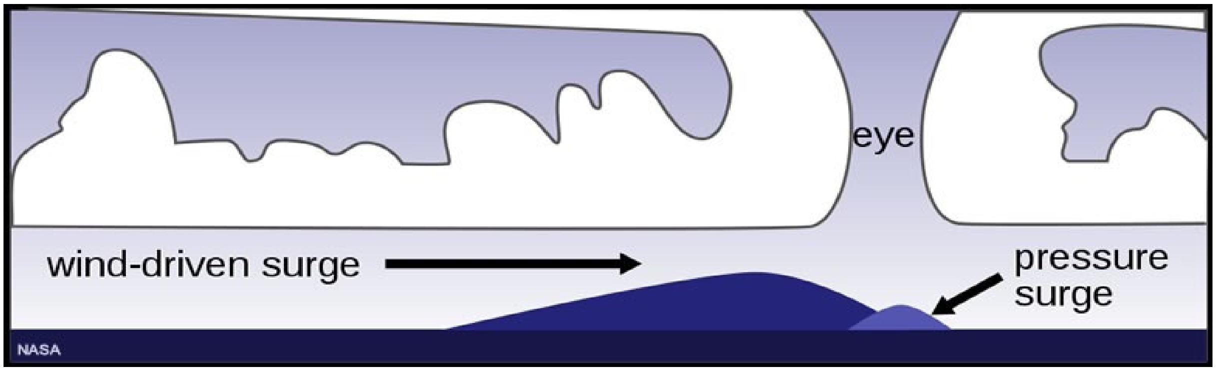


Figure 4.2-6. Strom surge
Source: Geology.com, Image by the National Aeronautics and Space Administration.

During storm surge flooding, water is pushed up onto otherwise dry land by onshore winds. Friction between the water and the moving air creates drag that, depending upon the distance of water (fetch) and velocity of the wind, can pile water up to depths greater than 20 ft from the shoreline inland. The storm surge is the most dangerous part of a typhoon as pounding waves create very hazardous flood currents. Coastal configuration in the form of estuaries or bays can cause a funneling or amplification effect. Coincidence with high tide will also increase surge height. Worst-case scenarios occur when the storm surge occurs concurrently with high tide. Stream flooding is much worse inland during the storm surge because of backwater effects.

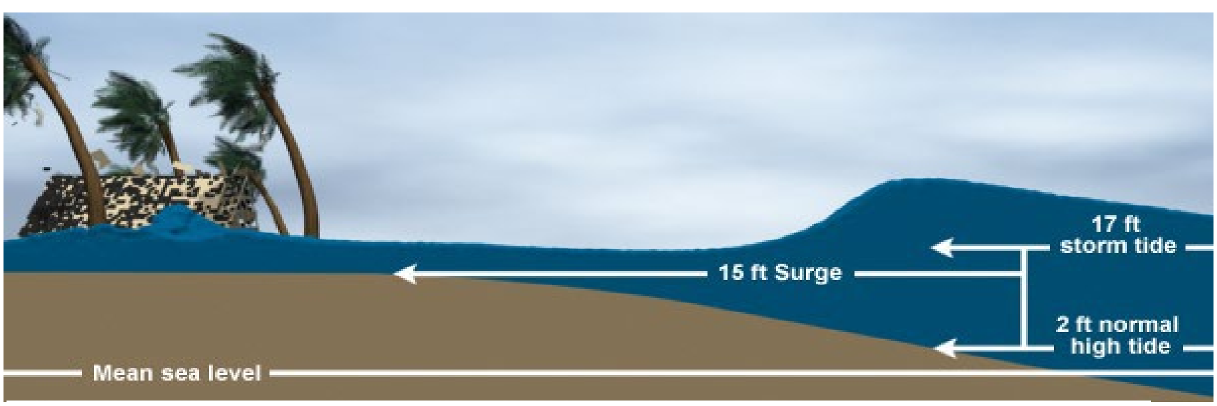


Figure 4.2-7. Storm surge and tide levels.
Source: National Hurricane Center, n.d

Although the maximum surge usually affects only a relatively short length of coastline, combined storm surge and wave action may have damaging effects over the entire coastline facing a major storm center. Wind-driven waves on top of the storm surge pose several added problems. The wave run-up can flood areas not reached by the surge itself. The scouring power of waves is considerable and can cause severe coastal erosion. The duration of storm surge is usually relatively short, being dependent upon the elevation of the tide, which rises and falls twice daily, and the speed of a storm's onset. However, maximum tide elevations can be identical on consecutive days. The high velocities of typhoon winds often produce wave heights higher than the maximum level of the prevailing high tide in the Mariana Islands.

Storm surge, rain, and wind cause most of the damage associated with typhoons. Storm surge floods and erodes coastal areas, salinizes land and groundwater, causes agricultural losses, results in loss of life, and damages structures and infrastructure. Rain damages structures, infrastructure, and results in loss of life. During past typhoons in the Commonwealth about 90% of the deaths near the coast have resulted from storm surge. Strong winds can result in loss of life, create tremendous amounts of debris which impact utilities and transportation, cause agricultural losses, and destroy lightly constructed buildings.

Heavy Rain

Typhoons and other tropical cyclones often produce widespread, torrential rains in excess of 6 inches, which may result in deadly and destructive flooding. Rainfall amounts are not directly related to the strength of the storm but rather to the speed and size. Slower moving larger storms produce more rainfall. Additionally, mountainous terrain enhances rainfall from a hurricane (National Oceanic and Atmospheric Administration, n.d.).

El Niño Southern Oscillation

The El Niño Southern Oscillation (ENSO) is correlated to increased formation of Super Typhoons (defined as storms with lifetime-maximum intensities of 150 mph). with longer lifetimes in the Western North Pacific (Kang et al., 2019). Researchers investigated the formation and duration of storms in relationship to the Southern Oscillation Index—a standardized index based on the observed sea level pressure (SLP) differences between Tahiti and Darwin, Australia, which is one measure of the large-scale fluctuations in air pressure occurring between the western and eastern tropical Pacific (i.e., the state of the Southern Oscillation) during El Niño and La Niña episodes (NOAA-NCEI, 2024). Kang et al. (2019)

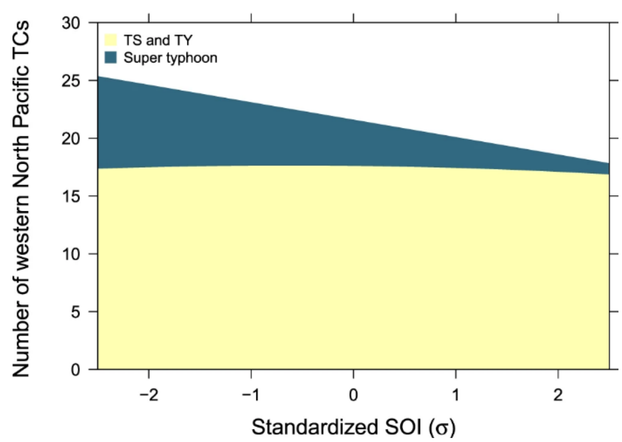
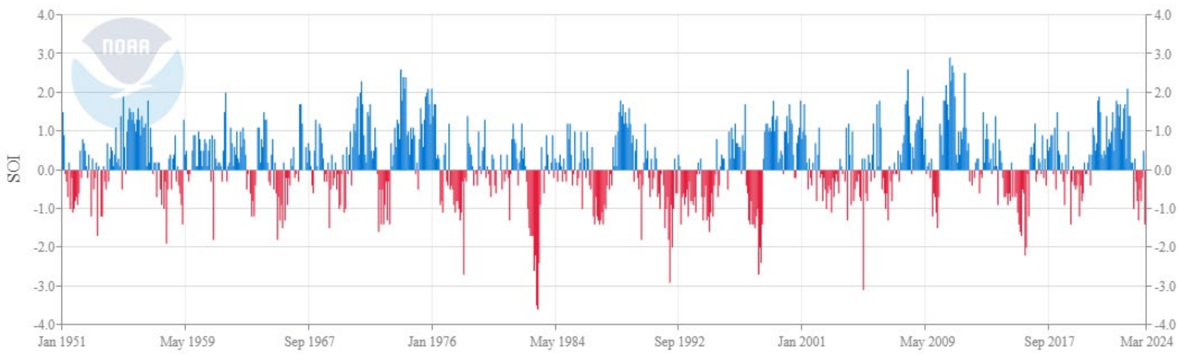


Figure 4.2-8. The quantified response to tropical cyclone activity to ENSO: An interpretation of ENSO influence on the total number of tropical cyclones and Super Typhoons in the Western North Pacific.
Source: Kang et al., 2019

demonstrated that the ENSO conditions did not influence the number of tropical storms and less intense typhoons, but the number of Super Typhoons increased in relationship to the warm phases of ENSO (Figure 4.2-8). The warm phases of ENSO are represented by negative numbers on the SOI scale shown in red in Figure 4.2-9. ENSO events amplify the intensity and duration of Super Typhoons in the Western North Pacific.



Source: https://www.cpc.ncep.noaa.gov/data/indices/soi

Figure 4.2-9. Southern Oscillation Index.

Location

The Western Pacific is the most active location on earth for typhoons and the storms in the Pacific are some of the strongest recorded storms on the Planet (Belles, 2018). The movement pattern of typhoons across the Pacific basin and near the Commonwealth can be erratic and unpredictable. The low-pressure center of a typhoon extends outward 20 or 30 miles from the rim of the storm's eye (center). A typical typhoon eye wall is about ten miles thick. The islands are relatively small compared to the size of typhoons; therefore, if a storm makes landfall, the entire island is typically affected. Not all storms intersect the Mariana Islands. More commonly, storms pass close to the islands and generate large swells and moderately high winds. Although these storms do not make land fall, they can cause damage from high winds, marine over wash, beach erosion, and flooding due to heavy rain, storm surge, and large, energetic storm-waves.

The damage to and destruction of the built environment, particularly public infrastructure such as transportation, utilities, and communications often represents enormous economic, social, and general functional costs to a community, while also impeding emergency response and recovery activities. During previous storms sustained winds for many hours caused extensive structural damage to residential buildings and some public and commercial buildings in the Commonwealth. In general, damage is especially severe to buildings constructed with wooden framing and corrugated tin walls and roofs. Damage to roads can have major implications for a community: general loss of productivity; disruption of physical access preventing residents from getting to work or other daily activities, prevention of emergency vehicles from reaching their destinations, with the associated health and safety implications and the potential access difficulties causing the disruption of important lifeline supplies such as food and other deliveries to the community.

Damaged or destroyed utility lines and facilities including electricity, computer and satellite links, gas, sewer, and water services can cripple a region after a disaster. Power lines are often badly damaged or destroyed, resulting in the loss of power for days, weeks or even months. In addition, public water supplies, water treatment and sewage facilities can also be impacted. Electric pumps cannot pump drinking water into an area without power. In past events, temporary generators were installed to provide power to some of the water wells. Disaster victims who do get water may have to boil it to eliminate waterborne pathogens introduced to the supply in damaged pipelines.

Indirect costs include the widespread distribution of debris, accidental spills of fuel, sewage and industrial waste, household chemicals, or other contaminants onto the land or into the marine environment; in addition to environmental damage associated with storm debris or material cleanup, includes the loss of landfill capacity. As experienced with previous typhoons within the Mariana Islands, post-storm debris management can be a difficult problem, especially when vast amounts of debris are generated, including vegetation and potentially toxic, treated building materials from destroyed buildings.

Extent

As discussed throughout this section, the Commonwealth has experienced intense typhoons including several Super Typhoons (Category 5) in recent years as well as over the last several decades. In addition, storm surge inundation from typhoons can cause significant damage along the coastline.

Warning Time

Tropical cyclones are closely monitored and tracked in the Pacific basin. Therefore, accurate warnings can be issued days in advance of a storm. Improved computing capabilities and computer models have improved predictions of potential storm tracks.

Tropical disturbances are monitored in the Western Pacific by the Joint Typhoon Warning Center (JTWC). The JTWC initiates tropical cyclone warnings when one or more of the following four criteria are met:

- Estimated maximum sustained wind speeds within a closed tropical circulation meet or exceed a designated threshold of 29 mph in the North Pacific Ocean.
- Maximum sustained wind speeds within a closed tropical circulation are expected to increase to 40 mph or greater within 48 hours.

- A tropical cyclone may endanger life and/or property within 72 hours.
- US Indo-Pacific Command (USINDOPACOM) directs JTWC to begin tropical cyclone warnings.

The National Weather Service, Weather Forecast Office (WFO) Guam works in coordination with the JTWC to issue tropical cyclone advisories, warning, and watches for the Commonwealth of the Northern Mariana Islands (CNMI). Together the JWTC and the WFO Guam issue the following Tropical Cyclone Products:

- **Forecast Advisories**: Forecast advisories contain lists of storm latitude and longitude coordinates, intensity, and system motion. The advisory contains position, intensity, and wind field forecasts for 12, 24, 36, 48, 72, 96, and 120 hours from the current synoptic time. All wind speeds in the forecast advisory are given in knots (nautical miles per hour).
- **Public Advisory**: This is a plain language interpretation of the JWTC warning bulletin. The advisory provides the latest information on tropical storm/typhoon watches and warnings. Advisories are issued at least every 6 hours when a tropical cyclone is expected to affect WFO Guam's Area of Responsibility, which includes the CNMI, within 48 hours.
- **Typhoon (Hurricane) Local Statement**: This provides a specific forecast for each island under a watch or warning, including rain, wind, surf, storm surge, and coastal inundation, as well as recommendations for preparation.
- **Tropical Cyclone Update**: This update provides the hourly estimated position of a tropical cyclone with the range of Guam's Doppler radar. An update may be issued any time a significant change occurs in the development or progress of a tropical cyclone.
- **Post-Storm Tropical Cyclone Reports**: This provides a brief history of the tropical cyclones that warranted a warning or watch. The report includes statistics of bulletins issued to the tropical cyclone and statistics and data analysis of the islands affected by the storm.
- **Forecast Discussions**: The JTWC Prognostic Reasoning message describes the rationale for the forecaster's analysis, observations justifying the analyzed intensity of the cyclone, and a description of the environmental factors expected to influence the cyclone's future activity. The NWS Guam Area Forecast Discussion further elaborates on local impacts, reasoning, and confidence levels related to watches and warnings.
- **Typhoon Watches and Warnings**: WFO Guam issues a Typhoon Watch when tropical storm force winds—winds that exceed 38 mph—from an observed cyclone are forecasted to be possible within 48 hours. A Typhoon Warning is issued when tropical storm force winds from an observed cyclone are forecasted to be possible within 24 hours.
- **Tropical Cyclone Forecast Cone**: The JTWC Forecast Cone is also known as the Area of Potential Gale Force Winds. The area is produced by adding the 39 mph wind radii to the 5-year running mean official forecast track error at each corresponding forecast time.

> The cone represents the possible track/projection of the center of the tropical cyclone, including the impacts of the 39-mph winds. The cone will naturally be larger than the NWS-produced cone that only focuses on the average 5-year JTWC error measured from the cyclone center location.

The CNMI Homeland Security Emergency Management (HSEM), in coordination with the WFO Guam, sets tropical cyclone readiness conditions to help prepare prior to the arrival of a storm (HSEM, 2021). The readiness conditions prescribe preparedness actions to accomplish before a storm arrives and the conditions are based on the time before the storm's arrival.

Condition 4: Estimated Time of Arrival within 72 hours.

- Command staff meeting to review Tropical Storm/Typhoon SOP and discuss necessary issues related to Commonwealth Office of Transit Authority (COTA) operations prior to, during and post landfall.
- Operation & Maintenance Coordinator (Operations) shall meet with his/her supervisors to review Tropical Storm/Typhoon SOP and update contact information for all personnel.

Condition 3: Estimated Time of Arrival within 48 hours.

- Command staff meeting to discuss updated weather forecast, the potential for activation of Tropical Storm/Typhoon Command Plan, assignments and planning for upgrade to Condition 2.
- Once activated, each Tropical Storm/Typhoon Command Division will conduct meetings with staff assigned to each respective division as necessary.
- Facility and fleet preparation
- Personnel shall take home all personal effects and PPE if their respective station is evacuated prior to their return for duty.

Condition 2: Estimated Time of Arrival within 24 hours.

- Command staff meeting. At this point, CNMI Emergency Operations Center (EOC) may activate COTA to execute its emergency support functions (ESF) 1 Transportation responsibilities. Assigned personnel will be contacted by their supervisors for their assignment.
- All supervisors shall ensure that actions listed in Conditions 4 and 3 have been accomplished. Once completed, supervisors shall report status via email to the COTA Incident Commander and Deputy Incident Commander.
- Deputy Incident Commander or Supervisors shall coordinate a reasonable amount of leave time for on duty personnel to prepare families/personal property if applicable.
- Conduct test of all emergency power systems and communication equipment. Ensure that all apparatus/equipment is fully fueled.

Condition 1: Estimated Time of Arrival within 12 hours

- Command staff meeting every 4 hours or as needed.
- Personnel ordered to duty shall report with clothing, personal items, food, and provisions to sustain their readiness in duty for a minimum of 2 days.
- As needed, stations may be evacuated, and all personnel and equipment relocated as deemed appropriate by the COTA Command or CNMI EOC.
- Total relocation of personnel and assets may be directed by the COTA Incident Commander.
- When the decision to cease responses is implemented, Dispatch will tone out personnel advising them and will re-tone once the conditions allow responses to resume.

In addition, the CNMI HSEM Emergency Management Office also maintains a page on Facebook, *State Warning Point*, to disseminate information to the public.

2023 Threat and Hazard Identification Risk Assessment (THIRA)—Typhoon

To identify and prepare for hazards, the Commonwealth updated the *CNMI Threat and Hazard Identification Risk Assessment* (THIRA) in 2023 (HSEM, 2024). The plan used situational and after-action reports developed in response to Super Typhoon *Yutu* to inform the scenario and capabilities assessment presented in the THIRA (Table 4.2-3). These reports provided information on the numbers of shelters and people sheltering, the number of people without power and water services, and other quantifiable damge. The THIRA estimates the total population impacted if a Super Typhoon makes landfall on Saipan and a portion of Tinian (based on Super Typhoon *Yutu*). For this scenario, the numbers of people expected to be affected by the storm is estimated for several impact categories. This information can be used to estimate the proportion of the population, and the proportion of the population with functional needs, which requires evacuation, shelter, food/water assistance, and short-term shelter following a Category 5 typhoon.

Table 4.2-3. Typhoon response scenario developed for the CNMI Threat and Hazard Identification and Risk Assessment.

Impact Category	Estimate	% Total Affected Population
Affected	47,438	
Affected with access and functional needs	4,474	10%
Limited English Proficiency	4,474	10%
Require Emergency Shelter	1,000	2%
Require Emergency Shelter with access and functional needs	100	0.2%
Require food and water	37,950	80%
Require food and water with access and functional needs	3,795	8%
Require Temporary non congregate housing	136	0.3%

Table 4.2-3. Typhoon response scenario developed for the CNMI Threat and Hazard Identification and Risk Assessment (*cont'd*).

Impact Category	Estimate	% Total Affected Population
Require Temporary non congregate housing with access and functional needs	14	0.03%
Require Long-term Housing r	172	0.4%
Require Long-term Housing with access and functional needs	16	0.03%

These estimates for people requiring evacuation and sheltering are different from the estimates provided in the 2018 Standard State Mitigation Plan (SSMP). The estimates in the 2018 SSMP were derived from the Island Mass Management Tool (MMT), which is a spreadsheet model used by FEMA that supplements the hurricane evacuation (HURREVAC) program. The MMT is a decision-making tool to plan the mass movements of populations during a typhoon, whose application provides a greater degree of safety to the most vulnerable populations. The MMT allows for the implementation of sequential or multiple actions that address affected populations first and the remaining island populations groups in an appropriate order of prioritized need.

With the applied data inputs and assumptions from 2018, the evacuation outputs of the MMT for a moderate typhoon (Categories 1, 2, or 3 storms), approximately 3,400–3,800 people would need to be evacuated to a public shelter. For higher category typhoons (Categories 4 or 5 storms), the number of evacuees increases to approximately 7,200 people requiring public shelters. The MMT was not updated with 2020 population data for the 2024 SSMP update because of limited access to HURREVAC.

Previous Occurrences

Typhoons and tropical storms have been a common occurrence throughout the history of the Commonwealth. Since 1976, 18 storms have caused significant damage in the Commonwealth and been declared major disasters by the US Government (Table 4.1-2). More recently, between 2012 and 2022, a total of 24 named storms have passed within 60 miles of Saipan/Tinian, Rota, and the Northern Islands (Figure 4.2-10, Figure 4.2-11, and Figure 4.2-12). Eight of the 24 storms were within 60 miles of Saipan (Figure 4.2-10). A list of major typhoons and tropical storms in the CNMI between 1984 and 2018 is included in Appendix C.

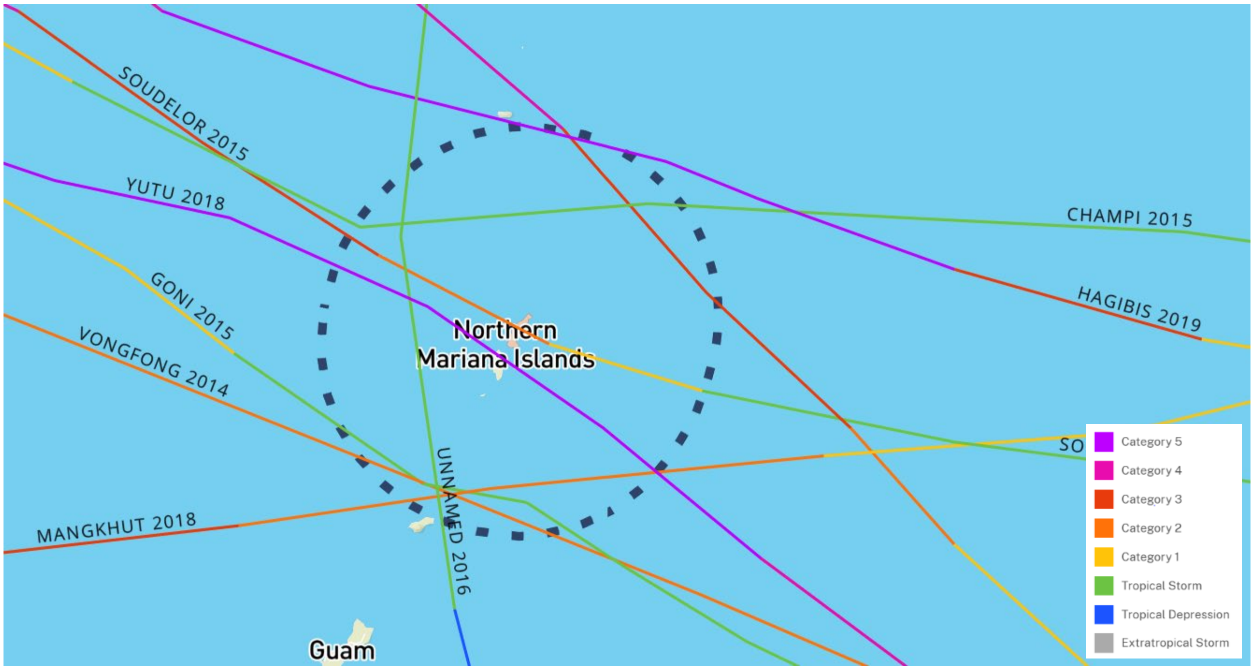


Figure 4.2-10. Named Storms within 60 Miles of Saipan and Tinian, 2012-2022.
Source: NOAA http://coast.noaa.gov/hurricanes/.

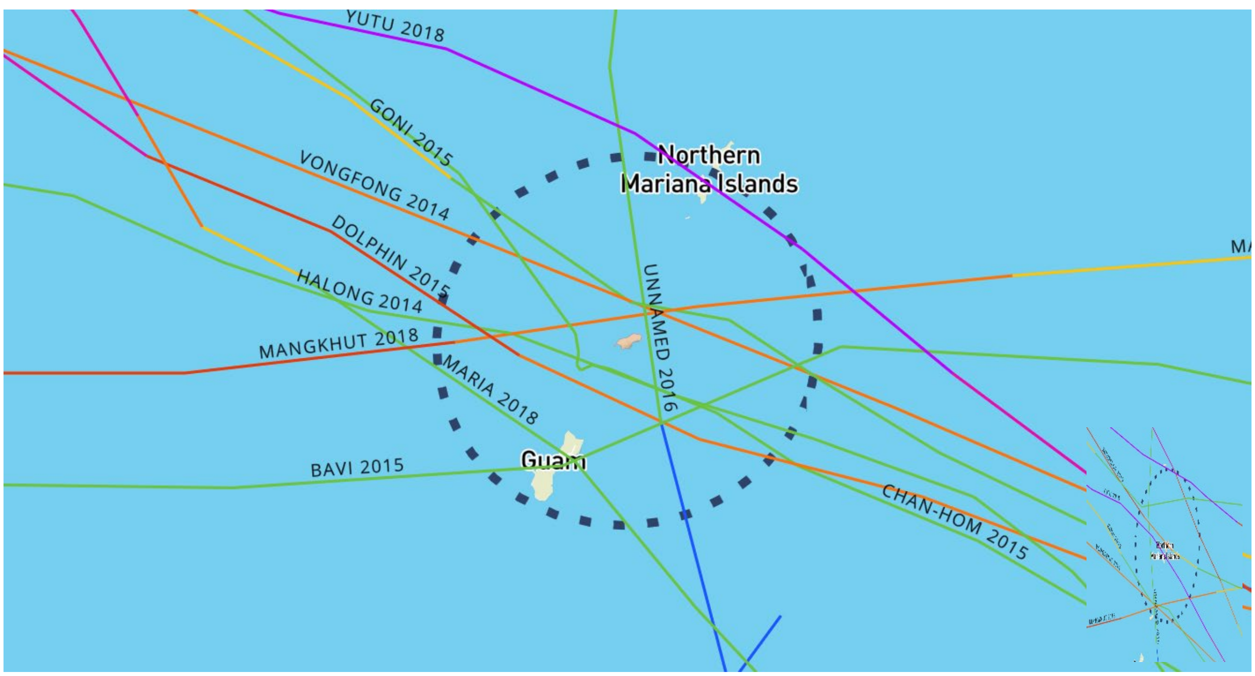


Figure 4.2-11. Named Storms within 60 Miles of Rota, 2012-2022.
Source: NOAA http://coast.noaa.gov/hurricanes/.

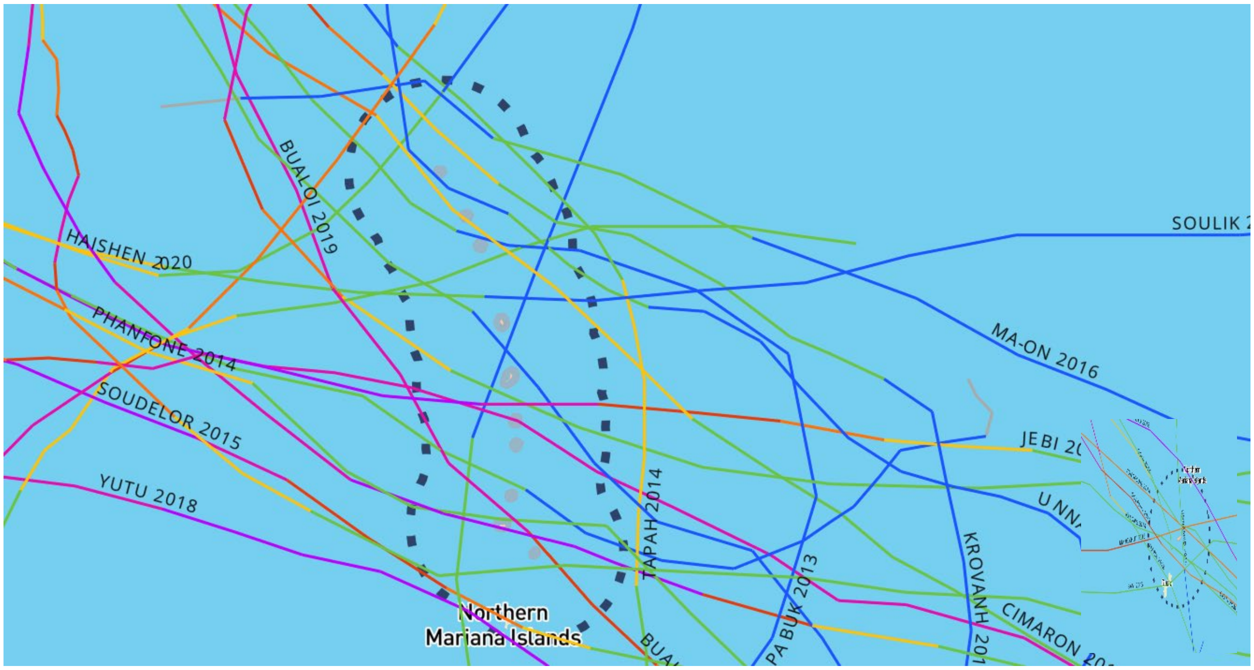


Figure 4.2-12. Named Storms within 60 Miles of Northern Mariana Islands, 2012-2022.
Source: NOAA http://coast.noaa.gov/hurricanes/.

A succinct history of notable storm systems is outlined below.

In April 1968, Typhoon *Jean* destroyed public and private facilities within the Commonwealth. Estimated losses equaled $18 million with more than 1,000 homes lost in addition to livestock and crops. No lives were lost.

In June 1976, typhoon *Pamela/Therese* caused significant damage on Guam. On Saipan, the storm produced tropical-storm force gusts and 10 inches of rain. A major disaster was declared (DR-508-MP).

In 1980, Typhoon *Dinah* affected the Commonwealth, and a major disaster was declared (DR-634-MP).

In December of 1986, Typhoon *Kim*, with maximum sustained winds of 135 mph, swept across the island of Saipan for nearly 12 hours causing major destruction to public and private facilities. The total loss to public facilities, residential, agricultural crops, and livestock equaled $25 million. A major disaster was declared (DR-783-MP).

In November 1987, Typhoon *Lynn*, with sustained winds of 50 mph and gusts to 75 mph, impacted Saipan, Tinian, and Rota. Throughout the Mariana Islands, agriculture damage was estimated at $2 million and 15 families were displaced from their homes. Roughly 100 people sought help from the Red Cross. A major disaster was declared (DR-800-MP).

In January 1988, Typhoon *Roy* caused moderate structural damage and extensive crop losses and Rota received the worst damage. At least 200 of the 450 homes on Rota were destroyed and the remainder were damaged; 95% of the power poles fell across the island, resulting in severe disruption to daily life. A major disaster was declared (DR-811-MP).

In 1990, Typhoon *Koryn* with sustained winds of 65 mph caused $2.2 million of damage. A major disaster was declared (DR-854-MP).

In 1997, two major storm systems struck the Commonwealth—Super Typhoon *Keith* in November and Super Typhoon *Paka* in December. Super Typhoon *Keith*, with sustained winds of over 160 mph, caused significant damage on Saipan, Tinian, and Rota. Over 106 homes were destroyed, and another 477 homes were majorly damaged. A major disaster was declared (DR-1192-MP) for Super Typhoon *Keith*. In December, Super Typhoon *Paka*, with sustained winds of 160 mph and gust to 175 mph, crossed near Rota with heavy rain. A Major Disaster Declaration was issued for Rota with extensive damage to homes, public facilities, infrastructure, and agriculture. Another major disaster was declared (DR-1194-MP) for Super Typhoon *Paka*.

In July 2002, Typhoon *Chata'an* (pronounced tsa-Ta-an), with sustained winds of 46 mph with gusts to 75 mph, made landfall on Rota. The storm inflicted major damage to agricultural parcels and damaged roads and buildings on Rota. Damage was estimated at $2.7 million. A major disaster was declared (DR-1430-MP).

In December 2002, Super Typhoon *Pongsona,* with sustained winds from 121 mph to 150 mph, made landfall on Guam and Rota. In Songsong Village on Rota, the inland reach of the storm surge was ~79 ft and an elevation of ~12 ft. The East harbor on Rota was covered by storm surge and shipping containers fell into the West Harbor blocking the channel and hindering deliveries of supplies and relief materials. A major disaster was declared (DR-1447-MP).

In July 2004, two major storm systems struck the Commonwealth—Typhoon *Tingting* in July and Super Typhoon *Chaba* in August. Typhoon *Tingting* destroyed 71 homes and hundreds were damaged in the Commonwealth. Total damage was estimated at $11.2 million, and a major disaster was declared (DR-1532-MP) for Typhoon *Tingting*. A month later, Super Typhoon *Chaba* caused significant damage on Rota where the eyewall remained for several hours with gusts peaking at 136 mph. The storm caused substantial damage to homes and buildings on Rota. Power outages were common across the Commonwealth. Damage was estimated at $18 million and 13 people were injured, with one fatality. Another major disaster was declared (DR-1541-MP) for Super Typhoon *Chaba*.

In 2005, Typhoon *Nabi,* with sustained winds of 59 mph and gusts of 75 mph, brought tropical storm force winds and heavy rain to several islands of the Commonwealth. On Saipan homes were damages and 70–80% of the crops were damaged. The entire island was left without power, some without water, after the storm. On Tinian, Typhoon *Nabi* damaged or destroyed homes and crops. On Rota, there was minor flooding and scattered power outages. A major disaster was declared (DR-1611-MP).

In August 2015, Super Typhoon *Soudelor* passed directly over Saipan, with gusts near 120 mph, destroying homes, downing trees, snapping power poles, and flooding the island's power plant. It was the strongest and the largest storm to make landfall on Saipan for nearly 30 years. In the wake of Super Typhoon *Soudelor*, people on Saipan experienced water and gasoline shortages, with water trucks making emergency deliveries. Many homes and buildings were destroyed and/or damaged. The American Red Cross documented 808 homes affected. Of this total, 158 were destroyed, 296 sustained major damage, and 354 were affected or sustained minor damage. The Red Cross also reported 400–550 people required shelter due to damaged homes. Oil spilled into the harbor causing a closure. Estimated total damage exceeded $21 million. A major disaster was declared (DR-4235-MP). Following Super Typhoon *Soudelor* the CNMI received FEMA funding but did not receive funding from the US Department of Housing and Urban Development (HUD).

In 2018, two major storm systems struck the Commonwealth—Typhoon *Mangkhut* in September and Super Typhoon *Yutu* in October. Typhon *Mangkhut* affect Saipan, Tinian, and Rota. Typhoon *Mangkhut* had sustained winds over 100 mph when the eye passed over Rota. According to FEMA's preliminary damage report, 738 residences were affected with 17 destroyed and 53 sustaining major damage. About 46% of the households affected were low income. The storm also caused power outages and knocked down power poles, flooded some areas, and uprooted large trees. A major disaster was declared (DR-4396-MP).

Then 45-days after Typhoon *Mangkhut,* Super Typhoon *Yutu* made landfall on the island of Tinian and the southern part of Saipan at its peak intensity, with a minimum central pressure of 900 millibars (27 inHg), 10-minute sustained winds of 134 mph, 1-minute sustained winds of 170 mph, and gusts of up to 190 mph. Super Typhoon *Yutu* was the most powerful tropical cyclone to make landfall worldwide in 2018. Most of the buildings in southern Saipan lost their roofs or were destroyed. On Tinian most of the homes were severely damaged or destroyed. The storm completely destroyed the commuter terminal at the Franscisco C. Ada Saipan International Airport and the airport was closed for 20 days and flights were disrupted for up to 22 days. Five hotels sustained major damage and major tourist sites were also heavily damaged. Visitor arrivals plummeted following the storm compared to the same time the previous year. This caused widespread and cascading impacts to the economy. FEMA estimated the damage to be $800 million. A major disaster was declared (DR-4404-MP).

In May 2023, Typhoon *Mawar* struck Guam and Rota, with sustained winds of 140 mph and gusts approaching 160 mph on Guam. Rota suffered damage from the storm including power outages. A major disaster was declared (DR-4716-MP).

Probability of Future Occurrence

Typhoon season within the Commonwealth extends from August through December. However, devastating winds can occur from a well-developed storm or typhoon within 90 nautical miles from the islands during any given month. Also, typhoon strength and intensity are often unpredictable. Table 4.2-4 provides the calculated percent probability of a tropical cyclone for each month.

Table 4.2-4. Percent probability of a tropical cyclone passing within 200 nautical miles of Saipan.

Month	Typhoon	Tropical Storm
January	2%	4%
February	1%	4%
March	1%	1%
April	5%	3%
May	8%	1%
June	1%	5%
July	11%	11%
August	7%	17%
September	20%	25%
October	25%	15%
November	14%	13%
December	5%	5%

To evaluate the wind hazard associated with typhoons, a return period of 100 years was selected. A return period is the inverse of annual frequency of occurrence and is not a recurrence interval. For example, a return period of 100 years does not mean that the selected hazard will only occur every hundred years, rather there is a 1% annual chance of the hazard occurring in any given year (USGS, n.d.). Based on the special wind region maps developed by FEMA (Figure 4.2-3), all areas on Saipan, Tinian, and Rota have a 1% annual chance of occurrence (i.e., a 100-year return interval) for winds at or above 154 mph, which is just below the threshold for a Category 5 Typhoon (winds greater than 157 mph) on the Saffir-Simpson Hurricane Wind scale. In addition, the 2023 THIRA for the Commonwealth uses a scenario centered a Category 5 Typhoon making direct landfall on a populated island. Therefore, the analysis for the 2024 SHMP Update will assume a 1% annual chance that a Category 5 Typhoon will affect the Commonwealth.

Between 1986 and 2020, 142 tropical cyclones (storms and typhoons) within 60 nautical miles of the Mariana Islands were named (NOAA, 2024). Forty -eight of these storms were typhoons, averaging 1.3 typhoons per year during this period. Fifteen of the 48 typhoons (31%) caused significant damage to populated islands and major disasters were declared (see Table 4.1-2 for Major Disaster Declarations for the CNMI from 1976 through 2023). Based on historical data there is a high probability that a typhoon will occur in any given year within 60 nautical miles of the Commonwealth and there is a greater than 30% chance the storm will cause significant damage on the populated islands leading to a major disaster.

Climate Change Considerations

According to Grecni et al. (2021) the frequency of tropical cyclones is expected to decrease in the future; however, storms that do form are more likely to be intense (higher category), delivering higher wind speeds and more rainfall. Waves generated by these systems are anticipated to cause widespread coastal erosion and flooding on all islands, which will be worsened by future sea level rise (SLR). In addition, high energy waves from strong storms will likely heighten shoreline erosion. As the shoreline erodes new areas become more susceptible to flooding and storm surge effects from future typhoons. More frequent ENSO events are also projected, increasing tropical cyclone activity and intensity amplifying the effects of corresponding waves, flooding, and erosion for the Commonwealth (Kang et al., 2019). As stated earlier, the number of very strong storms increases during ENSO events, thus stronger storms are expected due to climate change.

As sea level continues to rise, the effects from flooding and storm surge are expected to worsen. Higher sea levels will reduce the protective function of fringe and barrier reefs allowing storm driven waves to reach further inland. SLR will also contribute to raising the water table which may exacerbate flooding during extreme rainfall often associated with typhoons.

4.2.2 Vulnerability Assessment

Typhoons pose a threat to infrastructure, buildings, the economy, and to Commonwealth residents and visitors. One of the greatest challenges to disaster response in the Commonwealth is time and distance to Washington DC and FEMA Distribution Centers (HSEM, 2018). Also, the coastal areas on Saipan and Rota and heavily populated and exposed to storm surge and high winds, which are the main threats of a typhoon. For the 2024 SHMP Update, two analyses were conducted to assess typhoon vulnerability:

1) For the wind component, a minimum wind speed of 154 mph with a 100-year mean return interval, or a 1% annual chance of occurrence, was used to estimate potential impacts to communities (Figure 4.2-3). The wind return interval corresponds to the upper range of a Category 4 typhoon. The *2017 CNMI Catastrophic Typhoon Plan: Annex to FEMA Region IX All-Hazards Plan* (HSEM, 2018), uses a scenario based on a Category 4 typhoon to plan response activities. The 2023 THIRA uses a Category 5 Typhoon (based on experiences with Super Typhoon *Yutu)* to assess current commonwealth capabilities to respond to disasters (HSEM, 2024).
2) To assess vulnerability to storm surge and flooding caused by a typhoon, a spatial analysis was conducted by stacking asset data layers with the V-zones from the FEMA Flood Insurance Rate Map (FIRM). To estimate losses to vulnerable assets, a loss factor of 70% for structures and 70% for contents was applied. These factors were obtained from the V-Zone Flood Contents Loss Estimate Table provided in the FEMA Benefit-Cost Analysis Coastal V-Zone Module (1999).

The wind data was used to determine displaced households and shelter needs in the Commonwealth resulting from a Category 5 typhoon per the 2023 THIRA. The FIRM V-zone data was used to determine exposure to the hazard of Commonwealth and general assets, population, natural and cultural resources.

Currently, information for the Commonwealth is not available to model the typhoon wind hazard in FEMA's Hazus tool or storm surge in NOAA's Sea, Lake, and Overland Surges (SLOSH) tool.

Power infrastructure is particularly vulnerable to typhoons. Most recently Typhoon *Mangkhut* destroyed much of the power infrastructure on Rota and Super Typhon *Yutu* caused widespread damage to power infrastructure on Tinian and Saipan, disrupting power for several months. In response, the Commonwealth Utilities Corporation (CUC) is developing hazard mitigation strategies to harden and improve the resiliency of the energy infrastructure on all three islands. CUC is working with the US Department of Energy to develop strategies that focus on distribution automation, undergrounding systems and distributed energy resources to increase resiliency to typhoons.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the vulnerability of exposed Commonwealth assets (buildings and roads), and community lifelines and critical facilities to the typhoon hazard.

Commonwealth Buildings

All Commonwealth buildings are exposed to strong wind and rain associated with typhoons. Buildings located near the shore may also be exposed to storm surge. Results of the spatial analysis showed that 36 Commonwealth buildings are vulnerable to storm surge, with a total replacement value of $59 million and potential losses estimated at ~$42 million. Table 4.2-5 summarizes the Commonwealth buildings in the storm surge hazard zone by municipality; Table 4.2-6 summarizes the same information by agency. The Department of Land and Natural Resources is responsible for the greatest number of buildings (12) vulnerable to storm surge with potential losses estimated at $28 Million. For buildings vulnerable to flooding from storm surge, loss was estimated at 70% of the structure and contents.

Table 4.2-5. Commonwealth building exposure and potential losses to storm surge by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	14	$49,510,537	$34,657,376	4%
Tinian	83	$140,347,469	14	$5,289,642	$3,702,749	0%
Rota	58	$123,032,676	8	$4,522,738	$3,165,917	0%
Total	**387**	**$972,324,643**	**36**	**$59,322,917**	**$41,526,042**	**4%**

Table 4.2-6. Commonwealth building exposure and potential losses to storm surge by agency.

	Buildings Exposed			Estimated Potential Loss	
Agency	No.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Commonwealth Utilities Corporation	10	$7,983,591	1%	$5,588,514	1%
Dept. of Lands and Natural Resources	12	$40,487,843	4%	$28,341,490	3%
Dept. of Public Lands	1	$156,249	0%	$109,374	0%
Mayor's Offices	4	$1,681,276	0%	$1,176,893	0%
Office of the Governor	1	$342,563	0%	$239,794	0%
Ports Authority	6	$2,671,090	0%	$1,869,763	0%
Public School System	2	$6,000,305	1%	$4,200,214	0%
Total	**36**	**$59,322,917**	**6%**	**$41,526,042**	**4%**

Northern Islands Commonwealth Facilities

All buildings on the Northern Islands are vulnerable to typhoons. High winds from Super Typhoon *Yutu* damaged buildings and other infrastructure and recently the typhoon shelters were rebuilt on Agrihan, Alamagan, and Pagan. However, these shelters remain vulnerable to future storms because of the difficulty of transporting material and equipment to construct the facilities to meet current building standards to resist typhoon winds. Storm surge inundation zones are not mapped for these islands. The elevation of each facility was not available. Structures located 10 ft or less elevation above mean sea level or are located on a coastal plain are likely vulnerable to storm surge. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information, it is difficult to estimate potential losses from a typhoon. In addition, the estimate of total replacement value does not account for the added costs to construct facilities in the Northern Islands due to the extreme isolation and logistical challenges of transporting construction materials and equipment and lack of port facilities.

Commonwealth Roads

Roads provide ingress and egress to communities and provide community lifeline functions. If roads become flooded or blocked by debris, communities may become isolated from critical services. If roads become fully submerged the road integrity may be compromised and sometimes damage can occur to underlying soils that is not readily visible on the surface. There are 18.9 miles of Commonwealth primary roads in the storm surge hazard area.

Table 4.2-7. Commonwealth road exposure to storm surge by municipality.

Municipality	Total Road Length (miles)	Exposed Road Length (miles)	% of Total Length
Saipan	87	4.2	2.2%
Tinian	67.1	0.7	0.4%
Rota	39.6	14	7.2%
Total	**193.8**	**18.9**	**9.8%**

Community Lifelines and Critical Facilities

Typhoons have caused significant damage to critical facilities and lifelines in the Commonwealth. Facilities damaged in the past include airports that support transportation lifelines, utility infrastructure that supports energy lifelines, especially power poles, and many others that support critical services and operations. Strong storm surge has the power to damage piers and storage facilities at commercial ports, which could impede shipping activity and disrupt the supply chain causing wide-spread, cascading effects. Damage to critical facilities and interruption of essential services affects residents, visitors, and economic activity in general.

Super Typhoon *Yutu* caused extensive damage at the Fransisco C. Ada Saipan International Airport including destruction of the commuter terminal. Services at the airport were disrupted for twenty days with eight airlines canceling flights for twenty-two days.

The Port of Saipan is the major supply port for the Commonwealth. All goods, products, and materials entering the Commonwealth via commercial shipping are processed through the Port of Saipan before being shipped to Tinian, Rota, or the Northern Islands. All petroleum products arrive by ship. In addition, millions of tons of food and supplies arrive at the port annually. Potential closure of the port due to typhoon damage could delay disaster response assistance and cause widespread supply shortages.

Table 4.2-8 and Table 4.2-9 summarize the critical facilities by community lifelines that are within the storm surge hazard zone. Tinian has the most lifelines located in the hazard zone. The energy and transportation lifelines have the most critical facilities/structures vulnerable to storm surge hazards with estimated potential loss values of $2.9 million and $3.3 million, respectively.

Table 4.2-8. Community lifeline and critical facility exposure and potential losses to storm surge by municipality.

Municipality	Total No. of CLF	Community Lifelines Exposed: Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety & Security	Transportation	Water Systems	Total No. Exposed
Saipan	138	0	3	1	1	1	0	1	1	8
Tinian	56	0	4	1	0	0	0	6	0	11
Rota	43	0	7	0	0	0	0	1	0	8
Total	**237**	**0**	**14**	**2**	**1**	**1**	**0**	**8**	**1**	**27**

Table 4.2-9. Community lifeline and critical facility exposure and potential losses to storm surge by lifeline category.

Category	Total No. of CLF	Total Replacement Cost Value (RCV)	Community Lifelines Exposed		Estimated Potential Loss	
			No. of CLF	Replacement Cost Value	Value	% of Total RCV
Communications	4	$864,517	0	$0	$0	0.0%
Energy	46	$140,851,551	14	$5,628,074	$2,922,807	0.5%
Food, Water, Shelter	24	$37,356,099	2	$3,714,440	$3,714,440	0.6%
Hazardous Material	9	$48,091,161	1	$4,579,212	$4,579,212	0.7%
Health and Medical	19	$187,643,812	1	$227,317	$227,317	0.0%
Safety and Security	35	$38,639,592	0	$0	$0	0.0%
Transportation	48	$119,925,667	8	$3,255,559	$3,255,559	0.5%
Water Systems	52	$50,052,062	1	$1,682,183	$1,682,183	0.3%
Total	**237**	**$623,424,461**	**27**	**$19,086,785**	**$16,381,518**	**2.6%**

Northern Islands Commonwealth Facilities

The Commonwealth facilities on Agrihan, Alamagan, and Pagan are considered critical facilities that provide essential community lifelines for island residents. All facilities on the Northern Islands are vulnerable to high winds, heavy rainfall, and those located near the coast may be vulnerable to storm surge. The satellite Mayor's Offices on the islands provide shelter if people are present on the islands during a typhoon and serve as communications centers. In general, people are evacuated in advance of typhoons. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information.

General Asset Vulnerability Assessment and Potential Losses

This section provides a summary of vulnerability and potential losses to general building stock, socially vulnerable and total populations, and natural and cultural resource assets.

General Building Stock

The spatial analysis for the general building stock was conducted with the same approach used for the Commonwealth assets. Losses for vulnerable buildings and their contents were assumed to be 70%. There are 1,113 buildings vulnerable to the storm surge hazard and potential losses were estimated at ~$472 million (Table 4.2-10).

Table 4.2-10. General building stock exposure and potential losses to storm surge by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	871	$630,964,894	$441,675,426	6.4%
Tinian	98	$399,885,058	8	$9,339,958	$6,537,971	0.1%
Rota	1,261	343861559	234	$33,847,487	$23,693,241	0.3%
Total	**14,953**	**$6,923,089,892**	**1,113**	**$674,152,339**	**$471,906,637**	**6.8%**

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.

Socially Vulnerable and Total populations

The entire Commonwealth population is vulnerable to typhoons. Storm surge is a significant threat and most deaths from past typhoons have been related to storm surge. To estimate the total population and the socially vulnerable population that may be vulnerable to storm surge, a spatial analysis was conducted. Table 4.2-11 summarizes the number of people estimated in each social vulnerability class by municipality. A relatively large proportion of people in SVI 4 (indicating a moderate–high degree of social vulnerability) live on Saipan. Damaged buildings, flying debris, downed trees or other structures can also cause injury or death.

Table 4.2-11. Commonwealth population based on 2020 Census data exposed to storm surge by social vulnerability index and municipality.

				Proportion of Estimated Population Exposed		
Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	1	2	0%
	2	1,832	6,476	48	157	2%
	3	2,682	14,443	96	830	6%
	4	2,191	11,654	176	1,230	11%
	5	948	5,855	50	356	6%
		52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**371**	**2,575**	**6%**
Tinian	1	249	571	0	0	0%
	2	496	1,458	2	6	0%
Tinian Total		**745**	**2,029**	**2**	**6**	**0%**
Rota	1	409	749	79	160	21%
	2	561	1,116	5	3	0%
	0	22	0	0	0	0%
Rota Total		**992**	**1,865**	**84**	**163**	**9%**

SVI=Social Vulnerability Index

Socially vulnerable populations include the elderly and young, populations that are low income or limited English proficiency, people without transportation, people with functional challenges, such as mobility challenges, and people with life threatening illnesses. These socially vulnerable populations are more susceptible to typhoon hazards due to many factors such as physical and financial ability to react or respond during an event and the location and quality of their housing. Power outages can be life-threatening to those dependent on electricity for life support and are a significant concern. In fact, only the Aging Center in Kagman and the Hospital can shelter individuals that require electricity for life-support during a typhoon. These individuals must be separated from their families due to the limited capacity at these specialized shelters. In addition, there is limited logistical support to transport functionally challenged individuals to shelter facilities, especially on Tinian and Rota where ambulance services are limited. Ensuring family members are secure at different shelters adds additional burden and stress to these already vulnerable populations.

HSEM has prepared scenarios to estimate the number of people, including socially vulnerable people that may require shelter during a typhoon. The HSEM estimates 10% of people requiring shelter during a typhoon will have limited English proficiency and 10% will have functional challenges. This analysis is based on the resident population and does not include visitors and tourists, so sheltering needs may be higher, especially as the use of non-traditional hotels (i.e., condo-tels or short-term residence rentals) by visitors increases.

The Commonwealth Office Transit Authority (COTA) assisted with mass evacuation efforts for 679 individuals prior to Super Typhoon *Yutu*. During the recovery, COTA transported individuals to the FEMA Disaster Relief Center, American Red Cross, medical facilities, and back to their residences, providing vital health and social services to community members in need of transportation.

Flood resulting from typhoons also present threats to public health and safety, including unsafe drinking and washing water, poor sanitation, mold and mildew, mosquitos and other vermin, and mental stress and fatigue. There is also the risk of carbon monoxide poisoning from poor ventilation and the indoor use of generators and/or equipment that burns fuel (e.g., propane stoves). The best preparation for these potential risks is awareness that they can occur, public education on prevention, and planning to address them during typhoon response.

<u>Natural and Cultural Resources</u>

Storm surge can affect the numerous natural resources located along the Commonwealth shoreline including beaches, wetlands, and parks. Natural features such coral reefs, beaches, wetlands, provide protection from storm surge and SLR (Itzkin et al., 2021; Storlazzi et al., 2019; Wamsley et al., 2010). Impacts to the resources will not only damage the natural environment but may reduce their protective functions and may have cascading economic impacts.

Typhoons can impact the habitats of species of conservation concern throughout the islands. High winds can topple trees and otherwise damage vegetation. Vegetation can also be damaged by the force of storm surge and/or from saltwater intrusion. To evaluate the potential effects of storm surge, the terrestrial index developed by Dobson et al. (2020) was overlaid in a Geographic Information System (GIS) with the storm surge hazard zone from the FIRMS (i.e., V-zones). About 3 square miles of index class 3, indicating a relatively high concentration of species of conservation concern, was vulnerable to storm surge on Saipan and Tinian (Table 4.2-12). Another 1.2 square miles in index class 4 was vulnerable on Saipan.

Table 4.2-12. Natural resources exposure to typhoon-related storm surge by municipality.

Municipality	SH Index No.	SH Total Area (sq miles)	Suitable Habitat (SH) for Species of Conservation Concern Exposed	
			SH Area (sq miles)	% of SH Total Area
Saipan	1	26.5	0.8	3%
	2	14.5	0.2	2%
	3	27.8	2.6	9%
	4	4.0	1.2	31%
Saipan Total		**72.8**	**4.9**	**7%**
Tinian	1	1.8	0.1	6%
	2	35.8	1.3	4%
	3	7.8	3.0	38%
	4	0.1	0.1	61%
Tinian Total		**45.4**	**4.4**	**10%**
Rota	1	10.5	0.3	4%
	2	2.0	0.1	6%
	3	13.5	1.0	7%
	4	15.6	0.1	1%
Rota Total		**41.6**	**1.6**	**4%**

Cultural resources throughout the islands are vulnerable to the effects of high wind, heavy rainfall, debris, and storm surge associated with typhoons. Resources located at the coast are at risk from storm surge and flooding, including powerful wave action toppling structures, erosion, debris, and saltwater intrusion. To evaluate the vulnerability of cultural resources to storm surge, cultural resources data was overlaid in GIS with the storm surge hazard area. Table 4.2-13 summarizes the square miles designated for cultural resources within the storm surge hazard area. The greatest area exposed was on Saipan with ~2 square miles of area identified for as sensitive for cultural resources by the Historic Preservation Office are vulnerable.

Table 4.2-13. Cultural resources exposure to typhoon-related storm surge by municipality.

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	0.6	4%
Sensitive Area	16.0	1.5	10%
Saipan Total	**30.9**	**2.1**	**7%**
Tinian			
National Historic Landmark	0.0	0.0	0
Sensitive Area	16.6	0.1	1%
Tinian Total	**16.6**	**0.1**	**1%**
Rota			
National Historic Landmark	0.4	0.0	1%
Sensitive Area	33.9	0.6	2%
Rota Total	**34.3**	**0.6**	**2%**

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

Climate Change

As mentioned above, climate change will amply future typhoons in several ways. SLR will reduce the protective function of coastal assets such as coral reefs and allow storm-driven waves to reach further inland. An increase in wave energy and reach will likely cause shoreline erosion to worsen. ENSO events are likely to become more frequent, which will likely result in more very strong typhoons.

The effects of SLR on typhoons are expected to be relatively similar to the effects of SLR on event-based floods. Therefore, the exposure analysis for event-based flooding with 3 ft of SLR presented in Section 4.5.2 (Flood: Vulnerability Assessment) is assumed to be similar to the impacts of storm surge from future typhoons.

Because Saipan is the most developed and populated island, it remains the most vulnerable municipality to the future effects of storm surge/event-based flooding with 3 ft of SLR. See Section 4.5.2 (Flood: Vulnerability Assessment) for analysis details.

Potential or Projected Development

The Department of Public Lands (DPL) has identified area of that may be developed in the future (DPL, 2019). For this spatial analysis, specific land use types selected for evaluation included lands identified for homesteads, agricultural and villages, school relocation sites, civic uses, energy production, and recreation. These land use types were selected because of the potential for people to be present (residences, civic uses, and recreation areas) and the vulnerability of power infrastructure to hazards. Future analyses should continue to include additional community lifelines and critical facilities.

To evaluate the potential effects of storm surge, parcels identified by DPL for future development were overlaid in the GIS with the storm surge hazard zone. Most future development is planned outside the storm surge hazard zone; however, a small area (less than 0.01 square miles) of area designated for village homesteads on Tinian may be vulnerable to typhoon storm surge (Table 4.2-14).

Table 4.2-14. Identified future development parcel exposure to typhoon-related storm surge.

		Future Land Use Exposed	
Municipality	**Total Area of Future Land Use Type (sq miles)**	**Land Use Type (sq miles)**	**% Land Use Type Exposed for total Area of Each Land Use Type**
Saipan			
Agricultural Homestead	0.07	0.00	0.0%
Civic Uses	0.04	0.00	0.0%
Homestead Village	0.10	0.00	0.0%
Recreation	0.36	0.01	3.1%
Renewable Energy	0.24	0.00	0.0%
School Relocation	0.11	0.00	0.0%
Saipan Total	**0.91**	**0.01**	**1.2%**
Tinian			
Agricultural Homestead	1.57	0.00	0.0%
Homestead Village	2.92	0.01	0.3%
Tinian Total	**4.48**	**0.01**	**0.2%**

Table 4.2-14. Identified future development parcel exposure to typhoon-related storm surge (*cont'd*).

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed	
		Land Use Type (sq miles)	% Land Use Type Exposed for total Area of Each Land Use Type
Rota			
Civic Uses	0.14	0.00	0.0%
Cultural Visitor Center	0.01	0.00	0.0%
Homestead Village	2.62	0.00	0.0%
Power Plant	0.03	0.00	0.0%
Renewable Energy	0.10	0.00	0.0%
Rota Total	**2.90**	**0.00**	**0.0%**

Projected Changes in Population

The population in the Commonwealth is expected to remain relatively similar through the end of the century (United Nations, 2022). However, the proportion of older adults is expected to grow in coming years. Older adults can be more vulnerable during typhoon events due to several factors including decreased mobility, limited access to transportation, increased functional challenges, illness, dependence on electrical-powered medical devices. Shelter capacity to accommodate people with medical needs, especially those requiring constant electrical power, remains a challenge in the commonwealth. As the number of older adults increases in the population, the number of people requiring specialized shelter during a typhoon is also expected to increase.

4.2.3 Mitigation Success

Mitigation and recovery efforts have been ongoing in the Commonwealth since 2015 when Super Typhoon *Soudelor* struck. With compounding damage from Typhoon *Mangkhut*, Super Typhoon *Yutu,* and Typhoon *Mawar,* the CNMI Hazard Mitigation Grant Program (HMGP) has worked to help CNMI agencies to secure grant funding to implement a wide range of mitigation projects including storm shutter installation, replacement of wooden utility poles with concrete poles, installation of emergency generators, storm readiness projects, and many planning and design projects. The *Citizen-Centric Report, Fiscal Year 2023* published by the HMGP (2023) highlights numerous completed and ongoing hazard mitigation projects that will help reduce risks from future storms and help increase the resiliency and recoverability of the built environment and CNMI communities (Figure 4.2-13).

1 ABOUT HMGP
2 PERFORMANCE
3 FINANCES
4 OUTLOOK

Projects Completed in FY 2023

PDM FY 17 DCCA Tinian Aging Center Storm Shutter Project $33,270
PDM FY 17 DCCA Tinian Youth Center Storm Shutter Project $38,610
DR-4235-MP CUC Water System Mitigation Project Phase I $7,264,231
DR-4235-MP CUC Kannat Tabla Flood Control & Drainage Improvement Project $2,888,966
DR-4404 MP CPA Tinian Seaport Shutter Project $26,177
DR-4404 MP DPS Susupe Office Building Shutters $37,223.59
DR-4404 MP DCCA DYS Tanapag Youth Center Shutter Project $33,277.42


CUC Water System Mitigation Project, Site 11- San Vicente Generator Installation & Generator House Construction

Ongoing Projects

Post-Disaster HMA Programs
Hazard Mitigation Grant Programs

DR 4404-MP TYPHOON YUTU
Advance Assistance $4.5M
ARC Building Generator $28,952
CHCC Hospital Generator Phase I $128,400
CHCC Tinian Health Center Generator $94,500
CPA Saipan Airport Tower Base Office Shutter Project $21,147
CUC CHCC Underground Power $720,800
CUC Rota Concrete Power Poles $175,140
CUC Sadog Tasi Office & Lift Station Generator $76,437
CUC Tinian Concrete Power Poles $308,303.10
CUC Water System Mitigation Project Phase II $4,507,024
DFEMS Fire Station 1 & 5 Concrete Roof Phase I Design $212,500
DFEMS Tinian Fire Station 7 Generator Phase I Design $72,798
DPW Garapan Downtown Flood Management, Phase I $783,750
DPW Planning Road Condition & Flood Hazard Mapping $686,100
MOTA Tinian Early Warning System $259,615
NMHC Koblerville & Mihaville Estate Shutters $525,826
SAAR HOPE Recovery Center Shutters & Generator Project $264,488

DR 4396-MP TYPHOON MANGKHUT
CPA Rota Airport Rescue and Fire Fighting Facility Shutters $29K

Pre-Disaster HMA Programs
PDM and BRIC

BUILDING RESILIENT INFRASTRUCTURE & COMMUNITIES (BRIC)
DPW Dandan Flood & Storm Water Drainage Improvement $254,973
OPD Micro Beach Mitigation Scoping Assessment $145K
OPD/Zoning Blighted Buildings $200K

PRE-DISASTER MITIGATION FY 17 - FY 19
CHCC Tinian Health Center Storm Readiness Project $40K
CUC Sadog Tasi Wastewater Facility Storm Shutter Project $29,061.25
DCCA Saipan Office on Aging Storm Readiness Project $160,674
DOL Saipan Shutter Protection Project $16K
NMHC Storm Readiness Project $138,860

The BRIC program was created by S.3041 of the Disaster Recovery Reform Act of 2018 which amends Section 203 of the Stafford Act and replaces the PDM program. The first BRIC cycle started FY 2020.

Figure 4.2-13. Excerpt from the fiscal year 2023 *Citizen-Centric Report* prepared by the Hazard Mitigation Grant Program highlighting completed and ongoing mitigation projects.

References

Belles, J. (2018). *Typhoon Alley: Where the Planet's Most Intense Tropical Cyclones Most Frequently Happen*. The Weather Channel. https://weather.com/storms/typhoon/news/typhoon-alley-most-powerful-cyclone-earth

[HMGP] CNMI Hazard Mitigation Grant Program. (2023). *Citizen-Centric Report, Fiscal Year 2023*. CNMI Office of the Governor. https://www.opacnmi.com/oockuvoa/2023/10/Hazard-Mitigation-Grant-Program-FY-2023-Citizen-Centric-Report.pdf

[HSEM] CNMI Homeland Security and Emergency Management. (2018). *2017 CNMI Catastrophic- Typhoon Plan, Annex to the FEMA Region IX All-Hazards Plan* (p. 417). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2021). *Commonwealth of the Northern Mariana Islands Emergency Operations Plan* (p. 132). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024). *2023 CNMI THIRA Pre-Submission* (p. 46). CNMI Homeland Security and Emergency Management.

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[FEMA] Federal Emergency Management Agency. (2020). *Special Wind Region (SWR) Maps for the Commonwealth of the Northern Mariana Islands (CNMI)* (p. 11). US Department of Homeland Security.

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

Itzkin, M., Moore, L. J., Ruggiero, P., Hacker, S. D., & Biel, R. G. (2021). The relative influence of dune aspect ratio and beach width on dune erosion as a function of storm duration and surge level. *Earth Surface Dynamics*, *9*(5), 1223–1237. https://doi.org/10.5194/esurf-9-1223-2021

Kang, N.-Y., Kim, D., & Elsner, J. B. (2019). The contribution of super typhoons to tropical cyclone activity in response to ENSO. *Scientific Reports*, *9*(1), 5046. https://doi.org/10.1038/s41598-019-41561-y

[NOAA] National Oceanic and Atmospheric Administration. (n.d.). *Hurricane Preparedness-Hazards* [National Hurricane Center and Central Pacific Hurricane Center]. Retrieved April 6, 2024, from https://www.nhc.noaa.gov/prepare/hazards.php

[NOAA] National Oceanic and Atmospheric Administration. (2024). *Historical Hurricane Tracks*. https://coast.noaa.gov/hurricanes/#map=4/32/-80

[NOAA] National Oceanic and Atmospheric Administration, National Centers for Environmental Information. (2024). *Southern Oscillation Index (SOI) | El Niño/Southern Oscillation (ENSO)*. https://www.ncei.noaa.gov/access/monitoring/enso/soi

National Weather Service. (2021). *The Saffir-Simpson Hurricane Wind Scale* (p. 4). National Weather Service.

[HMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

Tropical Cyclone Classification | National Oceanic and Atmospheric Administration. (2023). https://www.noaa.gov/jetstream/tropical/tropical-cyclone-introduction/tropical-cyclone-classification

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

US Geological Survey, US Department of Interior. (n.d.). *Floods: Recurrence intervals and 100-year floods*. Retrieved March 29, 2024, from https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods

Wamsley, T. V., Cialone, M. A., Smith, J. M., Atkinson, J. H., & Rosati, J. D. (2010). The potential of wetlands in reducing storm surge. *Ocean Engineering*, *37*(1), 59–68. https://doi.org/10.1016/j.oceaneng.2009.07.018

What is a Storm Surge? Video, photos, information and more. (n.d.). Retrieved April 5, 2024, from https://geology.com/articles/storm-surge.shtml

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.3 Tsunami

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.3 Tsunami

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Tsunami	Occasional	Occasional	Significant	Medium

See table 4.1-1 for criteria definitions.

2024 Stante Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, the hazard profile was updated with information and graphics from recent reports and research.
- New and updated figures and information from federal agencies were incorporated.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to seismic activity is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.
- A mitigation success story achieved since 2018 was added to highlight continuous progress toward lowering the vulnerability of the Commonwealth to tsunami events.

4.3.1 Hazard Profile

Description

A tsunami is a series of waves generated in a body of water by an impulsive disturbance that vertically displaces the water column. Tsunamis are characterized as shallow-water waves with long periods and wavelengths. A tsunami possesses the potential to have a wavelength more than 62 miles long and a period on the order of one hour.

Tsunami can be generated by earthquakes, landslides, volcanic eruptions, and explosions. Tsunamis are created when the sea floor abruptly deforms and displaces the overlying water from its equilibrium position. Waves are formed when the displaced water mass, which is subjected to gravitational forces, attempts to regain its equilibrium. The initial size of a tsunami is determined by the vertical movement of sea floor deformation, which is a product of the magnitude, depth, and fault characteristics of the source event. The size of a tsunami is determined by the event type, the velocity of the sea floor deformation, the efficiency of energy transfer from the sea floor to the water column, and coastal and shoreline features such as shoreline and near-shore bathymetry. Tsunamis are sometimes referred to as *near-field*—meaning that the source of the tsunami is close to the coast and may arrive within 1 hour with little to no warning time—or *far-field*—meaning that the tsunami is generated far away from the coast and there is more time to issue and respond to warnings. For earthquakes, it generally takes a magnitude > 7.0 to generate a near-field tsunami and > 8.0 for a far-field tsunami with the potential to cause damage (Wood et al., 2011).

When a tsunami finally reaches the shore, it may appear as a rapidly rising or falling tide, a series of breaking waves, or even a bore. A bore is a traveling wave with an abrupt vertical front or wall of water when the wave moves from deep water to shallow. Often, the first sign of a tsunami is a receding water level caused by the trough of the wave. In some instances, however, the first sign of a tsunami is a small rise in the water level just before the recession. In both cases, the incoming wave approaches the shore much like the incoming tide, though much more rapidly. The maximum vertical height of the water in relation to normal sea level is referred to as *run-up* and the maximum horizontal distance is referred to as *inundation* (Figure 4.3-1).

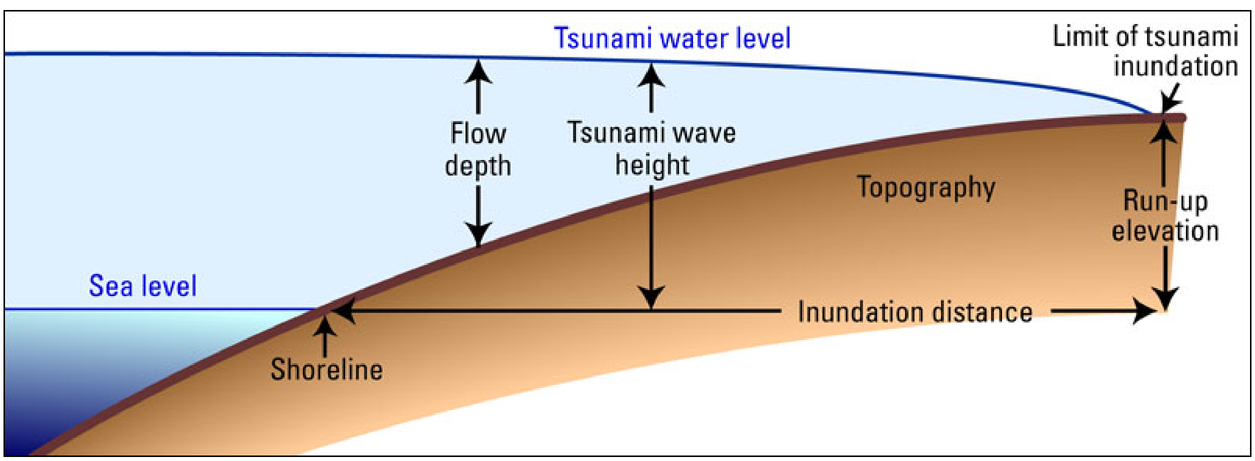


Figure 4.3-1. Tsunami terms.
Source: USGS (https://www.usgs.gov/media/images/tsunami-terms).

Reefs, bays, entrances to rivers, undersea features and the slope of the beach interact to modify the tsunami as it approaches the shore. Fringing and barrier reefs appear to have a mitigating influence on tsunamis by dispersing the wave energy. Islands in a group may *shadow* one another reducing the tsunami effect. Small islands may experience reduced run-up as the tsunami waves may refract around them.

Fatalities have occurred where people have ventured onto the exposed reef-scape to gather fish or explore the area during receding water. When the tsunami wave returns to cover the exposed coastline, it is traveling faster than people can run. Although there may be an interval of minutes or perhaps an hour between each wave, later waves are typically more destructive than the first. Residents returning too soon to the waterfront, assuming that the worst has passed, represent a preventable tragedy.

Location

Tsunami can occur in any large body of water; however, of the 754 confirmed events in the Global Historical Tsunami Database (GHTD), 78% of the tsunami occurred in the Pacific Ocean around geologically active zones (National Weather Service, 2024). Since 1990, most tsunami were generated off the coast of Japan (21%), then followed by Russia (8%) and Indonesia (8%). Most tsunamis are small, cause little damage to the nearby coastlines, and do not travel to distant shores. Powerful tsunamis have caused significant damage and death along distant coasts. Data from the GHTD shows the most damaging tsunami in the Pacific since 1900 have originated off Alaska, Chile, Japan, Indonesia, and Russia.

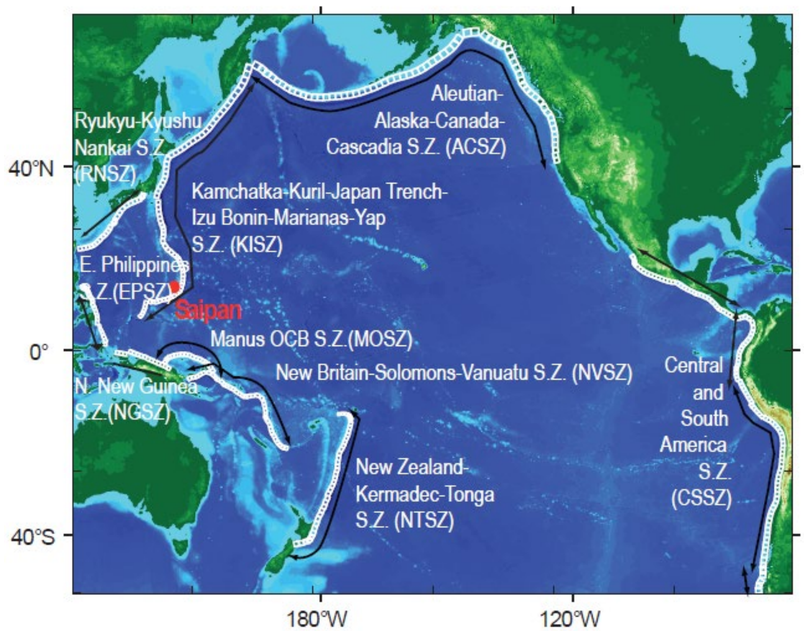


Figure 4.3-2. Pacific Basin unit sources that comprise the NOAA propagation database used as the basis for this numerical study. Saipan is shown in relation to the database subduction zones labeled in white on the map.
Source: Uslu et al. (2013)

A tsunami risk assessment was completed for the Commonwealth of the Northern Mariana Islands (CNMI) (Uslu et al., 2013). Results from the simulations showed that a local tsunami generated along the Mariana Trech could be potentially devastating to Saipan, Tinian, and Rota. A local tsunami from the Mariana Trench could reach the islands in a short time and there would be very little warning to evacuate. Tsunamis generated in other parts of the Pacific may also threaten the CNMI, but there would likely be ample warning time to prepare and evacuate vulnerable populations. Results of the simulations suggest that tsunami originating in the Western Aleutians, the Eastern Philippines, Japan, the Manus Trench, and New Guinea subduction zones could be a serious threat to all the Mariana islands. However, the effects from tsunami depend on the direction of the tsunami's approach to the islands. The southern coast of Saipan is most vulnerable to tsunami originating from the East Philippine, Ryukyu-Nankai, and Kuril-Kamchatka-Japan subduction zones; Saipan's western barrier reef provides some protection from tsunami (Figure 4.3-3).

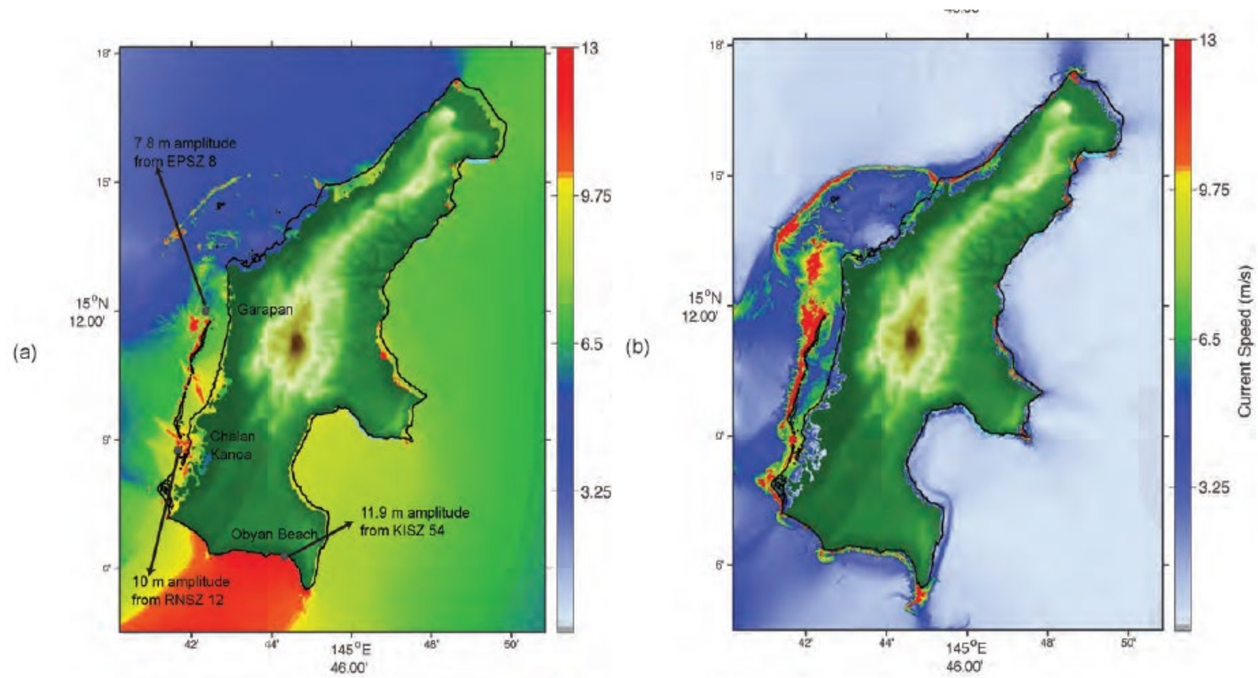


Figure 4.3-3. Maximum tsunami amplitudes (a) and currents (b) at Saipan computed using the high-resolution model for the 26 potential worst-case scenarios.
Source: Uslu et al. (2013). EPSZ 6, East Philippine Zone 6, RNSZ 12, Ryukyu-Nankai Zone 12, KISZ 54, Kuril-Kamchatka-Japan Zone 54 (Figure 4.3-2).

Tinian is most at risk from tsunami approaching from the east, but Tinian's east coast is relatively steep and undeveloped, so the vulnerability is likely low. However, the San Jose area on Tinian is vulnerable to tsunami originating from the Philippine and the Kuril-Kamchatka-Japan subduction zones (Figure 4.3-5).

Similar to San Jose, Songsong Village on Rota is also likely vulnerable to tsunami originating from the Philippine and the Kuril-Kamchatka-Japan subduction zones (Figure 4.3-4).

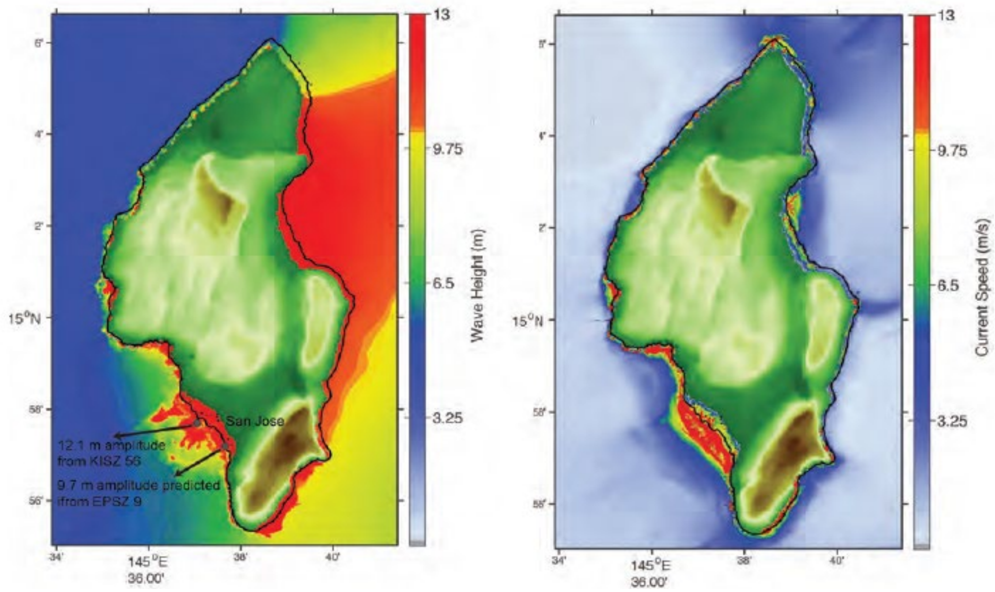


Figure 4.3-4. Maximum tsunami amplitudes (a) and currents (b) at Tinian computed using the high-resolution model for the 26 potential worst-case scenarios.

Source: Uslu et al. (2013). EPSZ 9, East Philippine Zone 9, KISZ 56, Kuril-Kamchatka-Japan Zone 56 (Figure 4.3-2).

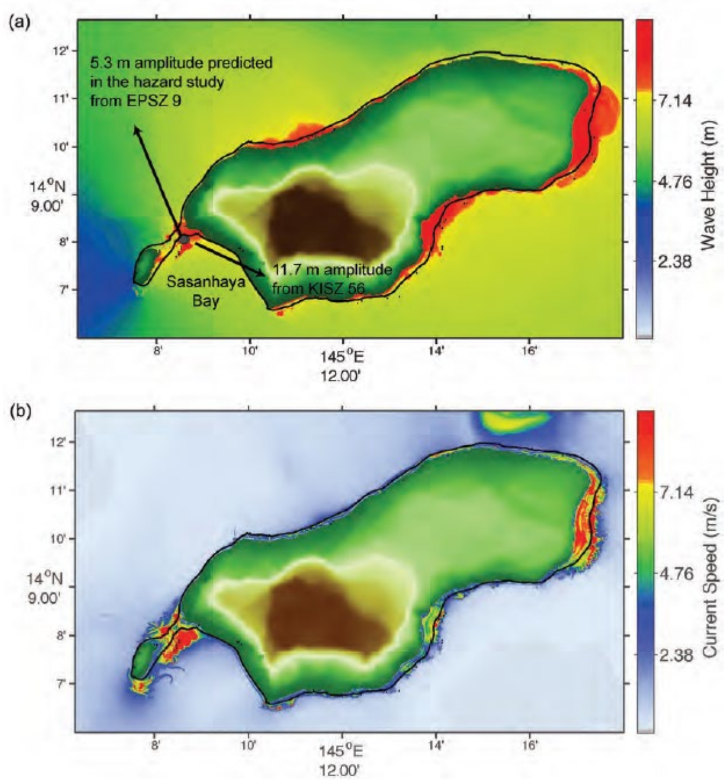


Figure 4.3-5. Maximum tsunami amplitudes (a) and currents (b) at Rota computed using the high-resolution model for the 26 potential worst-case scenarios.

Source: Uslu et al. (2013). EPSZ 9, East Philippine Zone 9, KISZ 56, Kuril-Kamchatka-Japan Zone 56 (Figure 4.3-2).

Extent

While most tsunami have historically caused little damage to the Commonwealth, the 2013 tsunami risk assessment demonstrates the potential risk to Saipan, Rota, and Tinian.

A tsunami's effect at the shoreline is measured in terms of run-up height and inundation (Figure 4.3-1). Run-up and inundation can vary considerably over short distances with one area experiencing no damaging wave activity, while another area waves can be large and violent. The first wave may not be the largest in the series of waves. Run-up tends to be highest at steep shorelines, while inundation is greatest along low-lying coastal plains.

When a tsunami reaches the shore, the water level can rise many feet. In extreme cases, the water level can rise to more than 50 ft for tsunamis of distant origin, and over 100 ft for tsunamis generated near the earthquake's epicenter (State of Hawaiʻi Emergency Management Agency, 2023).

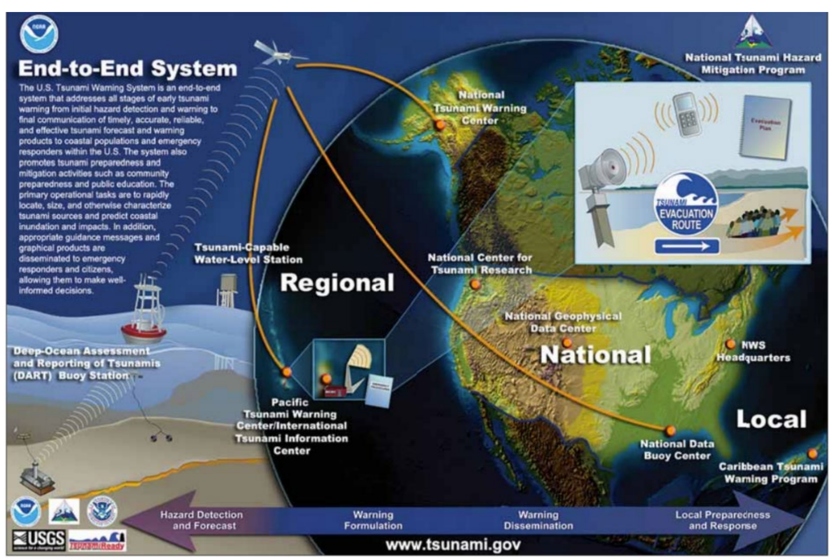
Warning Time

Tsunamis can be generated locally (i.e., near-field) along the tectonically active zone of the Mariana Trench. Warning time for local events is relatively short. For example, a near-field tsunami generated near Sarigan Island in 2010 reached Saipan 23 minutes following the event.

Far-field tsunamis originate at locations distant from the Commonwealth. Although these tsunamis originate far from the Commonwealth, the tsunami waves lose little energy in the open ocean environment and can cause great damage when they reach a shoreline. For far-field tsunamis, there is typically ample warning time to prepare and evacuate inundation zones.

Evacuation Plans and Warning Systems

The Pacific Tsunami Warning System (PTWS) was officially established in 1968. The goal of the system is to provide timely and reliable alerts. The PTWS addresses all stages of a tsunami warning from detection of the initial hazard, the issuing watches and warnings, to final communications to emergency responders to prepare for an event.



Source: International Tsunami Information Center (2015)

The National Oceanic and Atmospheric Administration (NOAA) operates two tsunami warning centers, which are staff 24 hours a day, 7 days a week. The Pacific Tsunami Warning Cener (PTWC) provides official tsunami warning for the Commonwealth. The PTWC issues the following tsunami messages: warnings, watches, advisories, information statements, seismic information statements, and warning cancelations (Figure 4.3-6). The National Weather Service (2024) provides the following definitions for tsunami messages:

Figure 4.3-6. Tsunami alerts.
Source: National Weather Service (https://www.weather.gov/safety/tsunami-alerts)

- **Tsunami Warning:** A tsunami warning is issued when a tsunami with the potential to generate widespread inundation is imminent, expected, or occurring. Warnings alert the public that dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after initial arrival. Warnings alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled based on updated information and analysis.
- **Tsunami Advisory**: A tsunami advisory is issued when a tsunami with the potential to generate strong currents or waves dangerous to those in or very near the water is imminent, expected, or occurring. The threat may continue for several hours after initial arrival, but significant inundation is not expected for areas under an advisory. Appropriate actions to be taken by local officials may include closing beaches, evacuating harbors and marinas, and the repositioning of ships to deep waters when there is time to safely do so. Advisories may be updated, adjusted geographically, upgraded to a warning, or cancelled based on updated information and analysis.
- **Tsunami Watch**: A tsunami watch is issued when a tsunami may later impact the watch area. The watch may be upgraded to a warning or advisory or canceled based on updated information and analysis. Emergency management officials and the public should prepare to take action.
- **Tsunami Information Statement**: A tsunami information statement is issued when an earthquake or tsunami has occurred of interest to the message recipients. In most cases, information statements are issued to indicate there is no threat of a destructive basin-wide

tsunami and to prevent unnecessary evacuations. Information statements for distant events requiring evaluation may be upgraded to a warning, advisory, or watch based on updated information and analysis.

- A **cancellation** is issued after an evaluation of water-level data confirms that a destructive tsunami will not impact an area under a warning, advisory, or watch or that a tsunami has diminished to a level where additional damage is not expected.

Tsunami messages are issued to emergency managers and other local officials and the public. The PTWC automatically issues a Tsunami Watch for any earthquake having a magnitude > 7.0 and located in an area where a tsunami can be generated. If tsunami activity is detected and the threat is imminent, a tsunami warning is broadcast through local radio and television, marine radio, wireless emergency alters, NOAA Weather Radio, and NOAA websites, such as *Tsunami.gov*. Evacuation procedures are implemented, and sea going vessels are advised to head out to sea, where in deep waters they will not be affected by the tsunami.

The PTWC also promotes tsunami preparedness through community preparedness and public education, including programs like TsunamiReady® (see Section 4.3.3 (Mitigation Success Story) for details about the TsunamiReady® program in the Commonwealth).

Although tsunami inundation models were developed for the Commonwealth, prior to 2023 no official tsunami evacuation maps were available to emergency managers, residents, or visitors. In 2023, through a collaborative process, federal and commonwealth agencies worked with private organizations to develop tsunami inundation and evacuation maps (NOAA-OCM, 2023). The team used tsunami models from 2009 and compared the data with NOAA 2020 topobathy Light Detection and Ranging (LiDAR) data. From this information the team identified hazard prone areas, used digital elevation models to revise the tsunami hazard zones for each island, and delineated priority evacuation areas. The maps were adopted by the Commonwealth. The Office of Homeland Security and Emergency Management (HSEM) is using the maps and associated web page for disaster preparedness and mitigation efforts and to further participation in the National Tsunami Hazard Mitigation Program.

Currently, only Rota has fixed tsunami warning sirens. Emergency management officials have applied for funding through the FEMA Building Resilient Infrastructure and Communities program to improve the early warning system on Saipan, Tinian, and Rota. Plans are to obtain portable sirens for Tinian and Saipan and to ensure that siren warning systems on all three islands are interoperable. The Commonwealth was also awarded $264,795 in tsunami mitigation funding from NOAA in fiscal year 2023.

Previous Occurrences

Tsunami history is poorly documented for the Commonwealth. Uslu et al. (2013) complied information from tsunami catalogues and list five credible tsunami for the CNMI in the years 1837, 1849, 1892, 1990, and 1993. The wave in 1849 is the only event in the Commonwealth known to have caused a fatality. The event in 1990 was caused by an underwater earthquake measuring 7.5 magnitude occurring 225 miles east of Saipan. This caused a small Tsunami which did not exceed 9.5 inches. In more recent years, the 2010 tsunami generated from an earthquake in Chile was registered on a tide gauge in Guam and the 2011 Tohoku tsunami caused flooding in Saipan and Tinian (Uslu et al., 2010). Also, in 2010 a submarine explosion at Sarigan Island caused a 6.4 magnitude earthquake that generated a tsunami. A tide gauge in Saipan detected the tsunami with a 1.4 inch amplitude above sea level approximately 23 minutes after the earthquake near Sarigan (National Tsunami Warning Center, n.d.). To help illustrate the potential risk of tsunami for the CNMI, Table 4.3-1 and Figure 4.3-7 summarize earthquakes with > 8.0 magnitude that occurred from 1900 to the present (Uslu et al., 2013).

Although similar risk was not assessed for the Northern Islands, a significant tsunami wave would likely have similar risks and all coastal development and populations on the Northern Islands is considered vulnerable.

Table 4.3-1. Earthquakes with magnitudes (M_w) greater than 8.0 in the Western Pacific.

Year	Longitude	Latitude	Depth (mi)	M_w	Location
1902	146	18	37	8.1	Agana, Guam
1906	138	34	211	8.4	Honshu, Japan
1909	142.5	31.5	50	8.3	Honshu, Japan
1909	145	12.5	62	8.0	Guam
1910	122.5	25.5	124	8.3	Taiwan
1911	131	28	99	8.7	Ryukyu Islands, Japan
1916	131.5	29.5	37	8.0	Duda, Japan
1918	125.2	45.4	21	8.3	Mindanao Island, Philippines
1920	122	23.5	6	8.3	Taiwan
1924	126.5	6.5	37	8.3	Mindanao Island, Philippines
1944	136	33.7	165	8.1	Kii, Japan
1946	135.6	33	18	8.1	Japan
1948	122	10.5	16	8.3	Panay, Philippines
1976	124	6	21	8.1	Mindanao Island, Philippines

Source: Uslu et al. (2013). $M_{w,}$ earthquake magnitude.

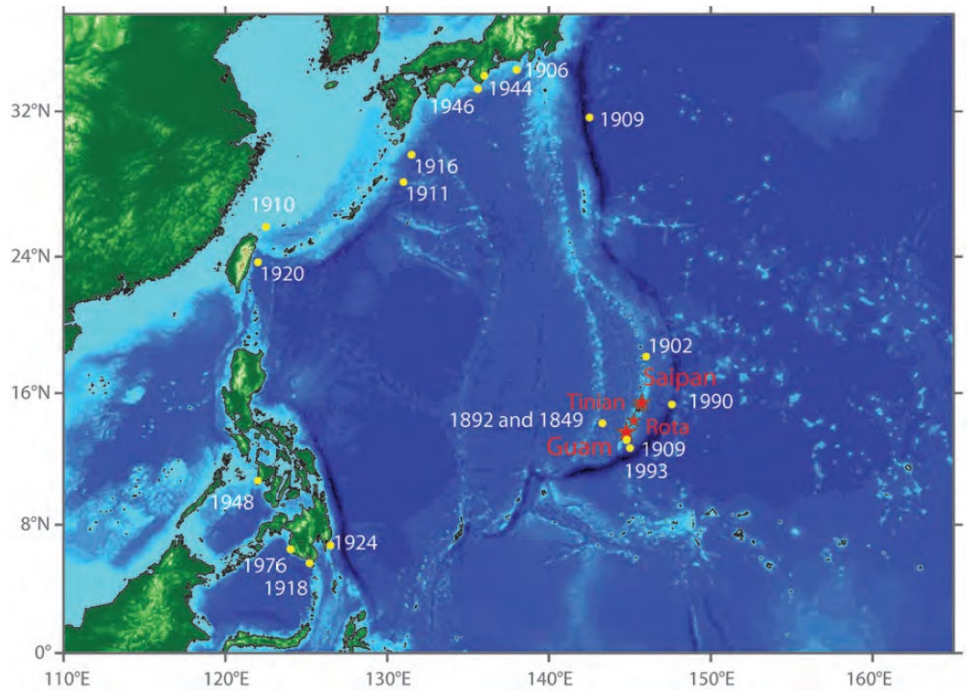


Figure 4.3-7. Earthquakes with magnitudes ≥ 8.0 identified as occurring in the western Pacific from USGS database and tsunami catalogues.
Source: Uslu et al. (2013)

Probability of Future Occurrence

Although no devastating tsunamis have struck the Commonwealth in recent history, the risk of severe impact from tsunami is present, but the future probability is difficult to predict. The probability of a tsunami is generally expressed as the potential of a return period and the wave run-up elevation with a 1% chance of being equaled or exceeded in any given year. Because of the limited historical data, a return period and the elevation of a tsunami with a 1% annual chance of occurring have not been and cannot be estimated for the Commonwealth. However, based on earthquake threat, locally and throughout the wider Pacific, the future frequency of a significant tsunami (similar to the impacts simulated by Uslu et al. 2013) is assumed to be at least 1% chance in 100 years.

Climate Change Considerations

Because the generation of tsunami is typically related to geologic phenomena, climate change is not expected to directly affect the future probability of tsunami. However, as sea levels continue to rise globally and locally in the Western Pacific, future tsunami may have greater potential inundations zones and the protective functions of reefs may diminish. Together these potential future conditions will likely increase the vulnerability of coastal populations in the Commonwealth.

However, current tsunami inundation models and risk assessments do not include future sea level rise (SLR); therefore, future vulnerability to tsunami at increased mean sea level is unknown.

4.3.2 Vulnerability Assessment

Tsunami sources originating along the subduction zones in the Eastern Philippines and offshore southern Japan pose the greatest risk to Commonwealth islands (Uslu et al., 2013). A 9.0 magnitude (M_w) earthquake along the Eastern Philippine subduction zone could result in tsunami with amplitudes exceeded 10 ft on Rota and exceeding 13 ft on Tinian and Saipan. A 9.0 magnitude (M_w) earthquake along the Ryukyu-Nankai subduction zone could result in a tsunami with an amplitude greater than 36 ft on Saipan.

Closer sources within the Marianas, primarily along the Mariana Trench subduction zone pose an even greater hazard. Predicted wave amplitudes at Saipan and Tinian would exceed 43 ft and would be greater than over 23 ft along the Rota coastline should a magnitude 9.0 earthquake occur in this area.

The recently updated tsunami inundation and evacuation zones for Saipan, Tinian, and Rota were used to evaluate exposure and vulnerability to the tsunami hazard (Figure 4.3-8). The scenario used to develop the updated tsunami maps was a merger of *worst case* events developed by Uslu et al. (2013) to allow focus on a single, comprehensive hazard Zone. Notably, this zone includes modeled inundation extents from a potential catastrophic (9.0+ magnitude) earthquake along the Marianas subduction zone, and therefore accounts for the Commonwealth's most significant near-field threat (Pacific Coastal Research and Planning, 2023). Losses for vulnerable assets were assumed to be 100%.

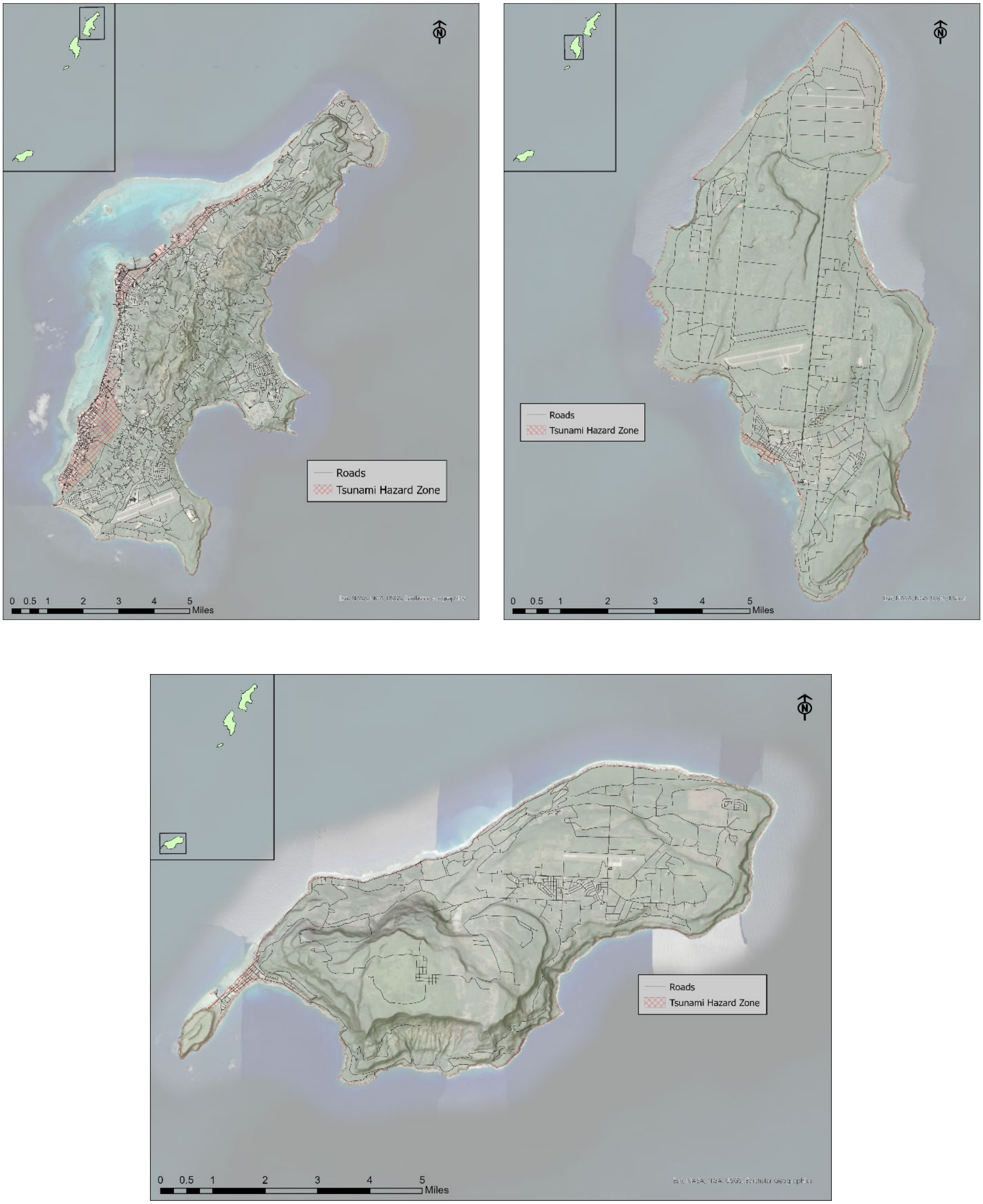


Figure 4.3-8. Tsunami inundation zones for Saipan, Tinian, and Rota based on a near-field earthquake along the Mariana Trench subduction zone.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the Commonwealth asset exposure and potential losses due to the tsunami hazard. Commonwealth assets include Commonwealth buildings, Commonwealth primary roads, and critical facilities and community lifelines.

Commonwealth Buildings

For the spatial analysis, 110 Commonwealth buildings were within the modeled tsunami inundation zone and considered vulnerable to the hazard. Vulnerable assets were assumed to be 100% lost. Table 4.3-2 and Table 4.3-3 summarize the Commonwealth buildings in the tsunami inundation area by municipality and agency, respectively. Saipan had the greatest number of vulnerable buildings (75) with a replacement cost value of ~$307 million, representing 32% of the replacement cost value of the total Commonwealth building inventory. The Department of Land and Natural Resources, Department of Public Safety, and the Public School System occupy the most buildings within the inundation zone. Many of these buildings are schools. With tsunami preparedness planning and the availability of recently updated tsunami evacuation maps, emergency mangers and public-school officials can plan for the timely evacuation of students and staff to designated safety zones along routes deemed to be safe.

Table 4.3-2. Commonwealth building exposure and potential losses to the tsunami hazard by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	75	$306,701,696	$306,701,696	32%
Tinian	83	$140,347,469	23	$53,233,100	$53,233,100	5%
Rota	58	$123,032,676	12	$45,505,443	$45,505,443	5%
Total	**387**	**$972,324,643**	**110**	**$405,440,239**	**$405,440,239**	**42%**

Table 4.3-3. Commonwealth building exposure and potential losses to the tsunami hazard agency.

Agency	Buildings Exposed			Estimated Potential Loss	
	No.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Commonwealth Healthcare Corporation	3	$55,874,026	6%	$55,874,026	6%
Commonwealth Utilities Corporation	19	$111,614,738	11%	$111,614,738	11%
Dept. of Community and Cultural Affairs	2	$1,443,348	0%	$1,443,348	0%
Dept. of Fire and Emergency Services	3	$1,950,114	0%	$1,950,114	0%
Dept. of Lands and Natural Resources	16	$88,722,172	9%	$88,722,172	9%
Dept. of Public Lands	1	$156,249	0%	$156,249	0%
Dept. of Public Safety	15	$17,163,816	2%	$17,163,816	2%
Dept. of Public Works	4	$15,561,238	2%	$15,561,238	2%
Marianas Visitors Authority	1	$247,864	0%	$247,864	0%
Mayor’s Offices	8	$8,401,715	1%	$8,401,715	1%
Office of the Attorney General	3	$1,306,400	0%	$1,306,400	0%
Office of the Governor	2	$2,022,012	0%	$2,022,012	0%
Office of Homeland Security & Emergency Management	1	$1,936,901	0%	$1,936,901	0%
Ports Authority	13	$21,470,406	2%	$21,470,406	2%
Private Entity	2	$2,608,262	0%	$2,608,262	0%
Public Library	1	$3,976,831	0%	$3,976,831	0%
Public School System	15	$68,219,171	7%	$68,219,171	7%
Other	1	$2,764,973	0%	$2,764,973	0%
Total	**110**	**$405,440,236**	**42%**	**$405,440,236**	**42%**

Northern Islands Commonwealth Facilities

In the Northern Islands, public facilities and typhoon shelters were rebuilt on Agrihan, Alamagan, and Pagan after being damaged by Super Typhoon *Yutu.* Tsunami inundation zones are not mapped for these islands. The elevation of each facility was not available. Structures below 30 ft or that are located on a coastal plain are likely vulnerable to a tsunami. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information, it is difficult to estimate the potential losses from a tsunami. In addition, the estimate of total replacement value does not account for the added costs to construct facilities in the Northern Islands due to the extreme isolation and logistical challenges of transporting construction materials and equipment and lack of port facilities.

Commonwealth Roads

Commonwealth roads are vulnerable to inundation and damage from tsunamis. Additionally, tsunami can deposit debris on roadways. Following a tsunami, several days to weeks may be needed to remove debris and repair damages. This may impact traffic patterns and may impede access to business, services, and communities. Saipan has the most miles of paved road and the greatest number of miles of paved roadway in the tsunami inundation zone. Although Rota has the fewest paved miles of roadway of all the islands, 15% are within the tsunami inundation zone posing a potentially large threat to paved roadways and communities on Rota.

Table 4.3-4. Commonwealth road exposure and potential losses to the tsunami hazard by municipality.

Municipality	Total Road Length (miles)	Exposed Road Length (miles)	% of Total
Saipan	87	19.1	22%
Tinian	67.1	0.9	1%
Rota	39.6	6	15%
Total	**193.8**	**26**	**13%**

Community Lifelines and Critical Facilities

Spatial analysis showed that about 32% of the Commonwealth critical facilities and community lifelines are within the tsunami inundation zone with most of the vulnerable facilities on Saipan (Table 4.3-5).

Table 4.3-5. Community lifeline and critical facility exposure and potential losses to the tsunami hazard by municipality.

Municipality	Total No. of CLF	Community Lifelines (CL) Exposed								
		Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety & Security	Transportation	Water Systems	Total No. Exposed
Saipan	138	0	18	5	3	2	6	8	7	49
Tinian	56	0	8	1	1	0	0	6	0	16
Rota	43	0	6	0	0	1	2	1	0	10
Total	**237**	**0**	**32**	**6**	**4**	**3**	**8**	**15**	**7**	**75**

Table 4.3-6 summarizes the number of critical facilities by community lifeline categories within the tsunami inundation zone with estimated replacement cost values. Thirty-two (70%) of the critical facilities that support the energy lifeline category are in the inundation zone and estimated

replacement cost values for these facilities is ~$118 million. Although only 3 critical facilities that support the health and medical lifeline are vulnerable to tsunami, the estimated replacement cost value is the second highest at $56 million.

Table 4.3-6. Critical facility exposure and potential losses to the tsunami hazard by lifeline category.

			Community Lifelines Exposed		Estimated Potential Loss	
Category	Total No. of CLF	Total Replacement Cost Value (RCV)	No. of CLF	Replacement Cost Value	Value	% of Total RCV
Communications	4	$864,517	0	$0	$0	0%
Energy	46	$140,851,551	32	$117,857,519	$117,857,519	21%
Food, Water, Shelter	24	$37,356,099	6	$11,139,239	$11,139,239	2%
Hazardous Material	9	$48,091,161	4	$18,807,659	$18,807,659	3%
Health and Medical	19	$187,643,812	3	$55,874,026	$55,874,026	10%
Safety and Security	35	$38,639,592	8	$10,085,923	$10,085,923	2%
Transportation	48	$119,925,667	15	$6,575,514	$6,575,514	1%
Water Systems	52	$50,052,062	7	$15,949,015	$15,949,015	3%
Total	**237**	**$623,424,461**	**75**	**$236,288,895**	**$236,288,895**	**41%**

Northern Islands Commonwealth Facilities

The Commonwealth facilities on Agrihan, Alamagan, and Pagan are considered critical facilities that provide essential community lifelines for island residents. Tsunami risk has not been mapped for the Northern Islands. Structures located 30 ft or below in elevation above mean sea level or are located on a coastal plain are likely vulnerable to a tsunami. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information, it is difficult to estimate the actual losses from a tsunami.

General Asset Vulnerability Assessment and Potential Losses

This section provides a summary of Commonwealth-wide exposure and potential losses to general building stock, socially vulnerable and total populations, and natural and cultural resource assets.

General Building Stock

All structures along the coast are vulnerable to tsunamis, especially buildings located along the western coastlines of Saipan, Tinian, and Rota. Buildings in the inundation zone are not only subjected to the powerful force of tsunami waves but may also be damaged or destroyed by debris carried by the waves.

The spatial analysis was conducted with the same approach used for the Commonwealth buildings; the general building stock layer was overlaid with the tsunami inundation zone in GIS to determine vulnerable structures. Loss to structures with the tsunami inundation zone was assumed 100%. The spatial analysis resulted in a total of 4,674 buildings, or 34% of the total general building stock, being vulnerable to tsunami. Most of vulnerable buildings are on Saipan, 3,381 or 33% of the total general building stock, with an estimated replacement cost value of ~$2.4 billion. Table 4.3-7 summarizes the general building stock vulnerability and estimated losses by municipality.

Table 4.3-7. General building stock exposure and potential losses to the tsunami hazard by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Costs Value (RCV)	Buildings Exposed		Potential Loss	
			No. of Bldgs.	Replacement Costs Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	3,381	$2,291,376,812	$2,291,376,812	33%
Tinian	908	$399,885,058	32	$9,390,984	$9,390,984	0%
Rota	1,261	$343,861,559	1,261	$85,527,794	$85,527,794	1%
Total	**14,953**	**$6,923,089,892**	**4,674**	**$2,386,295,589**	**$2,386,295,589**	**34%**

Widespread damage is expected if a large tsunami strikes the Commonwealth. This would have a negative effect on the economy by destroying businesses, disrupting normal commerce, and potentially deterring tourists for a period following the event. Impacts to residents would include displacement from destroyed or damaged homes and disruption of normal societal functions and services, such as public school. Impacts to the Commonwealth communities and economy for a large tsunami event will likely be similar to impacts experienced from strong typhoons.

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update

<u>Socially Vulnerable and Total Population</u>

The populations considered most vulnerable to natural hazards include children, the elderly (persons over the age of 65), and individuals with access and functional needs. Socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during a hazard. The cost of interventions to protect properties from tsunami risk may financially stress lower- or middle-income residents. Relocating may be difficult because of the expense and the availability of accessible housing, or the time needed to make housing accessible. Visitors recreating in or around the inundation areas are also vulnerable because they may not be as familiar with appropriate response and the best way to reach higher ground.

Also, people visiting or residing on the Northern Islands are at increased risk due to the proximity of active volcanoes and other seismic activity. It is possible that a tsunami originating event, such as large earthquake or volcanic eruption, can trigger a near-field tsunami that could arrive with little to no advanced warning. For people the Northern Islands population, knowing the natural warning signs of tsunami is critical because there may be only a short time to evacuate to safe ground.

Table 4.3-8 summarizes the total population and the socially vulnerable population estimated to be living in the tsunami inundation zone. The greatest number of people vulnerable to tsunami live on Saipan. A large proportion of the people vulnerable to tsunami on Saipan are in the highest socially vulnerability index (SVI) classes (4 and 5) indicating this segment of the population is at even greater risk from tsunami inundation. In addition, many public-school properties are within the inundation zone. Children may need extra time to evacuate to designated safety zones. Advanced planning and tsunami evacuation drills are essential to ensuring the safety of students and staff located in inundation zones.

Table 4.3-8. Commonwealth population based on 2020 census data exposed to the tsunami hazard by social vulnerability index and municipality.

				Proportion of Estimated Population Exposed		
Municipality	**SVI Index No.**	**Total No. Residences**	**Total Estimated Population**	**No. Residences**	**Estimated Population**	**% of Total Est. Pop. by SVI Index**
Saipan	1	1,670	4,652	7	41	1%
	2	1,832	6,476	303	990	15%
	3	2,682	14,443	523	4,133	29%
	4	2,191	11,654	589	4,293	37%
	5	948	5,855	420	2,217	38%
		52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**1,842**	**11,674**	**27%**
Tinian	1	249	571	0	0	0%
	2	496	1,458	26	78	5%
Tinian Total		**745**	**2,029**	**26**	**78**	**4%**
Rota	1	409	749	180	374	50%
	2	561	1,116	0	0	0%
Rota Total		**970**	**1,865**	**180**	**374**	**20%**

SVI=Social Vulnerability Index

Tsunami events can cause injuries and fatalities if timely evacuation does not occur. Further, tsunami waves can carry debris and people out to sea when they retreat. Currently, there are no estimates for the number of casualties a tsunami event might cause. The Commonwealth participated in the TsunamiReady® program to raise awareness and general preparedness of Commonwealth communities; this advance preparation will likely help to reduce injury and casualties from an event.

According to the Centers for Disease Control and Prevention, the primary health concerns after a tsunami event include clean drinking water, food, shelter and medical care for injuries. Flood water can pose health risks, such as contaminated water and food supplies. Most deaths from tsunamis are related to drowning; however, traumatic injuries are also a primary concern. Medical care is critical in areas impacted by a tsunami (Centers for Disease Control, 2013).

<u>Natural Resources</u>

Tsunami waves have the potential to impact terrestrial and marine ecosystems and resources. Fringing and barrier reefs do provide some protection against tsunami and storm surge for shorelines in the Commonwealth (Storlazzi et al., 2019; Uslu et al., 2013); however, damage from tsunami may reduce the protective function of coral reefs. Tsunami waves can also damage shorelines through scouring and erosion. Subsistence and commercial fisheries may be disrupted and affect the livelihoods of the people that depend on them.

Wastewater infrastructure, including sewer lines, pump station, and septic systems, is located within the tsunami inundation zone. A tsunami may lead to the failure of wastewater systems potentially diminishing water quality, impacting natural aquatic systems, and leading to human health exposure to these wastes.

Tsunami waves have the potential to generate large amounts of debris. Debris management is challenging in the Commonwealth due to its location and isolation. With limited landfill capacity, the ability to forecast the generation of debris from a tsunami would help improve planning for processing large amounts of debris at the landfill. Hazardous materials may be mixed with the debris and need to be considered during staging and disposal.

A spatial analysis was conducted using indices developed by Dobson et al. (2020) for terrestrial and marine species of conservation concern to estimate the square miles of suitable habitat within the tsunami inundation area. Table 4.3-9 summarizes the area of suitable habitat for each municipality. Higher suitable habitat index numbers indicate the area supports a higher concentration of species of conservation concern. Very little area of suitable terrestrial habitats with high index values on Saipan, Tinian, and Rota is within the tsunami inundation zone. However, on Saipan about ~26 square miles of marine suitable habitat, classed in the highest two tiers (3 and 4), are vulnerable to the effects of tsunami. For Rota about 20% of the marine suitable habitat is vulnerable to the effects of tsunami.

Table 4.3-9. Suitable habitat for species of conservation concern exposure to tsunami hazard by municipality.

Municipality	SH Index No.	SH Total Area (sq miles)	Suitable Habitat (SH) for Species of Conservation Concern Exposed			
			SH Land (sq miles)	% SH Land of SH Total Area	SH Marine (sq miles)	% SH Marine of SH Total Area
Saipan	1	26.5	3.0	4%	0.2	0%
	2	14.5	0.6	1%	0.1	0%
	3	27.8	1.5	4%	22.1	30%
	4	4.0	0.2	0%	3.8	5%
Saipan Total		**72.8**	**5.3**	**7%**	**26.1**	36%
Tinian	1	1.8	0.2	0%	0.0	0%
	2	35.8	0.9	2%	0.5	0%
	3	7.8	0.4	1%	5.8	13%
	4	0.1	0.0	0%	0.0	0%
Tinian Total		**45.4**	**1.5**	**3%**	**6.4**	**14%**
Rota	1	10.5	0.4	1%	0.2	1%
	2	2.0	0.1	0%	0.1	0%
	3	13.5	0.4	1%	4.9	12%
	4	15.6	0.4	1%	3.5	8%
Rota Total		**41.6**	**1.2**	**3%**	**8.7**	**21%**

Cultural Resources

Many cultural resources and heritage sites are located near the coast, including Chamorro and Carolinian historic sites. A spatial analysis was conducted to estimate the square miles designated as cultural resource areas within the tsunami inundation zone. Table 4.3-10 summarizes the square miles of sensitive areas for cultural resources vulnerable to tsunami by municipality. Saipan has the most square miles of vulnerable cultural resources to tsunami hazard.

Coastal sites are particularly vulnerable to submersion, downstream movement of items due to water receding and undercut shoreline sediment, changes in pH of buried artifacts, reduced site integrity due to soil displacement or accretion, increased risk of looting from exposure, and increased erosion due to water levels changes (Rockman et al., 2016). Historic landmarks are also susceptible to alteration and/or destruction of the historic landscape. Cultural landscapes are affected by flooding caused by a tsunami because it contributes to the loss of landscape features due to inundation, loss, or disruption of the use of foraging areas, loss of plant and animal species for subsistence, medicine, ceremony, etc. and degradation of vital cultural heritage resources. Loss of access to traditional places and cultural important sites (e.g., burial grounds, subsistence areas, etc.) and submersion of homelands are contributing stressors to and loss of social connections and interconnections. Post-flooding involves an increased risk of rot, fungal/insect attack, mold, and mildew on cultural resources. Swelling, distortion of wooden building materials and architectural features, spalling of wood, brick, and stone materials during drying and corrosion of masonry are adverse effects. For facilities that house collections, inundation will cause extensive damage to collection storage areas and artifacts. This results in an added strain on existing museum facilities and staff due to salvage operations. Collections are particularly vulnerable to flooding events brought on by tsunami due to increased risk of mold, increase rusting/corrosion of metal objects, and damage and destruction from increased humidity and moisture.

During a tsunami, contaminated waters may deposit sediment within sites degrading site conditions and potentially exposing site users to contaminants (e.g., petroleum constituents, hazardous materials, or *Escherichia coli* bacteria from sewage or pet waste). Sensitive burial areas may also be at risk from wave energy and flooding. Preservation planners and advocates who wish to help historic properties withstand tsunami hazards will need to work collaboratively with floodplain managers and emergency management experts to develop mitigation plans.

Table 4.3-10. Cultural resources exposure to tsunami hazard by municipality.

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	2.6	8%
Sensitive Area	16.0	4.0	13%
Saipan Total	**30.9**	**6.6**	**21%**
Tinian			
National Historic Landmark	0.0	0.0	0
Sensitive Area	16.6	0.5	3%
Tinian Total	**16.6**	**0.5**	**3%**
Rota			
National Historic Landmark	0.4	0.0	0%
Sensitive Area	33.9	1.2	4%
Rota Total	**34.3**	**1.2**	**3%**

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

Climate Change

As sea levels continue to rise globally and locally in the Western Pacific, future tsunami may have greater potential inundations zones and the protective functions of reefs may diminish. Together these potential future conditions will likely increase the vulnerability of coastal populations in the Commonwealth. However, current tsunami inundation models and risk assessments do not include future SLR; therefore, future vulnerability to tsunami at increased mean sea level is unknown.

Potential or Projected Development

The Department of Public Lands (DPL) has identified area of that may be developed in the future (DPL, 2019). For this spatial analysis, specific land use types selected for evaluation included lands identified for homesteads, agricultural and villages, school relocation sites, civic uses, energy production, and recreation. These land use types were selected because of the potential for people to be present (residences, civic uses, and recreation areas) and the vulnerability of power infrastructure to hazards. Future analyses should continue to include additional community lifelines and critical facilities.

Because tsunami inundation models do not incorporate future SLR, a spatial analysis was conducted using the current tsunami inundation zone overlaid with panels designed by the DPL for future development.

The spatial analysis resulted in no exposure of parcels designated for development on Saipan and Rota. On Tinian, a total of 0.06 square miles of area designated for village and agricultural homesteads are vulnerable to the tsunami hazard. The spatial analysis result tables are in Appendix D.

Projected Changes in Population

Population is expected to remain relatively stable though the end of the century (United Nations, 2022). However, the number of adults over 65 years is expected to increase in the population through 2100. Older adults are more vulnerable to the tsunami hazard for reasons described earlier and include factors such as decreased mobility and limited financial resources. Projected future development on public lands for new schools and residences is mostly located outside the current tsunami inundation zone.

4.3.3 Mitigation Success Story

Recently the CNMI Office of Homeland Security and Emergency Management developed tsunami evacuation maps in partnership with the Pacific Coastal Research and Planning team, and the whole community. As part of this project, a web application was developed to access online web maps of the inundation zones, evacuation routes and evacuation safety sites. New signs were installed along the routes on Saipan. In addition, tsunami outreach materials were updated including the development of an activity book for children.

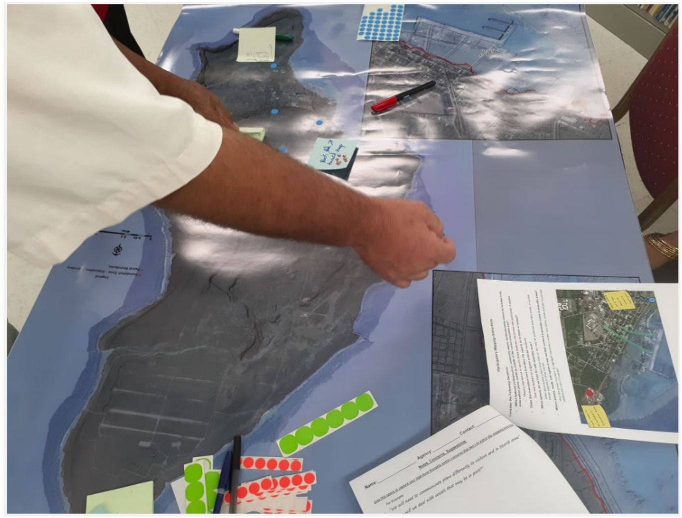


Figure 4.3-9. Local partners and community members on the island of Tinian review basemaps with LiDAR-derived tsunami evacuation zones during a participatory mapping workshop.
Source: NOAA Digital Coast.

Figure 4.3-10. Department of Public Safety, fire department, CNMI Homeland Security and school personnel escort Gregorio T. Camacho Elementary School students to their evacuation site during a tsunami drill.
Source: Marianas Variety, May11, 2022, contributed photo.

References

[CDC] Centers for Disease Control. (2013). *Health Effects of Tsunamis | CDC*. https://www.cdc.gov/disasters/tsunamis/healtheff.html

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[NOAA] National Oceanic and Atmospheric Administration, Office for Coastal Management. (2023). *Building Tsunami Preparedness in the Commonwealth of the Northern Mariana Islands Using Lidar*. https://coast.noaa.gov/digitalcoast/stories/tsunami-preparedness.html

National Tsunami Warning Center. (n.d.). *Tsunami of May 29, 2010*. Retrieved March 22, 2024, from https://tsunami.gov/previous.events/Sarigan_05-29-10/05-29-10.htm

National Weather Service. (2024). *National Weather Service—Tsunami Hazards*. https://www.tsunami.gov/?page=tsunamiFAQ

Pacific Coastal Research and Planning. (2023). *Tsunami Evacuation Mapping for the Commonwealth of the Northern Mariana Islands.* (p. 33). CNMI Office of Homeland Security and Emergency Management, Office of the Governor.

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

State of Hawai‘i Emergency Management Agency. (2023). *State of Hawai‘i 2023 Hazard Mitigation Plan*. State of Hawai’i.

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

Uslu, B., Eble, M., Arcas, D., & Titov, V. (2013). *Tsunami Hazard Assessment Special Series: Vol. 3. Tsunami Hazard Assessment of the Northern Mariana Islands* (p. 192). National

Oceanic and Atmospheric Administration, Office of Oceanic and Atmospheric Research, Pacific Marine Environmental Laboratory.

Uslu, B., Titov, V. V., Eble, M. C., & Chamberlin, C. D. (2010). *Tsunami hazard assessment for Guam* (noaa:11107). https://repository.library.noaa.gov/view/noaa/11107

Wood, N., Orcutt, J. A., Grabowski, M. R., Atwater, B. F., Crawford, G., Eisner, R. K., Lin, J., Luther, D. S., Milburn, H. B., Mileti, D. S., Okal, E. A., Synolakis, C. E., & Yeh, H. (2011). *Tsunami Warning and Preparedness: An Assessment of the U.S. Tsunami Program and the Nation's Preparedness Efforts*. National Academies Press. http://www.nap.edu

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.4 Drought

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.4 Drought

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Drought	Likely	Extensive	Significant	Medium

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, drought activity from 2019 to present from the US Drought Monitor was incorporated.
- New and updated figures and information from federal agencies were incorporated.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to the effects of drought is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.
- A mitigation success story achieved since 2018 was included to demonstrate continuous progress toward lowering the vulnerability of the Commonwealth to drought.

4.4.1 Hazard Profile

Description

Although tropical Pacific Islands generally have wet climates, they are vulnerable to periodic drought; however, Pacific Islands have generally been overlooked in previous global or national-level studies of weather. The generalized concept of drought conditions is a period of abnormally dry weather. For the 2024 SHMP Update, drought is defined as more than 20% below mean annual historic rainfall, which is based on downscaled climate projections for nearby Guam (Grecni et al., 2021). In addition, data from the US Drought Monitor is also used to describe drought conditions in the Commonwealth and the recent drought history is described below using the national drought categories (Figure 4.4-1).

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

Figure 4.4-1. US Drought Monitor definitions for drought conditions.
Source: US Drought Monitor

Drought diminishes natural stream flow and depletes soil moisture, which can cause social, environmental, and economic impacts. In general, the term *drought* is reserved for periods of moisture deficiency that are relatively extensive in both space and time. A drought is caused by a deficiency of rainfall and can be increased by other factors such as high temperatures, high winds, and low relative humidity. Drought can also result from human activities that increase demand for water. Expanding populations and use of irrigation all impose pressure on water supplies. The severity of drought depends not only on the duration, intensity, and geographic range, but also on the regional water supply demands made by human activities and vegetation.

Drought differs from other natural hazards in three significant ways. First, the onset and termination of a drought period are difficult to determine since the effects accumulate slowly and may linger even after the apparent termination of an episode. Second, the absence of a precise and universally accepted definition adds to the confusion about whether a drought exists and if so, identifying the degree of its severity. Third, unlike most other natural hazards, drought impacts are less obvious and are spread over a comparatively larger geographic area. These characteristics have hindered the development of accurate, reliable, and timely estimates of drought severity and effects.

Researchers recognize several types of drought which are all functionally linked (Polhemus, 2017). For example, metrological drought is characterized by a deficit in precipitation over a given period leads to hydrological, ecological, and agricultural drought, which can disrupt societal functions and cause socio-economic drought. Brief descriptions of each type of drought are provided below.

Meteorological Drought

This type of drought is usually defined on the basis of the degree of *dryness* from normal over some specified period of time. This definition is usually region-specific, and presumably based on a thorough understanding of regional climatology. Within the United States, meteorological drought is defined when there is less than 1/10 inch of rainfall in 48 hours. As a standard, meteorological measurements are the first indicators of drought.

Agricultural Drought

This type of drought links various meteorological characteristics to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration rates (i.e., drying rates), soil water deficits, and reduced groundwater and reservoir levels. Agriculture is usually the first economic sector to be affected by drought.

Hydrological Drought

This type of drought refers to precipitation deficiencies that reduce surface and subsurface water supplies. The frequency and severity of hydrological drought is often defined on a watershed basin scale and is measured as stream flow and volume capacity of major water sources such as lakes.

Ecological Drought

Meteorological drought can affect plant communities through increased evapotranspiration, reduced soil moisture, and increased plant water stress. This can lead to drying and increased flammability of living and dead vegetation, which promotes conditions for increased wildfire risk. Ecological drought is an interaction between precipitation and temperature acting in combination to drive evapotranspiration rates of plants.

Socio-economic Drought

The aggregate effects of the hydrological, ecological, and agricultural droughts may have profound effects on local communities, ranging from lack of drinking water and shortages of food to the spread of disease. Increased incident of fire may also be a factor.

Impacts to Water Supply

The availability of freshwater resources is already a concern for many Pacific Island communities, because of their unique geography and density of population, tourism, and urban centers. Many islands suffer from frequent droughts and water scarcity due to insufficient precipitation. Atolls are typically more vulnerable than high islands because uplift (orographic effect) is a major factor for precipitation in the tropical zone. Atolls also have less ground water storage capacity compared to high islands.

The island communities of the Marianas rely upon groundwater resources called freshwater lenses. The size of the groundwater lens is directly related to the size of the island. It is also related to the normal amount and type of precipitation (e.g., heavy downpours recharge lenses, while light rain generally does not), and the discharge of fresh lens water into the ocean. The larger islands have larger lenses, thus are better buffered against drought conditions. Smaller islands have no lenses or shallow lenses that easily become depleted or contaminated with salt water. During drought conditions, there is no recharge to the lens, and the fresh water can be depleted rapidly, especially if extraction is high. Low sea levels associated with El Niño–Southern Oscillation (ENSO) periods lower the water table even more, making it more difficult to access the water and easier to disturb the fragile connection between the freshwater lens and the underlying salt water. Water quality is also an issue: many volcanic islands, like the Marianas, have highly permeable rock, which increases the potential for groundwater contamination. In some Pacific Islands, pollution problems reduce the ability of the groundwater system to provide clean, fresh water.

Patterns of precipitation are important in determining whether islands have an adequate freshwater supply. Long periods of rainfall are needed to recharge the freshwater lenses because short and light rainfall tends not to contribute to filling aquifers (groundwater sources). Land cover is also an important factor in how much water permeates into the ground or flows into streams. If the land is covered by forest, the forest floor absorbs and holds the rainwater for drier periods, but if the forest has been removed by urban development, for example, the rain runs off rapidly leaving less for recharge during dry conditions. On some islands, destruction of forest cover has caused many formerly year-round streams to stop flowing in the dry seasons and has contributed to landslides during periods of heavy rain.

<u>EL Niño–Southern Oscillation Conditions</u>

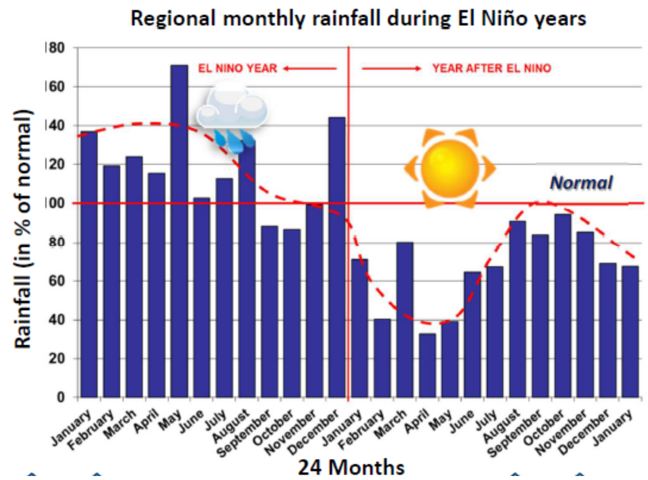


Figure 4.4-2. Rainfall patters decrease duirng El Niño years and dry conditions can persist for many months.
Source: PEACC (n.d.)

Droughts impacting the Commonwealth of the Northern Mariana Islands (CNMI) have been associated with ENSO. During ENSO events climate conditions change dramatically over the Pacific Basin. Sea surface temperatures warm during ENSO events and disrupt normal trade wind patterns, which leads to drier conditions in the Western Pacific (Figure 4.4-2). ENSO conditions can sometimes last a year or more and can start as early as March and peak in December (Pacific ENSO Applications Climate Center, n.d.). ENSO events are expected to increase as the climate continues to warm (Cai et al. (2014) in Mycoo et al., 2022). Researchers estimate there have been 30 ENSO events between 1900 and 2023 with strong events in 1982, 1997, and 2015 (Figure 4.4-3). The two most recent ESNO events occurred in 2019 and 2023, with the event in 2023 likely being one of the strongest ENSO on record (NOAA, 2023).

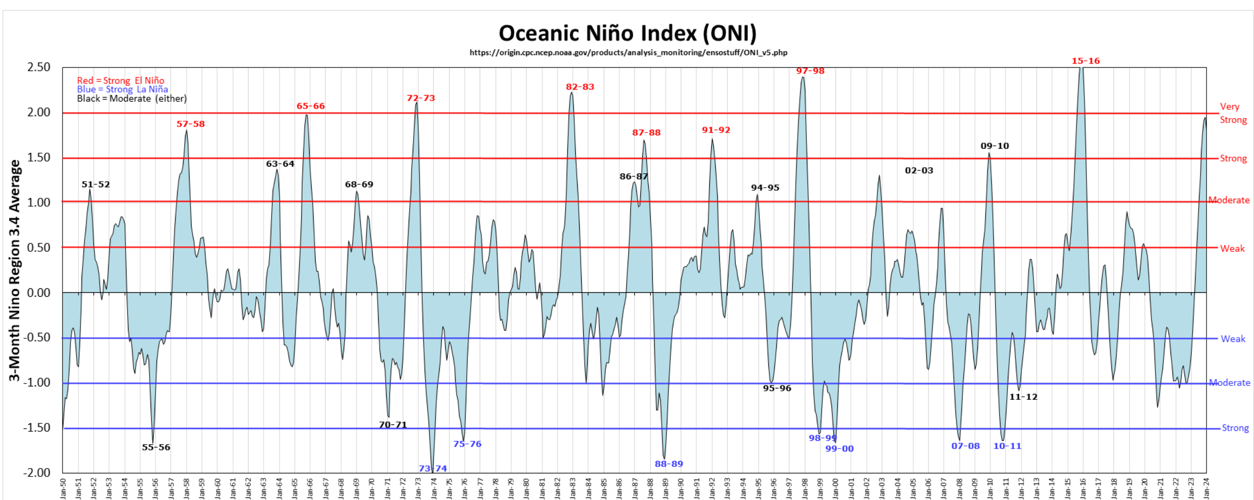


Figure 4.4-3. El Niño and La Niña events between 1950 and 2024.
Source: NOAA (https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php).

ENSO impacts to rainfall coupled with decadal rainfall patterns for the Commonwealth can increase flood or drought risks (Table 4.4-1).

Table 4.4-1. Average CNMI seasonal rainfall variations during El Niño-Southern Oscillation.

El Niño Year				Year Following El Niño			
Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
88%	87%	84%	104%	73%	63%	92%	92%
La Niña Year				**Year Following La Niña**			
Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
113%	139%	106%	104%	135%	182%	115%	82%

Source: National Weather Service. Values are % of normal rainfall (https://www.weather.gov/peac/raincnmi).

Across the Commonwealth drought is of medium concern due the potential effect on groundwater recharge. However, residents that rely on catchment for drinking water and other uses are at greatest risk from drought. Residents of the Northern Islands are particularly at risk due to added isolation of the homesteads.

Location

Drought affects the entirety of the CNMI as rainfall patterns are consistent across the entire region (Grecni et al., 2021). Drought patterns for Tinian and Saipan are expected to be closely aligned due to the proximity of the islands; however, Rota is expected to follow a slightly different pattern due to its distance from Saipan and Tinian.

Extent

Drought records are limited for the CNMI. Records from the US Drought Monitor are available back to February 2019. Between February 19, 2019, and July 23, 2019, CNMI experienced 23 consecutive weeks where the drought index was moderate drought (D1) or greater (Figure 4.4-4). Between February 11, 2020, and August 25, 2020, CNMI experienced another 29 consecutive weeks of drought with 18 weeks (April to August) where drought conditions were extreme drought (D3) or exceptional drought (D4; Figure 4.4-4). Although this data covers a short period and spans the ENSO event of 2019, it demonstrates that drought conditions can affect the CNMI for many consecutive weeks and reach extreme dryness. In 2021, moderate drought conditions persisted for 8 weeks from March to April and the Commonwealth Utilities Corporation (CUC) issued a drought/water advisory to encourage conservation (CUC, 2021). As ENSO conditions continued in February and March 2024, the Commonwealth is again experiencing drought at moderate level (National Integrated Drought Information System, 2024).

Warning Time

Droughts are caused by complex interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on a global scale (Zhou et al., 2019). Due to the complexity of these factors, scientists have difficulty predicting drought. Predictions of drought conditions are usually limited to about a month in advance in most locations. Determining the length and intensity of drought is also challenging and drought conditions may persist for weeks to decades.

The US Drought Monitor provides current and recent history of areas and populations affected by drought including for the Commonwealth. Drought is correlated with ENSO events and often develops in the year following the El Niño phase. This can give a lead time of up to 12 months to prepare for potential drought conditions. However, it is also challenging to predict ENSO events. The National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center produces a monthly ENSO Diagnostic Discussion, which provides analysis of current oceanic and atmospheric conditions as well as projection summaries of ENSO prediction models.

Previous Occurrences

Since 2015 the National Weather Service (NWS) has issued drought information statements for the Marianas for below-normal rainfall in every year except 2018. Also, between 2019 and 2023, data from the US Drought Monitor showed that Saipan experienced drought on 23% of days (Figure 4.4-4, D1 and above; see Figure 4.4-1 for definitions of drought conditions), with 13% of days in extreme or exceptional drought (D3 and D4,). Drought records were not available for Tinian, but conditions on Tinian are assumed to be closely correlated to conditions on Saipan. Over the same period, Rota experienced drought on 18% of days (Figure 4.4-4, D1 and above), with 10% of days in extreme drought (D3).

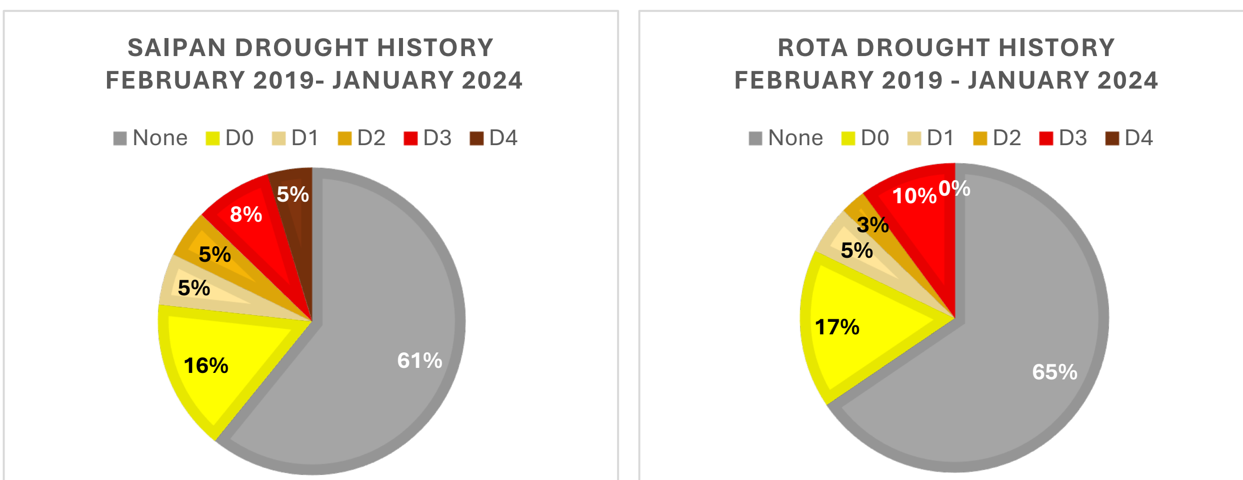


Figure 4.4-4. Patterns of drought in Saipan (left) and Rota (right) between 2019 and 2023 as reported by the US Drought Monitor. Data for Tinian were not available, but drought conditions are assumed to be closely correlated to Saipan.

D0, Abnormally Dry; D1, Moderate Drought; D2 Severe Drought; D3 Extreme Drought; D4 Exceptional Drought

Drought conditions are strongly associated with ENSO events, which occur every 2–7 years on average (US Department of Commerce, 2024). For example, during the drought associated with the strong ENSO event between 1997 and 1998 widespread water rationing was necessary across the Commonwealth (Polhemus, 2017). Drought events in 1983 and 1998 reduced livestock forage and livestock production was negatively affected (Polhemus, 2017). Also, citrus and garden crops were affected by the 1998 drought conditions.

Probability of Future Occurrence

The historic rate of drought is 1.6 years out of 10 years on average (Gingerich et al., 2019; Zhang et al., 2016).

ENSO events will occur in the future with certainty, which will influence drought conditions. However, the duration and magnitude of each ENSO event and the potential extent of associated drought is unpredictable. Based on historical data, El Niño and La Niña events:

- Tend to develop during the period April to June
- Tend to reach their maximum strength between October and February
- Typically persist for 9–12 months, though occasionally persisting for up to 2 years
- Typically recur every 2 to 7 years (IRI, 2024)

Climate Change Considerations

Downscaled climate projections for nearby Guam indicate drought conditions (defined here as more than 20% below mean annual historic rainfall) are projected to occur in 4 out of 10 years on average in 2080–2099 under a high emissions scenario (Grecni et al., 2021).

The El Niño and La Niña phases of ENSO can dramatically affect precipitation, air and ocean temperature, sea surface height, storminess, wave size, and trade winds (Keener et al., 2018). Exactly how the timing and intensity of ENSO will continue to change in the coming decades is unknown, but recent climate models suggest a doubling in frequency of both El Niño and La Niña extremes in this century as compared to the 20th century under scenarios with greater global warming.

Drought can also increase the likelihood of wildfire. An increase in wildfire events can destroy forested lands and support the spread of fire-adapted (and often fire-promoting) invasive species. It is anticipated that climate change will increase the frequency of meteorological and agricultural droughts. This will increase the frequency of brief hydrological droughts, and the probability of a long hydrological drought.

4.4.2 Vulnerability Assessment

Drought can impact agricultural and livestock production, damage terrestrial and aquatic wildlife, enhance wildfires, contribute to soil erosion and runoff, and cause economic damage. In addition to these impacts, other issues are surface and groundwater interrelationships, and the effect of growing water demands. Droughts will continue to adversely affect the environment, economy, and CNMI residents.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the Commonwealth asset exposure and potential losses due to drought. Commonwealth assets include commonwealth buildings, commonwealth primary roads, and critical facilities and community lifelines.

Commonwealth Assets

Drought does not directly affect buildings, so no Commonwealth buildings are considered vulnerable to drought. However, drought can amplify the risk from wildfire to Commonwealth buildings.

The Commonwealth owns and operates the public water systems on Rota, Saipan, and Tinian including the sources, treatment, storage, testing, and distribution of potable drinking water that may be affected by drought. Impacts to water systems may include loss or reduction of water supply, loss of water pressure, or poor water quality. Drought may have a disproportional impact on water availability in the Northern Islands. The Northern Islands have limited surface storage and rely on rain for drinking water and agriculture. Prolonged drought with severe water shortage may cause the Northern Island residents to leave the islands until rains return.

Drought conditions may make structures more vulnerable to wildfires, which are more likely during a prolonged drought. Risk to life and property is greatest in areas where degraded forest invaded by invasive grasses adjoin urbanized areas. Therefore, all Commonwealth buildings and critical facilities (discussed below) located in areas with high wildfire risk are considered vulnerable to drought because drought and wildfire risk are directly related (Section 4.8 [Wildfire] describes the Commonwealth's vulnerability to the wildfire hazard).

Community Lifelines and Critical Facilities

Drought may affect water-dependent community lifelines and critical facilities. Under extreme drought conditions, where local water supplies are depleted and water utilities are unable to supply adequate water pressure, fire stations and healthcare facilities could be impacted. Healthcare facilities, including hospitals, clinics, and nursing homes, rely on water for heating, cooling, and ventilation systems as well as for equipment sterilization, sanitation, water-based patient treatments, fire suppression, and hazmat decontamination.

Secondary impacts from drought include an increased risk of wildfires, which could threaten community lifelines and critical facilities. Tertiary impacts include sediment runoff during severe rainfall events in areas where the vegetation and ground cover have been burned by wildfire.

Sediment can damage and kill fragile coral reef systems. Uninhibited runoff could reduce recharge of the underlying aquifers.

During drought periods in 1998 and 2016, increased pumping rates from wells on Saipan caused chlorine concentrations to increase in the wells (Polhemus, 2017). In 1998 the chloride concentrations exceeded drinking water standards, which lead to temporary water shortages and restrictions (Carruth, 2003; Polhemus, 2017). In 2016, the Donni Spring pumping station was unable to draw water resulting in a loss of 24-hour water supply to the tourist hub of Garapan. Since, several larger resorts have installed water purification systems to ensure consistent water supply.

General Assets and Potential Losses

This section provides a summary of Commonwealth-wide exposure and potential losses to general building stock, socially vulnerable and total populations, and natural and cultural resource assets.

General Building Stock

Drought is expected to impact all regions of the Commonwealth, including the Northern Islands. Currently, data to model drought conditions on a finer scale is not available. Drought conditions, durations, and impacts in the Commonwealth are not well documented making it challenging to plan for drought mitigation and preparedness. The general building stock, as defined for this plan, would continue to be functional during a drought. As discussed above, droughts can create conditions conducive to wildfires, and therefore populations and buildings in and adjacent to areas of high wildfire probability are considered vulnerable to wildfire. Drought primarily impacts the population's water supply and the agricultural sector. Because the Commonwealth has limited groundwater resources and is isolated, it is vulnerable to drought.

Drought events impact the economy, including loss of business function and damage and loss of inventory. Industries that rely on water for business may be impacted the hardest (e.g., agriculture). Even though a majority of businesses will still be operational, they may be impacted aesthetically, which is important to the recreation and tourism industry.

Economic impacts may include:

- Losses from crop, livestock, and associated businesses
- Losses from tourism sector, recreation providers and associated businesses
- Long-term loss of economic growth and development

During a long-term drought (several months to years) unirrigated agriculture is affected first. As the drought continues, surface water-supplied water systems are impacted due to lowered stream flows, there is an increase in wildland fire occurrence, and residences that rely on rainwater catchment may need to purchase drinking water. If the drought continues, ground water supplies and drinking water utilities may be affected due to decreases in aquifer recharge.

According to the 2018 Census on Agriculture, approximately 1,515 acres of CNMI land are used for agriculture. Another 924 acres are used for pasture or grazing lands for several cattle ranching operations, which is down from 2,955 acres (67%) from 2007. Most of the remaining agricultural lands are used for croplands. The primary product groups that support the agricultural industry within the CNMI include root crops; vegetables and melons; fruits, nuts, and nursery crops; livestock, poultry, and eggs; and aquaculture. The market value of agricultural products sold within the CNMI in 2018 contributed approximately $1.6 million annually. All agricultural lands are exposed and vulnerable to drought (Table 4.4-2).

Table 4.4-2. Prime agricultural land and managed watershed vulnerable to drought.

Municipality	Prime Ag. Land (sq miles)	Watershed (sq miles)
Saipan	3.1	45.9
Tinian	2.5	39.1
Rota	0.0	33.0
Total	**5.6**	**118.0**

Persistent drought can develop into ecological drought and affect the health of watersheds and their ability to sequester water and recharge aquifers. There are approximately 118 square miles of forest on Saipan, Tinian, and Rota collectively that are designated and managed as watersheds. Because when drought does occur the effects are widespread, all watershed lands are considered exposed and vulnerable to drought (Table 4.4-2). However, effects of drought on Commonwealth forests has not been documented or studied (Polhemus, 2017). The Commonwealth actively manages watersheds on Saipan, Tinian, and Rota. Watersheds with management plans include Achugao, Garapan, and LaoLao Bay on Saipan and Talakhaya on Rota. Proactive management of the watershed helps to retain, and possibly improve, ecosystem resiliency and reduce vulnerability to external shocks such as drought.

<u>Socially Vulnerable and Total Populations</u>

Directly or indirectly, the entire population is vulnerable to drought events. Drought can directly affect people's health and safety, and lead to other indirect impacts. Health problems are related to low water flows or poor water quality. Other impacts may include air quality reduction; compromised food and nutrition; and increased incidence of illness and disease. Vulnerable populations who rely on rainfall catchment for residential water supply may be especially impacted if they do not have the physical or financial ability to obtain imported water to refill dry catchment tanks. How and to what degree drought affects the population varies.

Natural and Cultural Resources

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality. Drought is associated with forest fires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for months to years and may become permanent.

Watersheds are critical to replenishing the Commonwealth's groundwater aquifers, which supply most of the drinking water. Healthy watersheds also reduce polluted runoff into nearshore waters and support healthy streams and near-shore ecosystems. Watersheds impacted by drought-induced ecosystem damage or wildfires result in decreased ground and surface water supplies and damage to nearshore waters and reef ecosystems.

Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover when these conditions are temporary. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. The impacts to vegetation and wildlife can include death from dehydration and the spread of invasive species or disease because of stressed conditions. Invasive species pose problems for the ecosystems in which they are introduced. Like many hazards that affect the Commonwealth's environment, invasive species have both direct and indirect impacts.

When groundwater is not replenished over a period of time, aquifer and well water levels diminish, making irrigation and drinking water difficult to obtain. In addition, contamination of surface water sources can occur during drought conditions. Further, reduced aquifer recharge and depletion of aquifer storage may affect the discharge of groundwater to the coastal nearshore waters. This may negatively impact the groundwater dependent ecosystems, which rely on coastal discharge of groundwater to flourish. Subsidence of the ground surface may occur where aquifer levels are permanently reduced.

Drought poses a threat to cultural resource assets from loss of stratigraphic integrity due to crack/heave damage in drier soils, destabilization of wetland sites, exposure of submerged sites due to lower water levels in lake environments, sites are more vulnerable to wildfire and wind, and increased exposure from vegetation loss and soil erosion (Rockman et al., 2016). Drought has the potential to impact Chamorro and/or Carolinian cultural significant species and traditional and customary practices, which rely on healthy terrestrial, marine, and groundwater dependent ecosystems. Indirect effects include changes in ceremonial cycles and religious practices involving water control, and loss of culturally relevant plants and animals. For collections without appropriate climate controls, dry hot weather contributes to damage of wooden, paper, textile, and organic objects. As discussed above, drought and its secondary impacts can damage watersheds and nearshore waters, and may impair, diminish, or impede the exercise of traditional and customary practices.

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in visitor arrivals
- Projected changes in population
- Availability and vulnerability of water supplies
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

The stresses on the Commonwealth's water sources will likely increase as more residences are connected to the utility water system and the number of visitors increases as the tourism industry recovers. More water resources will be needed for human use and consumption and these resources will be further taxed by changing climate conditions. Drought conditions and development are interrelated—as water is drawn down from increased rates of use, drought can occur more readily than from lack of precipitation alone. In addition, newly developed land or degradation of forested areas may reduce groundwater recharge.

In February 2024, the Environmental Protection Agency announced that the CNMI will receive $20 million from the Infrastructure Investment and Jobs Act (i.e., the Bipartisan Infrastructure Law) for upgrades to drinking water, wastewater, and stormwater infrastructure. Improvements to water infrastructure, particularly the drinking water system, can help reduce water losses and help to minimize system-wide stress when drought conditions are present.

4.4.3 Mitigation Success

Drought is expected to increase in the CNMI because of changing rainfall patterns due to climate change. Drought may have long-term impacts on water supply and quality. In 2022, the US Army Corps of Engineers completed the *CNMI Final Post Disaster Watershed Plan* (USACE, 2022) and identified existing

Water Quality and Quantity

Focus	Recommendation	Potential Funding
Drought Planning	Drought Monitoring and Forecasting: Closely track surface and groundwater resources, climate data, soil data, etc., to develop a wholistic approach to help forecast future drought trends prior to its onset.	Estimated Cost: $ Potential Funding: USGS
	Drought Management Plan: Develop a drought management plan in conjunction with local agencies to help address water usage, storage, and availability.	Estimated Cost: $ Potential Funding: EPA, FEMA, USACE PAS, USACE Silver Jackets

Figure 4.4-5. US Army Corps recommendations for fill gaps in drought planning in the CNMI
Source: USACE (2022).

information and data gaps that need to be addressed to effectively monitor, plan for, and respond to drought (Figure 4.4-5). Recognizing that information and data gaps exist is one of the first steps to developing effective future mitigation actions. In addition, the US Drought Monitor now tracks current drought conditions in the Northern Mariana Islands and reports of current and historic conditions back to 2019 are available online (National Drought Mitigation Center, 2024).

Over the past 5 years, the Commonwealth Utilities Corporation has completed several water tank construction projects with federal funds. These water tank projects help increase the reliability of the water supply, especially during dry periods, and may help to mitigate the impact of drought on the drinking water supply. In 2021, construction of a 750,000 gallon pre-stressed concrete water tank was completed, using funds from the US Environmental Protection Agency, and will serve the San Vicente, Upper Dandan homestead, Naftan, and Obyan communities. Funding from the US Department of Housing and Urban Development, Community Development Block Program, Disaster Reduction program was used to complete designs to replace 4 additional water tanks (Kagman, Dandan, Tinian, and Kagman 50K) with pre-stressed concrete tanks.

Figure 4.4-6. New 750,000-gallon pre-stressed concrete water tank in San Vicente. Photo by Bryan Manabat as published in the Mariana Variety on Dec 31, 2021 (accessed online).

References

Carruth, R. L. (2003). *Ground-water resources of Saipan, Commonwealth of the Northern Mariana Islands* (Water-Resources Investigations Report 03–4178). US Department of the Interior and US Geological Survey.

[CUC] Commonwealth Utilities Corporation. (2021, February 1). *CUC issues drought/water advisory*. Marianas Variety News & Views. https://www.mvariety.com/news/cuc-issues-drought-water-advisory/article_f4bb4d08-63b3-11eb-b133-2b7288f14263.html

Gingerich, S. B., Adams, A. G., Rosa, S. N., Marineau, M. D., Wright, S. A., Hay, L. E., Windlasky, M. J., Jenson, J. W., Wong, C. I., Banner, J. L., Keener, V. W., & Finucane, M. L. (2019). *Water Resources on Guam-Potential Impacts of and Adaptive Response to Climate Change* (Scientific Investigations Report 2019–5095; Scientific Investigations Report). US Geological Survey.

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

IRI – International Research Institute for Climate and Society, ENSO Forecast | March 2024 Quick Look. (2024). https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Keener, V. W., Helweg, D., Asam, S., Balwani, S., Burkett, M., Fletcher, C. H., Giambelluca, T., Grecni, Z. N., Nobrega-Olivera, M., Polovina, J., & Tribble, G. (2018). *Chapter 27: Hawai'i and Pacific Islands. Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume II*. US Global Change Research Program. https://doi.org/10.7930/NCA4.2018.CH27

Mycoo, M., Wairiu, M., Campbell, D., Duvat, D., Golbuu, Y., Maharaj, S., Nalau, J., Nunn, P., Pinnegar, J., & Warrick, O. (2022). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

National Drought Mitigation Center. (2024). *OCONUS Drought Status*. US Drought Monitor. https://droughtmonitor.unl.edu/DmData/OCONUSDroughtStatus.aspx

National Integrated Drought Information System. (2024). *US Affiliated Pacific Islands | Drought.gov*. https://www.drought.gov/states/us-affiliated-pacific-islands

[NOAA] National Oceanic and Atmospheric Administration. (2023). *December 2023 El Niño update: Adventure! | NOAA Climate.gov*. http://www.climate.gov/news-features/blogs/enso/december-2023-el-nino-update-adventure

Pacific ENSO Applications Climate Center. (n.d.). *El Niño Impacts on Guam and the Commonwealth of the Northern Marianas Islands*. Pacific ENSO Applications Climate Center.

Polhemus, D. A. (2017). *Drought in the U.S.-Affiliated Pacific Islands: A Multi-level Assessment*. https://doi.org/10.21429/C9ZS74

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

[USACE] US Army Corps of Engineers. (2022). *The Commonwealth of the Northern Mariana Islands Final Post Disaster Watershed Plan* (p. 166). US Army Corps of Engineers, Honolulu District.

US Department of Commerce, N. O. and A. A. (2024). *What are El Niño and La Niña?* https://oceanservice.noaa.gov/facts/ninonina.html

Zhang, C., Wang, Y., Hamilton, K., & Lauer, A. (2016). Dynamical Downscaling of the Climate for the Hawaiian Islands. Part I: Present Day. *Journal of Climate*, *29*(8), 3027–3048. https://doi.org/10.1175/JCLI-D-15-0432.1

Zhou, H., Liu, Y., & Liu, Y. (2019). An Approach to Tracking Meteorological Drought Migration. *Water Resources Research*, *55*(4), 3266–3284. https://doi.org/10.1029/2018WR023311

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.5 Flooding

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.5 Flood

Hazards	Frequency	Spatial Extent	Severity	Overall Significance
Event-based	Likely	Significant	Critical	Medium
Chronic Coastal	Occasional	Limited	Negligible	Low
Coastal Erosion	Likely	Limited	Significant	Medium
Hazards with Sea Level Rise	**Frequency**	**Spatial Extent**	**Severity**	**Overall Significance**
Event-based	Likely	Significant	Critical	Medium
Chronic Coastal	Likely	Significant	Significant	Medium
Coastal Erosion	Likely	Significant	Significant	Medium

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, the hazard profile is now expanded to include event-based flooding for coastal and inland areas. Challenges with existing Flood Insurance Rate Maps (FIRM) were identified.
- Chronic coastal flooding is newly described and factors that contribute to chronic coastal flooding are discussed in detail. Challenges and opportunities for improving data or models for chronic coastal hazards were identified.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- Information for historic rainfall was updated with recent data. The information regarding flood occurrences, independent of typhoons, was incorporated.
- New and updated figures and information from federal agencies were incorporated.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to flood is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.

- A mitigation success story achieved since 2018 was included to highlight continuous progress toward lowering the vulnerability of the Commonwealth to flood.

4.5.1 Hazard Profile

Floods are a temporary inundation of water with a landmass that stems from excessive rainfall, increased sea level, increased water table level, and/or wave action. This section addresses in detail event-based floods and chronic coastal flooding. Coastal flooding is also influenced by coastal erosion; therefore, it is addressed concurrently in this section.

Flood problems can exist where development has encroached into identified flood plains, which are identified land areas that are adjoining to a channel, stream, ocean, or some other watercourse or body that are susceptible to flooding. Floods have the potential and capability to undermine buildings and bridges, erode shorelines and coastal plain areas, destroy vegetation, and wash out access routes and transportation nodes.

Flooding is also categorized by where it occurs such as inland or coastal. Coastal flooding occurs when water inundates normally dry land because of high or rising tides or storm surge (Figure 4.5-1). Tropical cyclones, especially typhoons, cause most coastal flooding (National Hurricane Center, n.d.). During these events, high winds and surf can push water several feet and even hundreds of yards inland. There are several factors that influence event-based and chronic coastal flooding such as, high tides (i.e., astronomical tides), seasonal variations in mean sea level height, wave energy and characteristics, sea level rise, and other water anomalies.

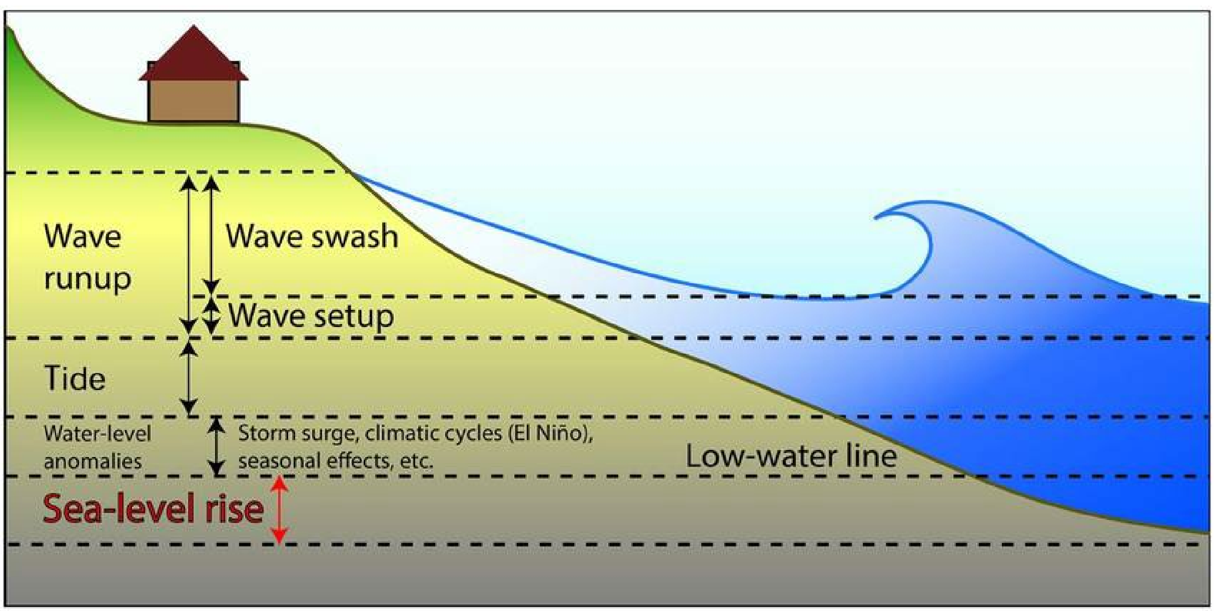


Figure 4.5-1. The water-level components that contribute to coastal flooding.
Source: Vitousek et al. (2017) (https://www.researchgate.net/figure/The-water-level-components-that-contribute-to-coastal-flooding_fig1_317006904).

Inland flooding occurs in areas away from the coast and in tropical climates is generally caused by excessive rainfall over a short period or the accumulation of moderate rainfall over several days. High tides may also cause inland flooding by elevating the water table. Types of inland flooding include:

- **Watercourse flooding**—Watercourse flooding is when waterbodies exceed the capacity of their natural or constructed border to accommodate water flow/level and water overflows the border, spilling out into adjacent low-lying, dry land.
- **Flash flooding**—Flash floods can occur in mountainous terrain or high-sloped drainage basins when rainfall exceeds three inches per hour. Flash floods typically rise rapidly with little or no warning and may transport large concentrations of sediment and debris as they sweep channels clean. Flash floods may trigger mud and landslides, structural failures, and other threatening conditions. Watershed vegetation, soil conditions, drainage infrastructure, and streambed and floodplain characteristics all influence flash flood conditions.
- **Ponding**—Ponding or standing water occurs in poorly drained low-lying areas and can be a problem even when rainfall is not heavy. Such drainage issues can be naturally occurring or human-caused. When human-caused, such flooding is sometimes referred to as urban flooding.

Flood severity categories used by the National Weather Service include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat.

- **Minor Flooding**—minimal or no property damage, but possibly some public danger or inconvenience.
- **Moderate Flooding**—some inundation of structures and roads near streams or coastlines. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- **Major Flooding**—extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

Event-based Flooding

Event-based floods result when storms cause temporary inundation through excessive rainfall or wave action and includes coastal and inland flooding. Additional flooding hazards result from strong tropical cyclones.

For the purposes of the 2024 SHMP Update, event-based flood is defined as the 1% annual chance flood as depicted on the FEMA Flood Insurance Rate Maps (FIRM), inclusive of all A- and V-zones, also defined as the Special Flood Hazard Area (SFHA, Figures 4.5-2 to 4.5-4).
Flood zone designations in the maps below are described as:

- **A**: Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year lease. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
- **AE**: The base floodplain where base flood elevations are provided.
- **AO**: River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 ft. These areas have a 26% chance of flooding over the life of a 30-year lease.
- **V**: Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year lease. No base flood elevations are shown within these zones.
- **VE**: Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of 30-year lease. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones

The FIRM for the Commonwealth have not been updated since the last Flood Insurance Study in 2005. Between 2019 and 2020, as part of the Risk Mapping, Assessment, and Planning Program (Risk MAP), the Federal Emergency Management Agency (FEMA) engaged agency and public stakeholders to evaluate the need for a new Flood Insurance Study and to assess current risks and risk reduction actions (FEMA, 2021). FEMA is currently planning to update the Flood Insurance Study for the Commonwealth, which will result in updated flood zones and FIRM for the Commonwealth of the Northern Mariana Islands (CNMI). New maps are expected in the next 5 to 10 years.

Event-based inland flooding may occur from several days of rainfall or from heavy downpours. There is very little runoff from rainfall on karst limestone substrates compared to volcanic soils and only a few perennial streams are present on Saipan and none on Tinian (USACE, 2022). Torrential rainfall, however, can create flash flooding and inundation island-wide causing water to run off rapidly across impervious zones, fire damaged terrain, and gravel roadways.

Event-based coastal flooding occurs when sea level rises due to high surf, storm surge, or prolonged strong onshore flow of wind and inundates coastal areas that are typically dry under normal conditions (Figure 4.5-1). Strong storms are a primary cause of coastal flooding. However, in this section, event-based coastal flooding is limited to discussion of such flooding from a 1% annual chance storm and is limited to the SFHA. Refer to Section 4.2 (Typhoon) for additional discussion on storm surge associated with typhoons and Section 4.3 (Tsunami) for flooding related to tsunami.

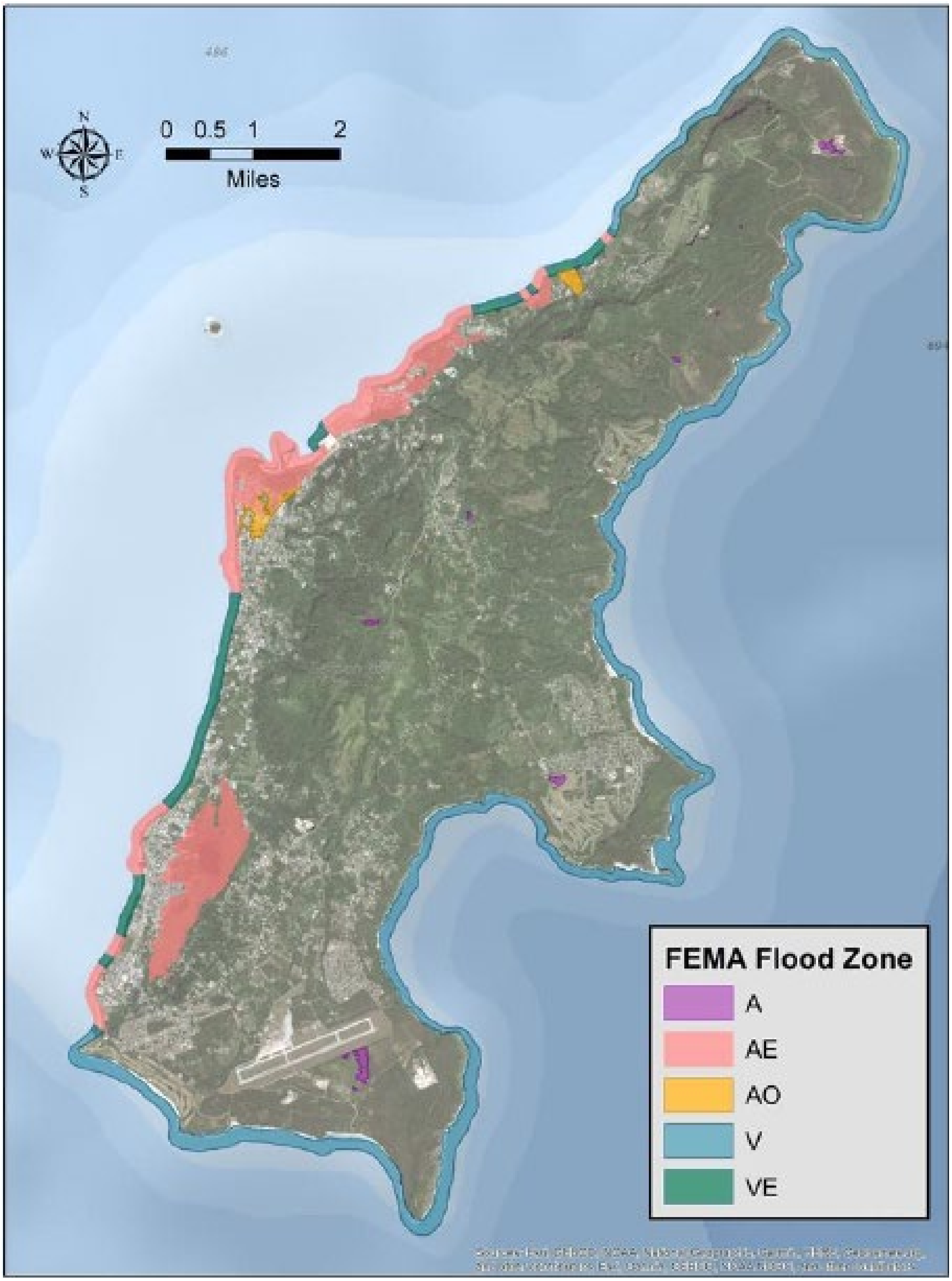


Figure 4.5-2. Saipan Special Flood Hazard Area based on FEMA flood zones A and V.
Source: NMHC (2023).

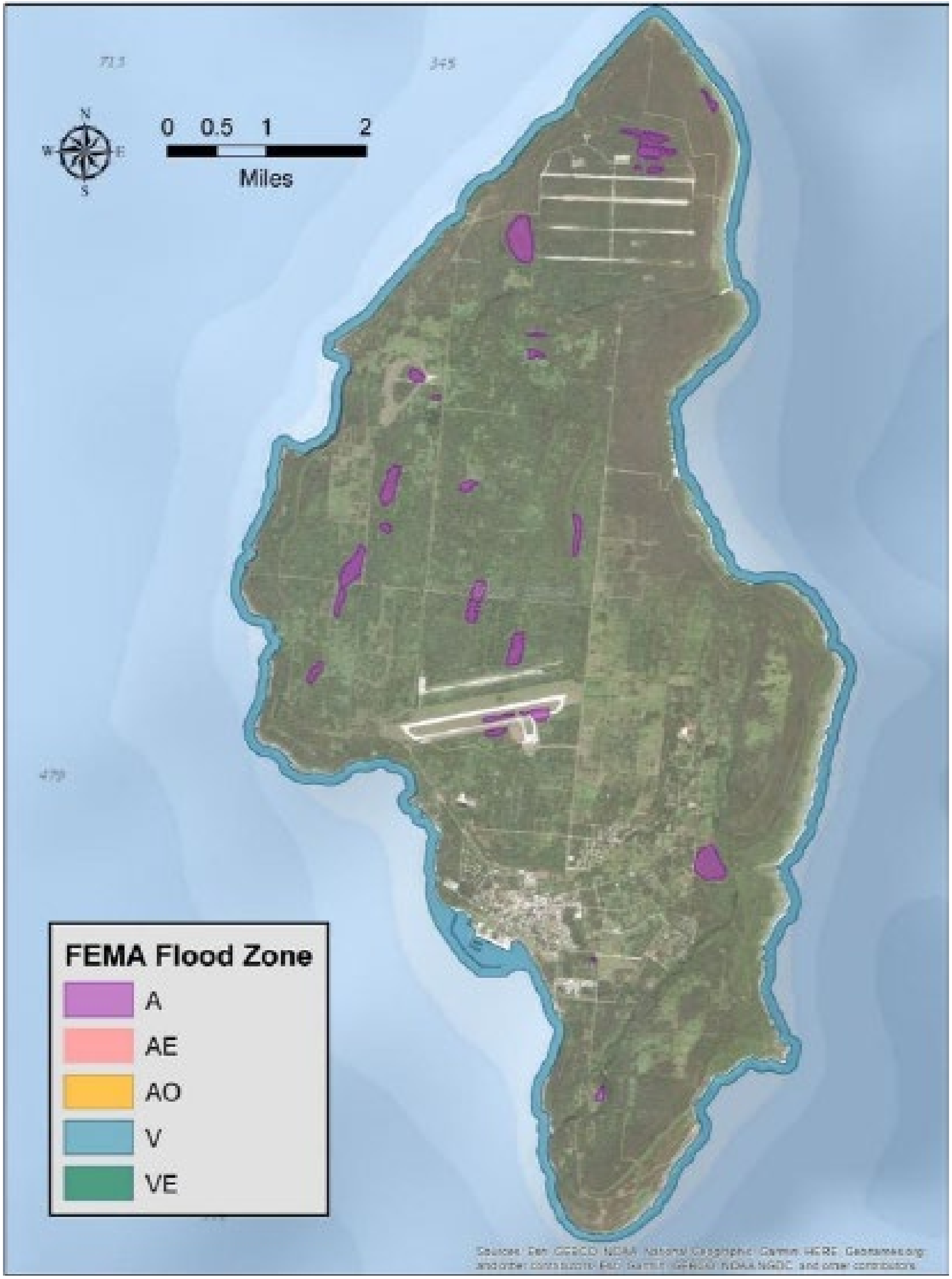


Figure 4.5-3. Tinian Special Flood Hazard Area based on FEMA flood zones A and V.
Source: NMHC (2023).

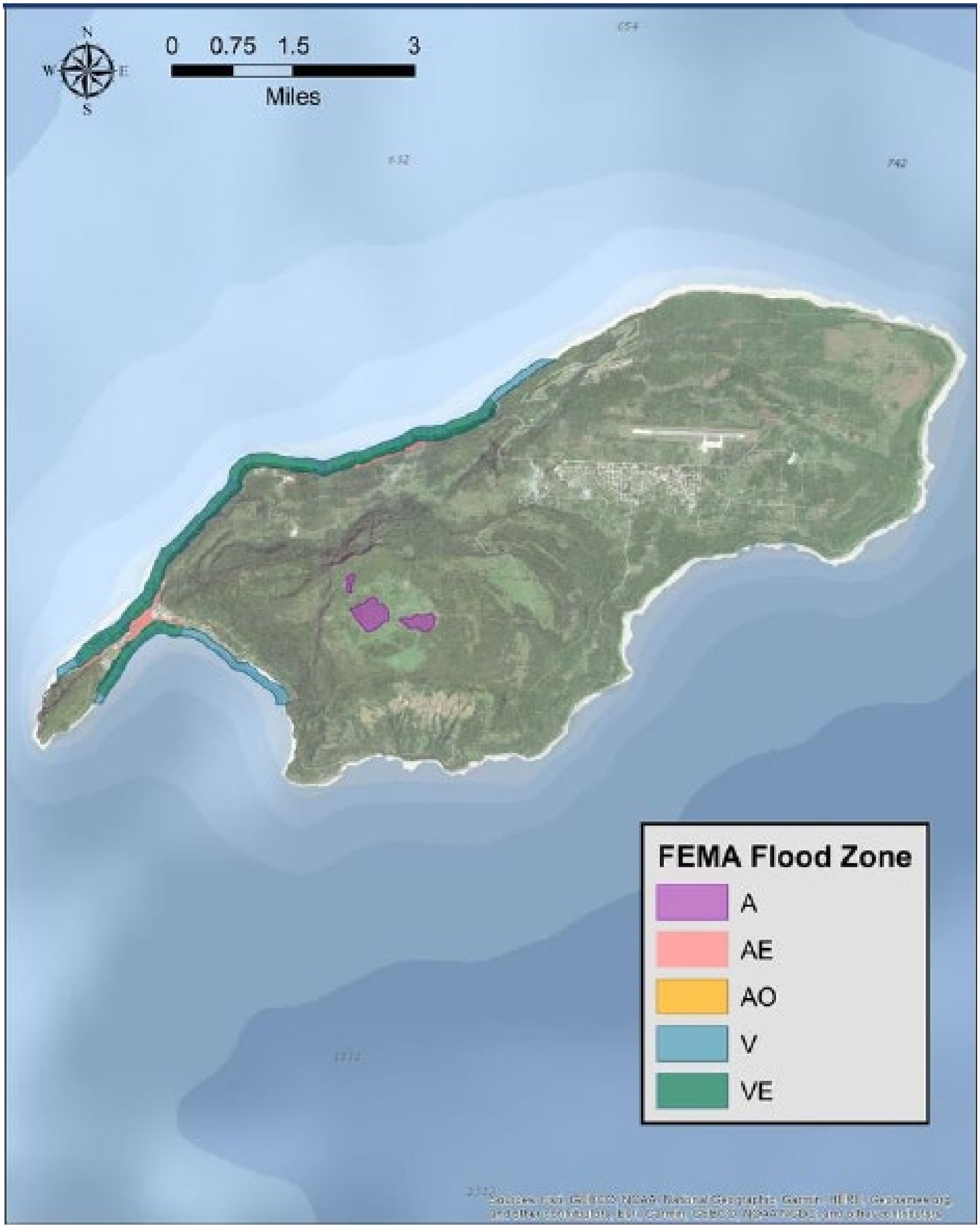


Figure 4.5-4. Rota Special Flood Hazard Area based on FEMA flood zones A and V.
Source: NMHC (2023)

The recurrence interval of a flood, or flood frequency, is the average number of years between floods of a certain size. Recurrence interval is statistically derived. The actual number of years between floods of any given size varies because of the natural variations in climate and weather events (US Geological Survey, US Department of Interior, n.d.). As discussed previously, FIRMs identify a flood hazard area as the area that would be inundated by a flood with a 1% chance of occurring annually (FEMA, 2021). These measurements reflect statistical averages only; it is possible for two or more floods to occur with a 1% annual or greater chance of occurring in a short time period. Table 4.5-1 describes the recurrence intervals and probabilities of occurrence for flood events.

Table 4.5-1. Recurrence intervals and probabilities of occurrences.

Recurrence Intervals (years)	Probability of Occurrence in any Given Year	Percent Chance of Occurrence in Any Given Year
100	1 in 100	1
50	1 in 50	2
25	1 in 25	4
10	1 in 10	10
5	1 in 5	20
2	1 in 2	50

Source: USGS (US Geological Survey, US Department of Interior, n.d.).

Chronic Coastal Flooding

Chronic coastal flooding is comprised of several factors that when combined can result in increased inundation. The components include passive inundation, high wave flooding, tidal (or astronomical) flooding and coastal erosion. For the 2024 SHMP Update the exposure analysis for coastal chronic flooding is limited to passive inundation of low-lying areas susceptible to high tide flooding and does not include integrated effects of annual high wave flooding, coastal erosion, or future sea level rise. Commonwealth and general assets were analyzed for proximity to areas considered at-risk for chronic coastal flooding. The anticipated effects of sea level rise (SLR) to chronic coastal flooding are analyzed and discussed later in this section.

<u>Passive Inundation</u>

Passive flooding, also called hydrostatic flooding, includes marine inundation of lands that are below the water level and lands that are flooded due to increased water table heights due to sea level rise. Excessive rainfall can worsen passive inundation as it prevents drainage, and as such, runoff and marine waters can combine to produce larger impacts. The passive flooding analysis includes areas that are hydrologically connected to the ocean (i.e., marine flooding) and low-lying areas that are not hydrologically connected to the ocean (i.e., flooding from groundwater; Figure 4.5-5).

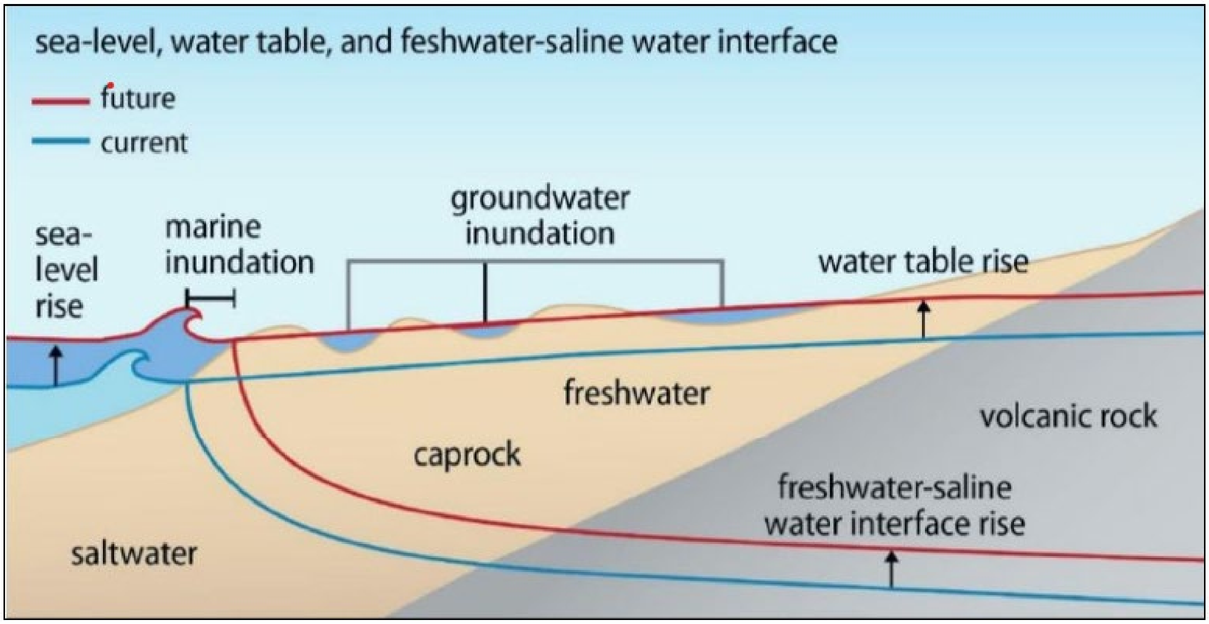


Figure 4.5-5. Effects of sea level rise on passive inundation.
Source: Hawai'i Climate Change Mitigation and Adaptation Commission (2017).

Annual High Wave Flooding

Storms or high winds over the open ocean can generate large waves that trigger high surf in coastal areas. Five distinct wave patterns exist in Commonwealth waters: 1) trade wind waves from the east (the most common), 2) long period swell energy from the north, 3) local wind generated waves from the north, 4) long period swell energy from the west or southwest , and 5) storm waves associated with typhoons (USACE, 2022).

The average wave height measured at the wave information study (WIS) station ST81420, located about 45 nautical miles northwest of Saipan, was 6.44 ft with the average range of wave heights between 4.16 ft and 8.72 ft (Li et al., 2023). The maximum height recorded at the station was 36.15 ft. Most waves approach the islands from an easterly direction (Figure 4.5-6).

Table 4.5-2. Wave statistics for wave information study station ST 81420.

Statistic	Value
Average wave height	6.44 ft
Standard deviation of wave height	2.28 ft
Average wave period	9.68 sec
Standard deviation of wave period	1.47 sec
Maximum wave height	36.15 ft
Period associated w/ max wave height	14.13 sec
Direction associated w/ max wave height	92.0 deg
Date associated w/ max wave height	11/2/1997, 1200 h
Total number of wave records	280,511

Source: Li et al. (2023).

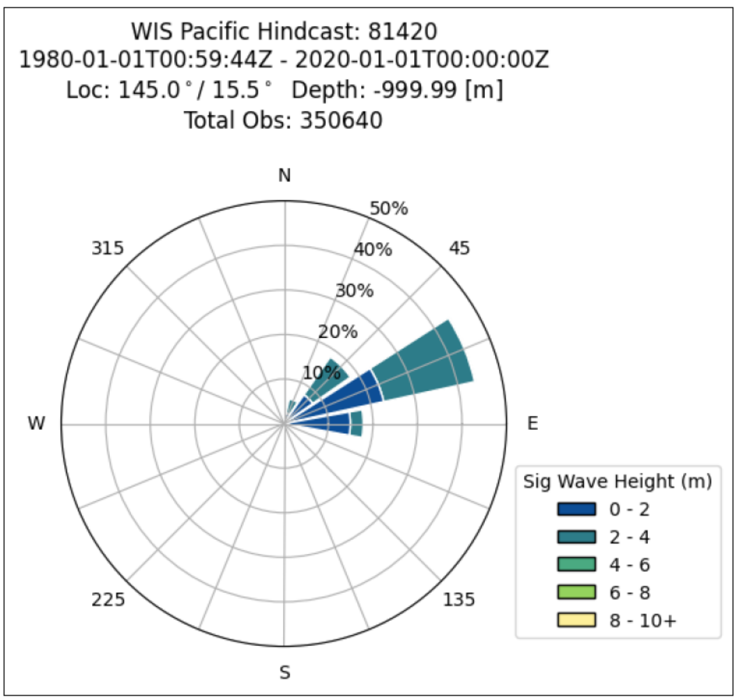


Figure 4.5-6. Wave rose for the wave information study station ST 81420 located ~45 nautical miles northwest of Saipan in waters greater than 10,000 ft.
Source: USACE (2022)

There are strong seasonal variations to wave conditions with smaller, trade-wind driven waves in the summer months (June–August) and during the winter months (December–February), high pressure systems in the Northwestern Pacific generate the trade winds that increase wave heights (Figure 4.5-7) (Li et al., 2023). Other research has shown the 100-year return interval for sea level extremes is highest between October and December and ranges between 2.2 inches and 25 inches (Chowdhury et al., 2010). Other weather systems to the north of the Commonwealth also produce severe wind and wave conditions during the winter.

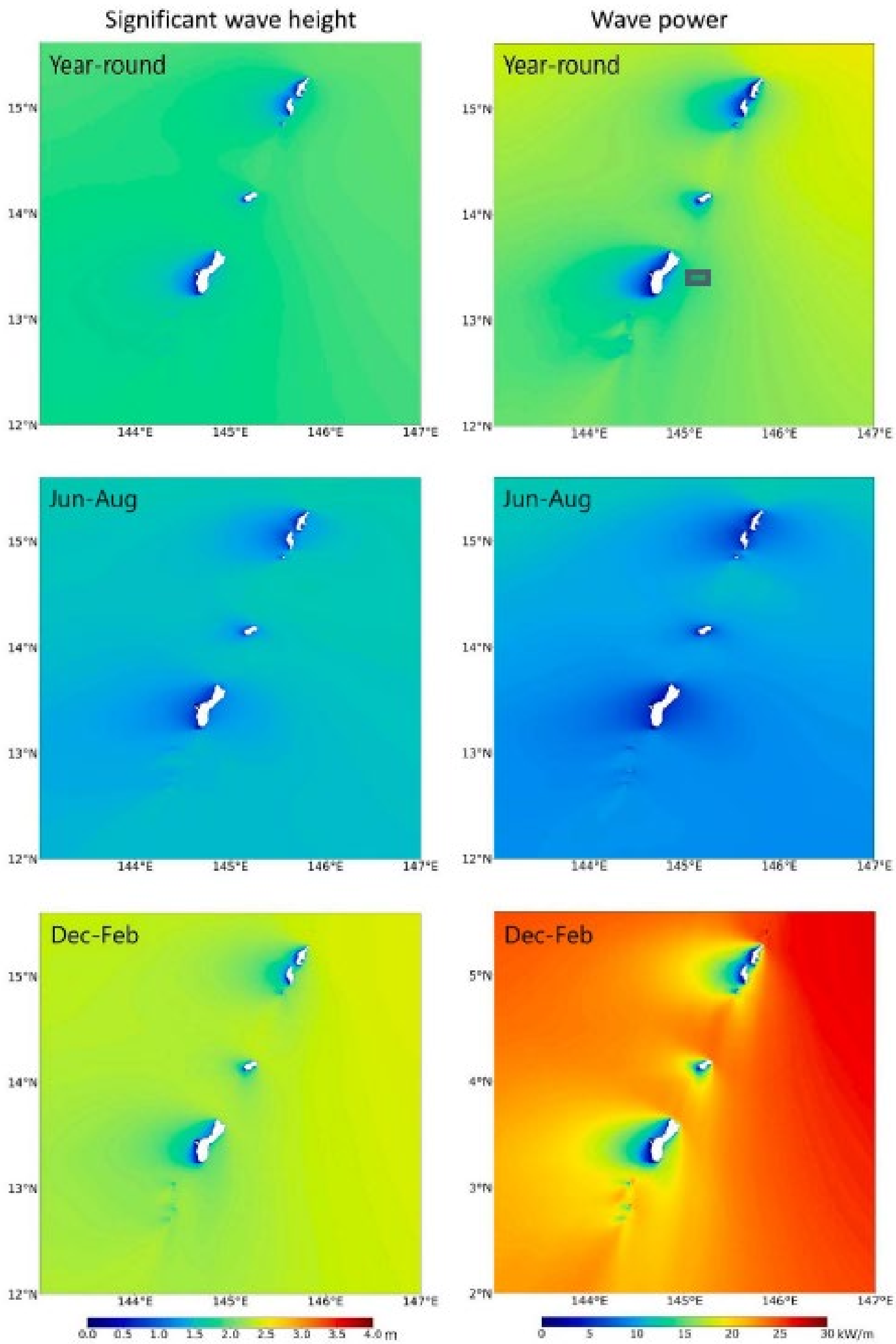


Figure 4.5-7. Year-round and seasonal average significant wave heght and wave power from the 1979–2020 hindcast.
Source: Li et al., 2023

There is limited work to model annual wave heights on Saipan and similar models were not available for Rota, Tinian, and the Northern Islands. In 2017, SLR maps were updated for Saipan using a bathtub model approach, which allowed changes in still-water levels over a high resolution, conditioned digital elevation to be mapped. This map update also included seasonal sea level extremes for October to December (Greene, 2017). The update in 2017 also considered flood scenarios for Saipan that included additional sea level height due to typhoon activity. Similar flood models investigating seasonal sea level heights and their contribution to chronic flooding are not yet available for Rota, Tinian, or the Northern Islands. To try and keep analysis consistent between islands, the additional data for seasonal sea level heights on Saipan was not included in the chronic flooding analysis for this update.

Tidal Flooding/King Tides

Tidal flooding, also known as sunny day flooding or high tide flooding, is the temporary inundation of low-lying areas during exceptionally high tides (Figure 4.5-8). *King tides* is a non-scientific term used to describe exceptionally high tides that occur in summer and winter when the moon is at its closest point to the Earth. Astronomical king tides are predictable but additional impacts on top of king tides, such as high waves and additional elevated water levels, can be hard to foresee more than a week in advance (University of Hawai‘i Sea Grant College Program, 2019). This type of flooding is already occurring more frequently compared to the year 2000 and is predicted to occur more frequently and severely in coming decades with increasing sea level rise.

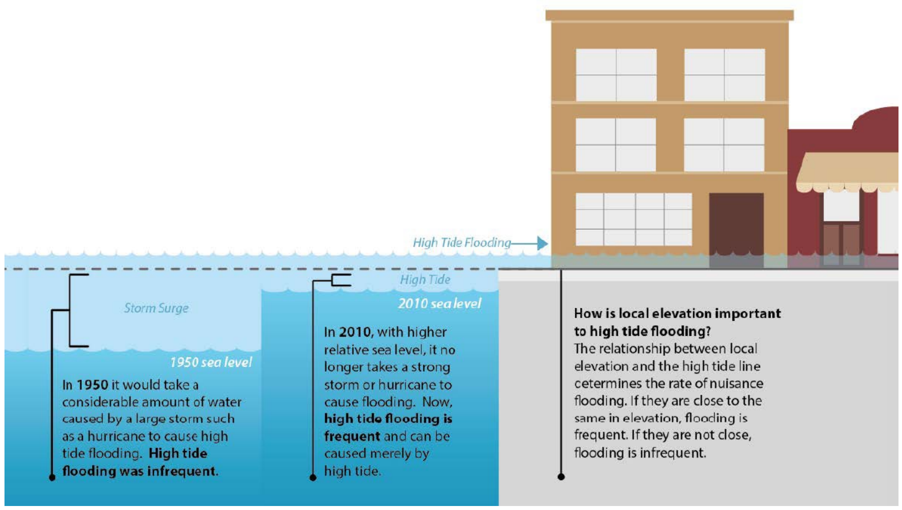


Figure 4.5-8. High tide flooding.
Source: NOAA (https://oceanservice.noaa.gov/infographics/)

Coastal Erosion

Coastal erosion is the process by which local sea level rise, strong wave action, and coastal flooding wear down and/or carry away rocks, soil, and/or sand along the coast. The extent and severity of coastal erosion is worsening with global SLR and increasing storm intensity due to climate change. Human activities can also cause coastal erosion through the construction of coastal structures, such as breakwaters, groins, and seawalls, that change the coastal sediment transport leading to erosion in some areas and accretion in others. Coastal erosion becomes a hazard when communities do not adapt to erosion effects on people, the built environment and infrastructure.

Coastal erosion is a concern for Pacific Islands, which will likely worsen as SLR and more intense storms increase the impacts of coastal erosion (N. Mimura, 1999; M. Mimura et al., 2007; Fletcher & Richmond, 2010). Many low-lying islands and atolls in the Western Pacific have already reported issues with erosion and occasional inundation. While the islands of the Commonwealth are significantly higher than Pacific atolls, impacts experienced on low islands may be similar to the lowest lying portions of high islands (Marra et al., 2012), such as the western coastal plain of Saipan where coastal erosion is already of great concern.

The Division of Coastal Resources Management (DCRM) monitors shorelines for erosion on Saipan, Tinian, and Rota. Information and reports about the shoreline monitoring program and monitoring trends are available online. Other research on Saipan suggests that erosion may be episodic and driven by storm events and that many public amenities and infrastructure were damaged and/or deteriorated at many beaches (Sea Engineering, Inc., 2018). An erosion hazard priority rating of high, due to potential damage to existing infrastructure, was assigned to six Saipan beaches: Tanapag Beach and boat ramp, Quartermaster Area (Red Beach), Fiesta Beach, Hyatt Beach, Sugar Dock Beach, and Fishing Base.

More recently, coastal erosion was modeled in a Geographic Information System (GIS) for Saipan using an erodible soils layer (NMHC, 2023). For the 2024 SHMP Update, a similar approach was developed for an exposure analysis and to assess erosion vulnerability of Commonwealth and general assets on Rota and Tinian. However, for this update, the interplay between coastal erosion and chronic coastal flooding is considered qualitatively because the compounding effects of these two hazards is not currently incorporated into predictive models.

Location

Event-based Flooding

FEMA provides flood hazard and risk data to help communities evaluate flood risks and inform mitigation actions. Using historical records, FEMA determines the probability of occurrence for different flood levels in a community. FIRMs show the location of these flood hazard areas. This mapping reflects risk from both coastal and major inland flooding. The location, extent, and vulnerability of the event-based flood hazard is analyzed using the Special Flood Hazard Area (SFHA) depicted on each island's FIRM. The SFHA is defined as all A- and V-zones shown on the FIRM and includes flood zones for rainfall flooding, coastal flooding, shallow flooding, and distinguishes areas where detailed studies have been conducted to determine flood elevations (Figures 4.5-2 to 4.5-4).

The SFHA serves as the regulatory boundary in which the CNMI Flood Damage Prevention Regulation (Title 155, Subchapter 155-10.2) is enforced. The flood damage prevention regulation requires that development in the SFHA meet certain standards to reduce damage from flooding.

The SFHA shows the horizontal extent of a flood that has a 1% chance of being equaled or exceeded in any given year (e.g., a 1% annual chance flood), while the base flood elevation shows the vertical height of flooding from a 1% annual chance flood at any given location within the SFHA.

Event-based flooding occurs primarily along coastal and low lying urban and impervious zones which correspond with all A- and V-zones on the FIRM. In these hazard areas, runoff from heavy rainfall events can flood low-lying urban areas, especially those areas with poor storm water management and in proximity to storm surge and high tides.

Riverine flooding along watercourses is not well characterized in the Commonwealth. The US Army Corps of Engineers has recently characterized streamflow (USACE, 2022). Saipan has relatively few perennial streams. Talofofo, Sadog Hasngot, and Sadog Denne streams are in the center of the island and drain eastward. Agatan and Sadog Dogas, part of the Achugao watershed, drain toward the west. Streamflow data (only available for Talofofo) reflect a very limited streamflow. No perennial streams flow on Tinian and there are no records of streamflow or flood runoff. Although runoff is expected after intense rainfall, amounts have not been quantified. Rough estimates of runoff from the limestone areas of Saipan range from 6–12% of rainfall. Several drainage systems have been installed under Capital Improvement Projects to alleviate flooding in residential areas. Based on the above information, the risk of event-based riverine flood along the watercourse is expected to be minimal. However, runoff from heavy rainfall events is expected to significantly contribute to flooding near the coast and in low-lying urban areas with poor drainage.

There is little information about stream systems in the Northern Islands, except for observations made by visitors (Yuknavage et al., 2022). There are 2 lakes on Anatahan—Hagoi Haya and Hagoi Lagu—and 2 lakes on Pagan—Lagona Sanhiyonga and Sanhalom. However, these lakes are contaminated with heavy metals and toxins related to military debris and munitions left from WWII activities (Yuknavage et al., 2022).

On Saipan event-based flooding occurs in 6 main areas Kanat Tabla, the San Roque village, the road at Tanapag, the lower base industrial area, Garapan/Putan Muchot, and the Chalan Kanoa-Lake Susupe area. An area of Garapan that is identified within the FIRM #750001 Series 0001–0065 consists of a 1.9 square mile basin, has been subject to severe, but infrequent, flooding conditions due to its low elevation (approximately 3–8 inches above mean sea level) and a lack of a suitable outlet channel to convey runoff.

Lake Susupe on Saipan lies in a broad, shallow depression on the western edge of an extensive low wetland. The normal surface area of the lake is approximately 45 acres with an additional 372 acres of surrounding marsh land and contains 17 small ponds and has a maximum depth of 7.2 ft. Presently, the lake has no outflow with water loss attributable only through percolation and evaporation. In previous flooding events, specifically Typhoon *Carmen* in 1978, flooding in the surrounding area was the result of the water rising 5.4 ft above average within the lake.

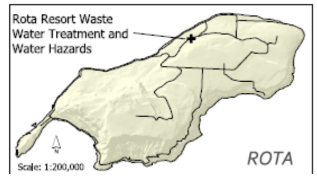
On Rota, flooding is mostly confined to Songsong village. Many of the feeder roads joining Route 10 and Route 100 into Songsong are aggregate roads that suffer high erosion rates during rainfall.

<u>Chronic Coastal Flooding</u>

Areas most susceptible to chronic coastal flooding include low-lying areas along the coast as well as inland, such as along wetlands, marshes, and lakes throughout the islands (Figure 4.5-9). All coasts are exposed to seasonal high wave action with the eastern and northeastern shores exposed to greater wave heights and power each winter (see Figure 4.5-7). In addition, high, powerful waves generated by tropical cyclones impact the CNMI. Even distant storms may have a significant effect on local wave heights.

Changes in sea level also affect passive flooding inland, especially at lakes and wetlands. While Lake Susupe's water surface elevation may not change at the same rate as the sea level (particularly during short-term events), there is evidence of changing water chemistry and salinity due to shifts in past sea levels (Caruth 2003). High tides cause water level in the lake to rise (Figure 4.5-10).

Lake Hagoi on Tinian is a fresh to brackish water body surrounded by marsh covering about 37 acres (Gingerich, 2002; Marshall et al., 2020). The wetland complex is considered the most pristine in the Commonwealth (Yuknavage et al., 2022). The marsh perennially supplied by groundwater (Gingerich, 2002); however, water level in the marsh also varies by season and is highest during the wet season (Marshall et al., 2020). Data from the National Oceanic and Atmospheric Administration (NOAA) Digital Coast Sea Level Rise Viewer showed a potential for increased flooding at Lake Hagoi during high tide periods (Figure 4.5-11). Chronic coastal flooding due to high tides may impact shorelines island wide and coastal assets near Songsong Village (Figure 4.5-12).



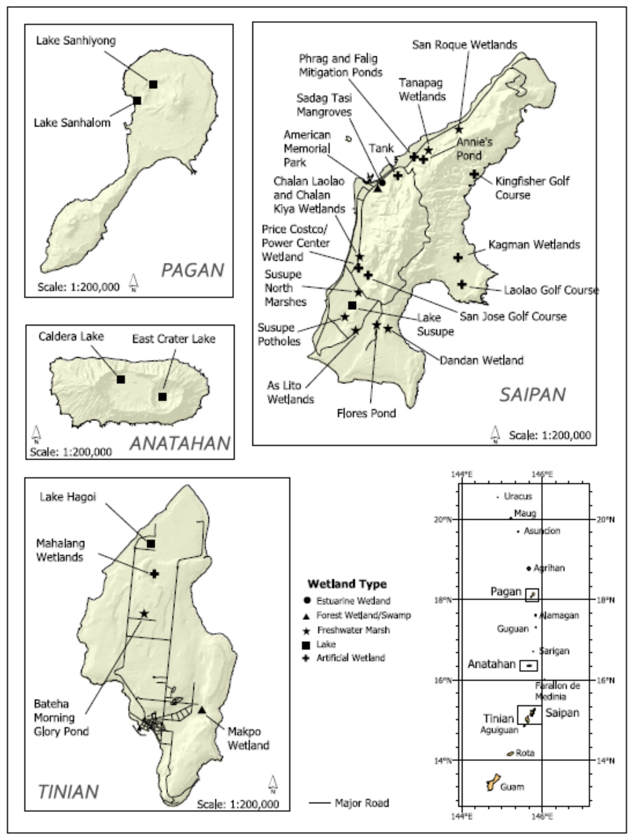


Figure 4.5-9.. Approximate locations of wetland types in the CNMI.
Source: Marshall (2020)

Figure 4.5-10. Chronic coastal flooding on Saipan due to high tides.

Figure 4.5-11. Chronic coastal flooding on Tinian due to high tides.

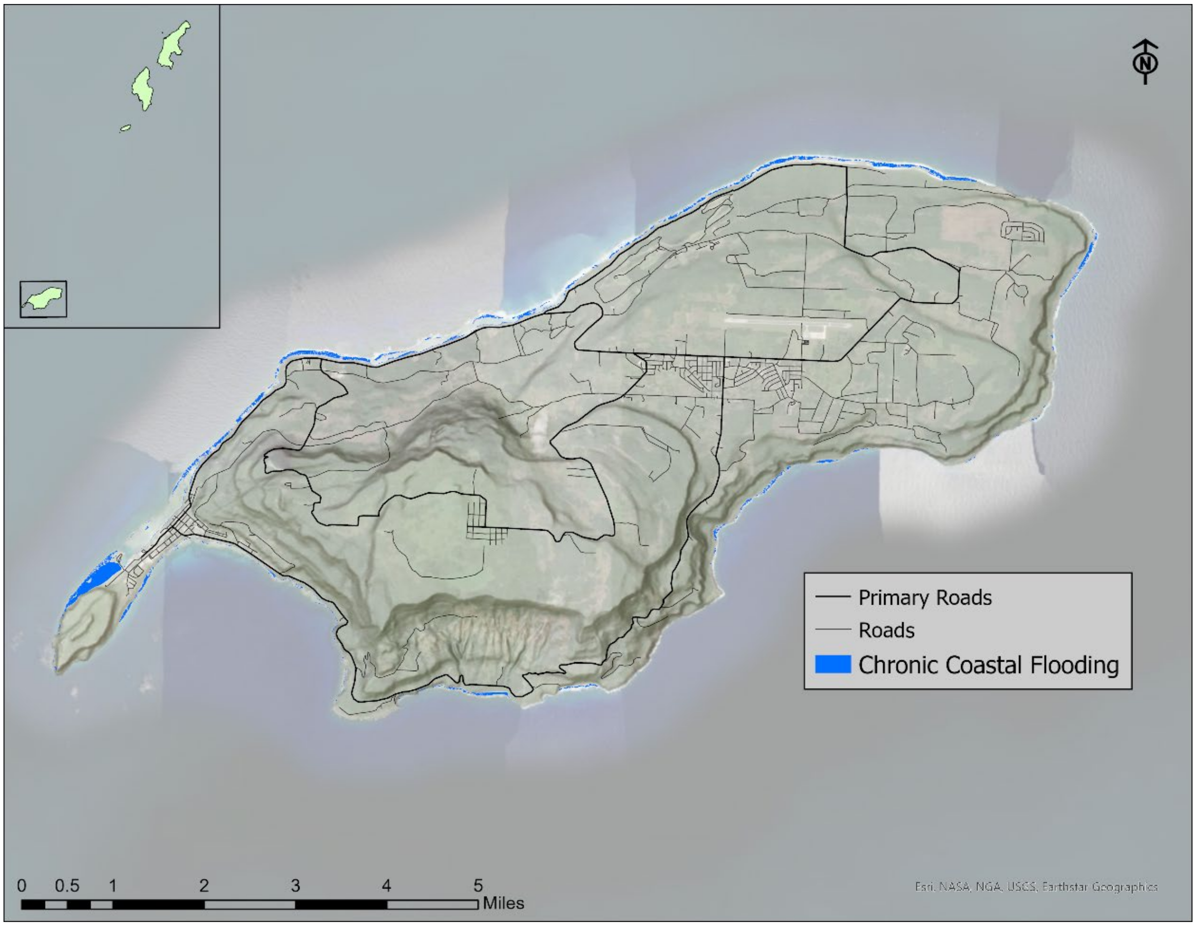


Figure 4.5-12. Chronic coastal flooding on Rota due to high tides.

Extent

The principal factors affecting flood damage are flood depth and velocity. Flowing water has tremendous power. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. The FIRM SFHA for CNMI is divided into A-zones and V-zones, which represent characteristics of flooding pertaining largely to depth and velocity.

<u>Event-based Coastal Flooding</u>

Flood severity from coastal flooding is generally determined by wave run-up and setup (see Figure 4.5-1). The degree of damage caused depends on the tidal stage at the time of the event. During high tides, water levels can be significantly higher than low tide and can inundate further inland causing more extensive damage. Most of the coastline of the Marianas are rocky and the terrain rises abruptly from the sea. The area of impact of storm surge floods is confined to regions along the immediate coastlines and typically extends to a few hundred feet inland (NOAA, n.d.).

Coastal areas that have a 1% annual chance of experiencing wave heights of 3 ft or greater are designated on the FIRM as V-zones. Under the National Flood Insurance Program, these coastal high hazard areas have stringent requirements to ensure that buildings constructed in these areas can withstand the velocities associated with this degree of wave action. New information following studies of large-scale flood events has demonstrated structures may be more vulnerable to wave action than previously estimated by FEMA V-zone estimates. To account for this new information, FEMA now delineates an area known as the Limit of Moderate Wave Action (LiMWA) that can be added to a FIRM when the Flood Insurance Study is updated, and a new FIRM produced (Figure 4.5-13). The LiMWA generally bisects an A-zone, which shows areas that have a 1% annual chance of flooding and less than 3 ft of expected wave heights. Areas seaward of the LiMWA may experience wave heights of 1.5 ft or greater. Areas landward of the LiMWA may still be flooded by ocean waves or other sources; however, the height of waves will be less than 1.5 ft in a 1% annual chance storm. At the time of the 2024 SHMP Update, the FRIM for Commonwealth has not been updated to show the LiMWA. Updates to the FIRM for the Commonwealth are expected in the next 5 to 10 years.

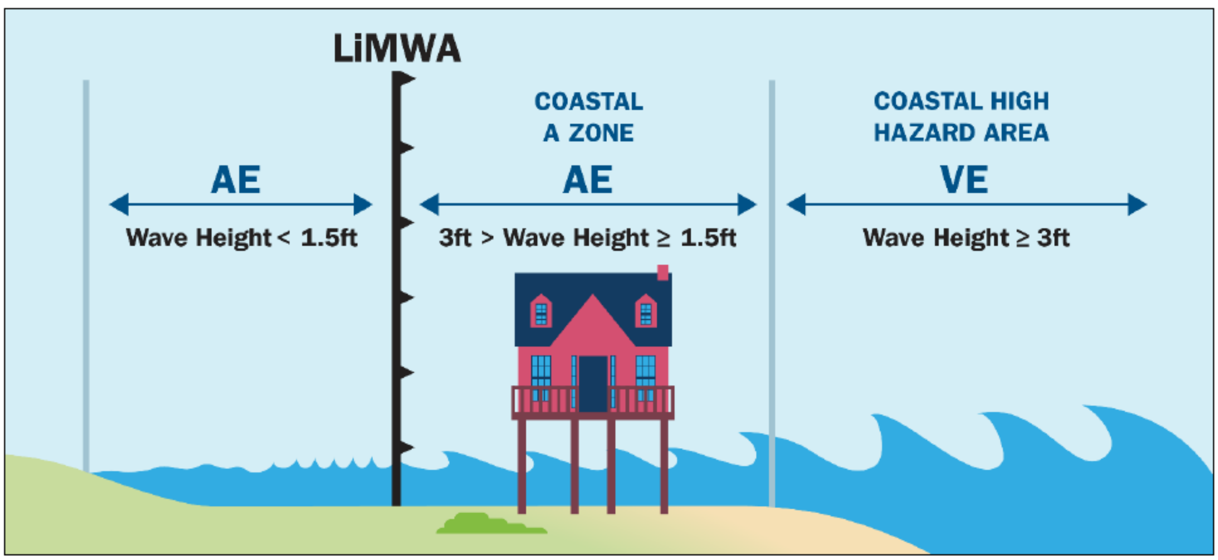


Figure 4.5-13. Limit of moderate wave action (LiMWA) potential impacts to chronic coastal flooding.
Source: FEMA (*Implementing the Limit of Moderate Wave Action in Coastal Communities | FEMA.Gov*, 2023).

<u>Event-based Inland Flooding</u>

Inland flooding occurs when moderate precipitation accumulates over several days or intense precipitation falls over a short period; other factors also influence inland flooding such as rain shed area, topography and steepness, soil type, soil moisture before an event, and ground cover (National Weather Service, 2010). Types of inland flooding were described at the beginning of this section and include watercourse flooding, flash floods, and ponding. Historically, in the US the average number of deaths related to flooding has been higher than all other natural hazards, except for heat-related mortalities in recent years.

A-zones on the FIRM show areas with a 1% annual chance of a flood. However, because the current FIRM does not show the LiMWA hazard, inland flooding cannot be easily distinguished from coastal flooding.

Warning Time for Event-based Flooding

Floods do not usually occur without warning. The National Weather Service (NWS) office typically provides flood warnings between 24 and 48 hours in advance. The NWS will update the watches and warnings and will notify the public when they are no longer in effect. The NWS issues the following coastal flood advisories, warnings, and watches (National Weather Service, n.d.):

- **Coastal Flood Advisory** is issued when minor or nuisance coastal flooding is occurring or imminent.
- **Coastal Flood Watch** is issued when moderate to major coastal flooding is possible. Such flooding could potentially pose a serious risk to life and property.
- **Coastal Flood Warning** is issued when moderate to major coastal flooding is occurring or imminent. This flooding will pose a serious risk to life and property.

The NWS issues the following inland flood advisories, watches, and warnings (National Weather Service n.d.):

- **Flood Watch** is issued when heavy rain leading to flash flooding is possible. People in the area of a flash flood watch should be prepared for heavy rains and potential flooding. Flood Watches may be issued up to 48 hours before flash flooding is expected.
- **Flood Advisory** is issued when nuisance flooding is occurring or imminent. A Flood Advisory may be upgraded to a Flash Flood Warning if flooding worsens and poses a threat to life and property.
- **Flash Flood Watch** is issued when flooding is possible due to either 1) causes other than heavy rain (e.g., dam or levee failure), or 2) heavy rain on burn scars leading to the threat of flash flooding and debris flows.
- **Flash Flood Warning** is issued when flooding is occurring or will develop quickly. If a Flash Flood Warning is issued for an area, the population needs to take shelter and/or move to high ground as necessary. Never drive or walk across a flooded roadway.

Duration of a flood event means the time between the start and end of the flood or the event that caused the flood. This can be difficult to define for floods, particularly inland floods, as they recede slowly and do not vanish completely; flood water moves from one area to another. Additionally, the duration of a flood depends on the type of flood. Flash flooding occurs within six hours of a rain event, while other types of flooding are longer-term events and may last a week or more (National Weather Service, 2010).

Chronic Coastal Flooding

The severity of any flood depends upon the type, cause, duration, and existing conditions (i.e., drainage design and pathways for water to exit). Flooding from severe rain events coupled with high tide flooding increases the severity of chronic coastal flooding.

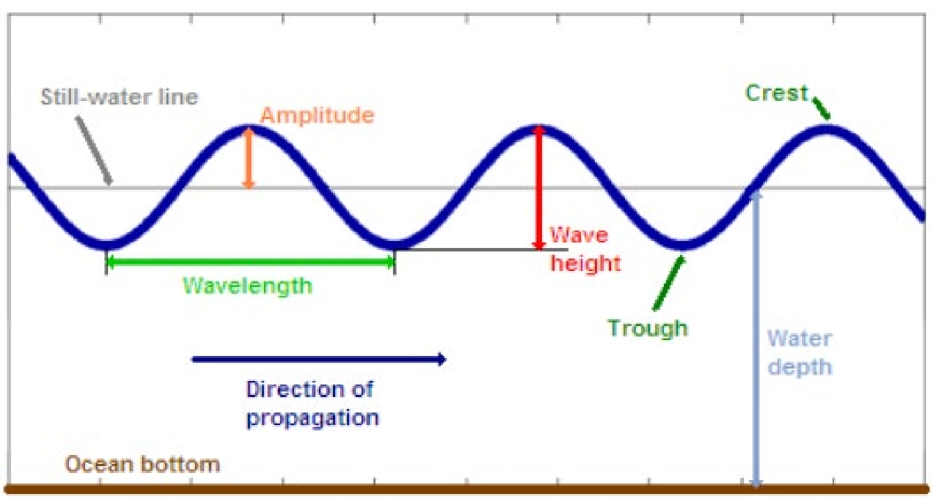
Warning Time for Chronic Coastal Flooding

Chronic coastal flooding includes a range of daily, monthly, and annual occurrences, based on the daily, monthly, and seasonal tides. Warning times for high tides and high surf are typically available as high surf and high tide advisories.

The NWS Guam Weather Forecast Office issues high surf advisories and high tide information for Saipan, Tinian, and Rota. For these islands, high surf advisories are issued based on shoreline direction and the significant wave height in feet. A high surf warning is issued when significant wave height is 15 ft for all shorelines on each island (Table 4.5-3). The significant wave height is determined by taking the average of the highest one-third (33%) of waves as measured from trough to crest. Some waves may be larger than the forecasted significant wave height.

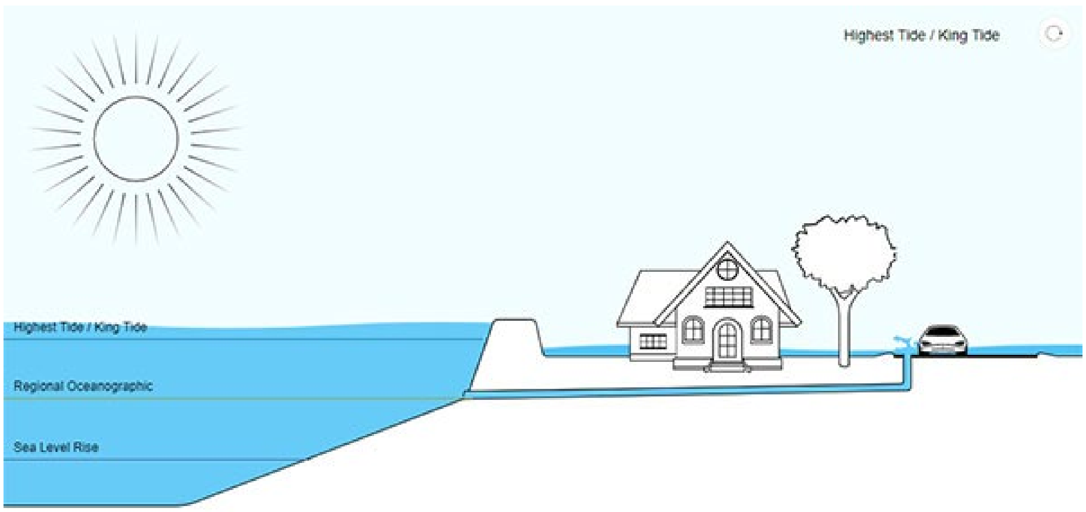
Table 4.5-3. High Surf Advisory Criteria used by the National Weather Service for Saipan, Tinian, and Rota.

Shoreline Aspect	Advisory Criteria (ft)	Warning Criteria (ft)
North Facing	9	15
East Facing	12	15
South Facing	9	15
West Facing	9	15



Source: National Weather Service (https://www.weather.gov/key/marine_sigwave).

High tide flooding and king tides are fairly predictable due to their occurrence during new or full moons. NOAA provides tide predictions for the commonwealth and can be accessed online[1]. Using this information helps predict when high tide flooding and king tides may occur and impact low-lying and coastal areas. However, as shown in Figure 4.5-13, impacts from king tides may be compounded by additional high-water levels, high waves, storms, and rainfall flooding, which may be predicted only days to a week prior to arrival (NOAA, n.d.).



Source NOAA (https://oceanservice.noaa.gov/facts/high-tide-flooding.html).

Previous Occurrences

Most deaths related to floods are a result of driving or riding into floodwaters, so the threat to life is not limited to floodplain residents. Even areas not under direct flooding conditions can experience indirect impacts. When floods inundate a water or wastewater treatment plant, these services may be impacted and affect the entire community. Overloaded sewers can flood streets and homes with sewage whereupon downstream communities could be subjected to an inundation of polluted water. Further, businesses can be impacted by the lack of utility service or inaccessibility due to inundated areas. Long-term impacts could include the closure of marginal businesses, which are disproportionately more dependent upon daily activity compared to steady businesses.

Although floods do occur in the Commonwealth, no flood event independent of a typhoon has been declared a federal emergency or federal disaster. Also, very few buildings in the Commonwealth are covered by the National Flood Insurance Program (NFIP). There are only 4 active policies at the time of the 2024 SHMP Update (see Chapter 5.0 [Mitigation Capabilities] for more information about the Commonwealth's participation in the NFIP). FEMA defines a repetitive

[1] NOAA Meteorological Observation–Station Selector at https://tidesandcurrents.noaa.gov/stations.html?type=Meteorological+Observations

loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period since 1978. According to data reports pulled from online tools from the NFIP for policy and loss statistics by flood zone for the commonwealth (data complied as of 2/29/24), only 4 claims were listed, and no properties met the criteria for repetitive loss properties.

Probability of Future Occurrence

<u>Event-based Flooding</u>

Although the geological composition of the islands allows for adequate infiltration in most parts of the islands, low-lying areas with poor drainage may be affected by event-based flooding. Records of floods for all the islands are not readily available. Data from the Guam WFO for event-based flood is limited to reports associated with tropical storm systems and from 2013 to 2023 floods were only reported in association with Tropical Storms *Bavi* (2105) and *Champi* (2015).

The frequency of extreme rainfall, defined as greater than 2 inches in 24 hours (99th percentile of the rainfall distribution), at Saipan's airport has changed little on average from 1989 (Figure 4.5-14) (Grecni et al., 2021; Marra & Kruk, 2017). The annual number of extreme rainfall days from 1994 to 2020 at the Benjamin Taisacan Manglona International Airport on Rota is shown in Figure 4.5-15. Variability in the monsoon and other factors means rainfall is much greater in some years than others.

Because extreme rainfall does not always result in event-based flooding, and the record for event-based floods is not readily available, the future probability of an event-based flood is assumed to be no greater than a 1% annual chance and the area of impact will be confined to all FIRM zones with A or V in the designation for the 2024 SHMP Update.

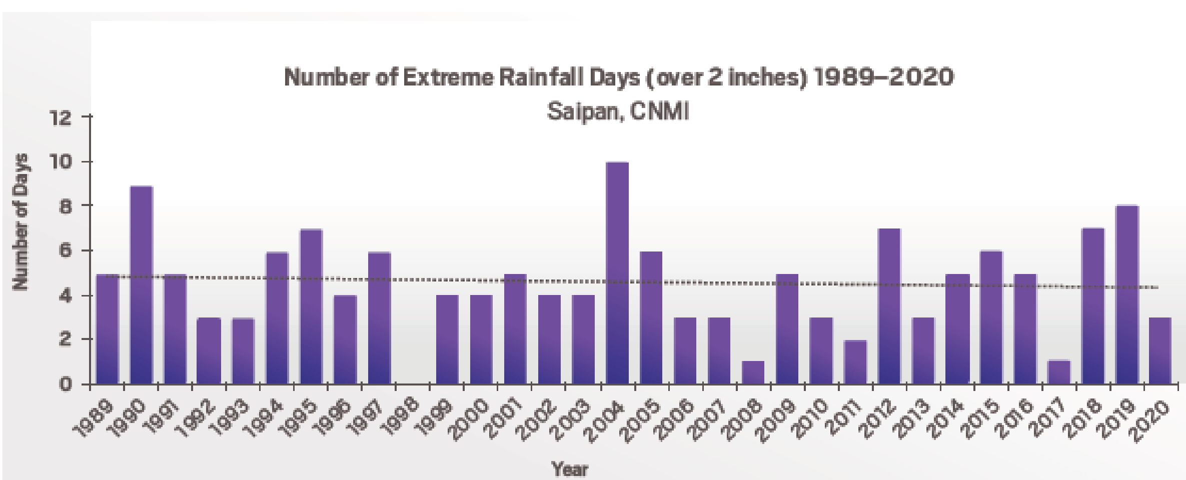


Figure 4.5-14. Annual number of extreme rainfall days, with daily rainfall totals exceeding the 99th percentile of the distribution (approximately 2 inches) from 1989 to 2020 at the Francisco C. Ada Saipan International Airport. The linear trend line (black, dotted line) shows no significant change over the record.

Source: Grecni et al. (2021). Original figure by Abby Frazier, using data from the NOAA GHCN-Daily database.

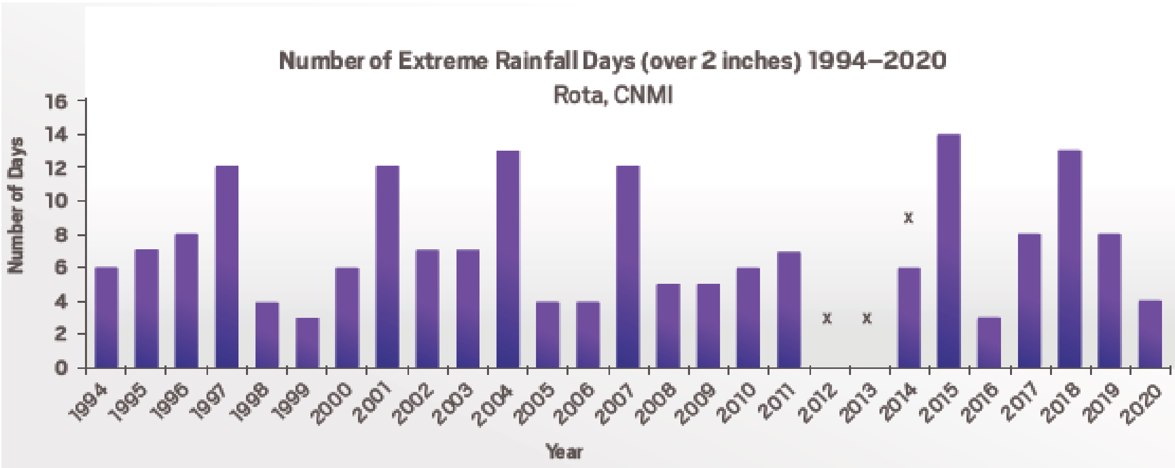


Figure 4.5-15. Annual number of days with daily rainfall totals exceeding 2 inches (51 mm) from 1994 to 2020 at Rota's international airport. The asterisks (*) represent years in which significant data were missing.
Source: Grecni et al. (2021). Original figure by Abby Frazier, using data from the NOAA GHCN-Daily database.

Chronic Coastal Flooding

Overall, the probability of future chronic coastal flooding will increase with increasing SLR and be punctuated by severe flood events that will be clustered in time around high tides and/or periods of elevated water levels. These recurring chronic floods in low-lying areas can lead to permanent flooding and permanent loss.

Less is known about the impacts of annual high wave events and the effects on shorelines. However, as sea level continues to rise, negative impacts on shorelines from annual high waves, especially during winter months, will likely increase.

The probability of tidal flooding/king tides is predictable based on lunar cycles with the greatest potential for flooding in summer and winter months around the new and full moons. However, impacts from king tide events depend on wave conditions, weather, and any additional water level anomalies. Low-lying areas have the highest probability of experiencing regular flooding from tides and king tides. As the sea level rises, these areas will become more vulnerable to regular flooding at high tides.

Chronic beach erosion leads to shoreline erosion and loss of shorefront property, resulting in loss of natural protection from coastal flooding and inundation. Coastal erosion will increase with increasing SLR in coming decades which will contribute to permanent loss and submergence of coastal lands. Also, episodic coastal erosion is connected to the return periods of storms, including typhoons. Although tropical cyclone activity may decrease in the western pacific, storms are expected to be stronger, which will likely have a greater effect on coastal erosion.

Climate Change Considerations

Event-based Flooding

Rainfall is expected to increase in the Western Pacific as global temperatures continue to rise (Sa'adi et al., 2017 in Mycoo et al., 2022). In the future, the Marianas region is expected to experience more frequent and intense extreme rainfall events with global warming (USGCRP, 2023; Zhang et al., 2016). Increased heavy rainfall events will result in increased runoff and increased potential for flooding and erosion.

Sea level is also projected to rise, increasing the risk of coastal flooding from typhoons and tropical storms. Event-based coastal flooding with SLR would increase the extent of the area subject to flooding from storm events where streams and rivers empty into the ocean. Overall, it is highly likely that changing future conditions will exacerbate current conditions and increase future event-based flood risk for inland and coastal areas.

For additional information on impacts resulting from climate change and sea level, refer to Section 4.1 (Overview) and Section 4.2 (Typhoon).

Chronic Coastal Flooding

Passive coastal flooding will continue to impact the Commonwealth as mean sea level continues to increase. Coastal areas are expected to experience an increase in frequency of chronic coastal flooding components (passive inundation, high wave flooding, tidal flooding, including king tides, and coastal erosion). SLR causes the number of high-water days to become more common. For the 2024 SHMP Update, the effects of SLR on chronic coastal flooding are evaluated below. Overall, chronic coastal flooding is expected to increase with the loss of land and structures through beach erosion, inundation due to high tides and high annual waves that reach farther inland, and area converted to wetlands or marshes due to rising water tables and altered natural drainage. However, it is expected that these chronic processes will be punctuated by less frequent but more severe events such as storms, extreme high wave events, or high-water level events.

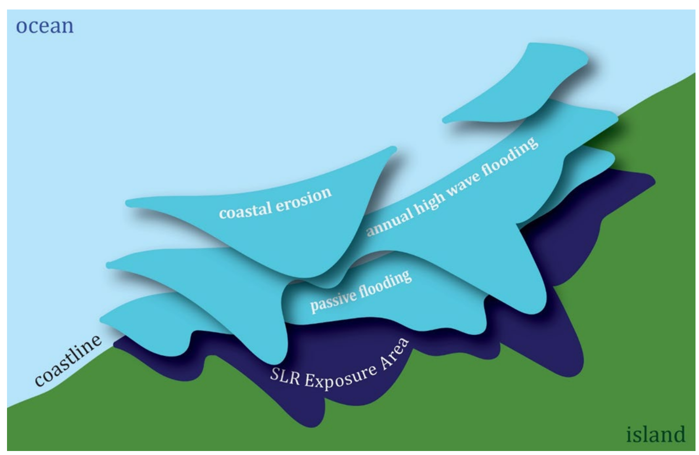


Figure 4.5-16. Chronic Coastal Flooding as the Cumulative Impact of Passive Flooding, Annual High Wave Flooding, and Coastal Erosion
Source: Hawai'i Climate Change Mitigation and Adaptation Commission (2017)

4.5.2 Vulnerability Assessment

Event-based Flooding

To assess risk from event-based flooding, a spatial analysis was conducted using spatial data for the SFHA as defined by A-zones and V-zones on the most current FIRM (2006). The best available, spatially delimited data for Commonwealth and general assets were overlaid with the SFHA in GIS to assess exposure and vulnerability. For assets exposed in the SFHA, the total replacement cost value (the combined value of the structure and its contents) was estimated. Losses for vulnerable structures in the SFHA were estimated as 45% of the structure value and 65% of the contents value to yield an estimated total loss value. The FIRMs need to be updated (FEMA, 2021). Therefore, the estimated results below may be underestimating vulnerability.

Chronic Coastal Flooding

For chronic coastal flooding, a spatial analysis was conducted using high tide flooding data from the NOAA Digital Coast Sea Level Rise Viewer. The best available, spatially delimited data for commonwealth and general assets were overlaid with the high tide flood risk area to assess exposure. For vulnerable assets within the high tide flood hazard area, the total replacement cost value (the combined value of the structure and its contents) was estimated. Losses for vulnerable structures in the high tide hazard area were estimated as 45% of the structure replacement value and 65% of the contents replacement value to yield an estimated total loss value.

Coastal Erosion

To assess risks from coastal erosion, a spatial analysis was conducted using a coastal hazards layer developed for Saipan (NMHC, 2023). Similar data layers were not available for Tinian and Rota; therefore, the approach to develop coastal erosion hazard areas for Saipan was applied to develop similar hazard areas for Tinian and Rota. Commonwealth and general assets were overlaid with the coastal erosion hazards in GIS to assess vulnerability. Loss for structures within the coastal erosion hazard areas was assumed to be 100%; however, this loss may take many years to actualize.

Climate Change and Sea Level Rise

To assess the influence of climate change on future flooding probability as well as future vulnerability of commonwealth assets to the flood hazard, a series of spatial analyses were completed. To conduct the spatial analyses, a SLR of 3 ft by 2100 was selected based on ample support for this projection under a moderate carbon emission scenario (USGCRP, 2023). See Section 4.1 (Overview) for more information about SLR. Spatially delineated flood areas representing 3 ft of SLR were obtained from the NOAA Digital Coast Sea Level Rise Viewer. Spatial data for commonwealth and general assets were overlaid with the 3 ft SLR hazard area to assess vulnerability. For buildings and structures within the 3 ft SLR hazard area, the total replacement value (structure value and contents value combined) was estimated. Total loss values for vulnerable buildings and structures were estimated at 45% of the building/structure value and 65% of contents value.

Assessment of Commonwealth Vulnerability

This section discusses the vulnerability of exposed Commonwealth assets (buildings and roads), community lifelines and critical facilities to hazards caused by event-based flooding, chronic coastal flooding, and coastal erosion.

Event-based Flooding in the SFHA

Commonwealth Buildings

The spatial analysis for event-based flooding resulted in 58 buildings located in the SFHA with a total replacement value of ~$197 million (Table 4.5-4). The total estimated loss value for these buildings to the 1% annual chance flood was estimated at 43% of the building/structure value and 65% of the contents value combined. The total loss value for the 58 vulnerable buildings was estimated at ~$102 million. Saipan had the greatest number of vulnerable buildings (37). The estimated total loss value due to a 1% chance annual flood is ~$96 million, which represents about 15% of the total replacement value of the entire commonwealth building stock. Table 4.5-4 summarizes the commonwealth building stock by municipality.

Table 4.5-4. Commonwealth building exposure and potential losses in the Special Flood Hazard Area by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldg.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	37	$184,655,254	$95,634,933	10%
Tinian	83	$140,347,469	10	$3,614,879	$1,808,108	0%
Rota	58	$123,032,676	11	$8,414,127	$4,248,207	0%
Total	**387**	**$972,324,643**	**58**	**$196,684,260**	**$101,691,248**	**10%**

Table 4.5-5 summarizes the Commonwealth building stock exposed in the SFHA by agency. Although the Department of Land and Natural Resources has the second greatest number of buildings within the SFHA (17), the estimated loss of the facilities due to the 1% annual chance flood is the greatest of all agencies at ~$46 million. The CUC is also responsible for 18 buildings in the SFHA with an estimated loss value due to a 1% annual chance flood of ~$24 million.

Table 4.5-5. Commonwealth building exposure and potential losses in the Special Flood Hazard Area by agency.

	Buildings Exposed			Estimated Potential Loss	
Agency	No. of Bldgs.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Commonwealth Healthcare Corporation	1	$23,472,107	2%	$11,814,294	1%
Commonwealth Utilities Corporation	18	$41,811,219	4%	$23,998,656	2%
Dept. of Commerce	1	$241,400	0%	$110,050	0%
Dept. of Fire and Emergency Services	1	$670,000	0%	$347,060	0%
Dept. of Lands and Natural Resources	17	$90,435,260	9%	$45,690,061	5%
Dept. of Public Lands	1	$156,249	0%	$78,645	0%
Dept. of Public Safety	2	$1,639,970	0%	$825,452	0%
Office of the Governor	2	$2,022,012	0%	$1,017,746	0%
Office of Homeland Security & Emergency Management	1	$1,936,901	0%	$974,907	0%
Ports Authority	9	$19,975,629	2%	$10,054,400	1%
Private Entity	1	$1,638,849	0%	$824,887	0%
Public School System	4	$12,684,664	1%	$5,955,090	1%
Total	**58**	**$196,684,260**	**20%**	**$101,691,248**	**10%**

Northern Islands Commonwealth Facilities

In the Northern Islands, public facilities and typhoon shelters were rebuilt on Agrihan, Alamagan, and Pagan after being damaged by Super Typhoon *Yutu.* Flood hazards have not been mapped for these islands. Structures located on a coastal plain are likely vulnerable to event-based flooding. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information, it is difficult to estimate the actual losses from an event-based flood. In addition, the estimate of total replacement value does not account for the added costs to construct facilities in the Northern Islands due to the extreme isolation and logistical challenges of transporting construction materials and equipment and lack of port facilities.

Commonwealth Road Exposure in the SFHA

Throughout the commonwealth, 16.7 miles of road are exposed to event-based flooding in the SFHA (Table 4.5-6). Public safety is compromised when motorists attempt to drive on flooded roads and highways. Floods can also deposit debris and impede egress to higher ground outside the SFHA. Flood water and debris can damage roads and increase maintenance and repair costs. Roadway contaminates, such as motor oil or transmission fluid, can contaminate flood waters degrading water quality and expose humans and wildlife to increased concentration of petroleum products in flood waters and sediments.

Table 4.5-6. Commonwealth road exposure in the Special Flood Hazard Area by municipality.

Municipality	Total Road Length (miles)	Exposed Road Length (miles)	% of Total
Saipan	87	9.6	5%
Tinian	67.1	0.3	0%
Rota	39.6	6.8	4%
Total	**193.8**	**16.7**	**9%**

Community Lifeline and Critical Facility Exposure in the SFHA

Critical facilities, including critical port facilities, that support community lifelines are exposed to event-based flooding. Table 4.5-7 summarizes the critical facilities and community lifelines exposed in the SFHA by municipality. Saipan has the greatest number of facilities exposed.

Table 4.5-7. Commonwealth community lifeline and critical facility exposure and potential losses in the Special Flood Hazard Area by municipality.

		Community Lifelines Exposed								
Municipality	Total No. of CLF	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety & Security	Transportation	Water Systems	Total No. CLF Exposed
Saipan	138	0	8	2	1	1	2	7	2	23
Tinian	56	0	0	0	0	0	0	1	9	10
Rota	43	0	7	0	0	0	1	1	0	9
Total	**237**	**0**	**15**	**24**	**9**	**19**	**35**	**48**	**52**	**42**

Table 4.5-8 summarizes critical facility exposure by community lifeline category. There is 1 critical facility that supports the health and medical lifeline exposed in the SFHA. The estimated loss value for this facility to the 1% chance annual flood is estimated at $23 million. Critical facilities that support community lifelines for Energy, Water Systems, and Transportation occur in the SFHA in relatively high numbers.

Table 4.5-8. Commonwealth community lifeline and critical facility lifeline exposure and potential losses in the Special Flood Hazard Area by lifeline category.

Category	Total No. of CLF	Total Replacement Cost Value (RCV)	Community Lifelines Exposed		Estimated Potential Loss	
			No. of CLF	Total Replacement Cost Value	Value	% of Total RCV
Communications	4	$864,517	0	$0	$0	0%
Energy	46	$140,851,551	15	$37,192,977	$21,674,141	3%
Food, Water, Shelter	24	$37,356,099	2	$3,569,389	$3,569,389	1%
Hazardous Material	9	$48,091,161	1	$4,579,212	$4,579,212	1%
Health and Medical	19	$187,643,812	1	$23,472,107	$23,472,107	4%
Safety and Security	35	$38,639,592	3	$2,685,910	$2,685,910	0%
Transportation	48	$119,925,667	9	$3,258,424	$3,258,424	1%
Water Systems	52	$50,052,062	11	$7,100,448	$7,100,448	1%
Total	**237**	**$623,424,461**	**42**	**$81,858,467**	**$66,339,631**	**11%**

Northern Islands Commonwealth Facilities

The Commonwealth facilities on Agrihan, Alamagan, and Pagan are considered critical facilities that provide essential community lifelines for island residents. Flood hazards have not been mapped for the Northern Islands. Structures located on a coastal plain are likely vulnerable to event-based flooding. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million, but with current available information, losses due to flooding were not estimated.

<u>Chronic Coastal Flooding</u>

No Commonwealth buildings, roads, or critical facilities/ lifelines, including on the Northern Islands, were exposed to chronic flooding hazards.

<u>Coastal Erosion</u>

Commonwealth Building Exposure to Coastal Erosion

A spatial analysis was conducted using Commonwealth assets overlaid with areas designated as high potential for erosion.
Table 4.5-9 summarizes Commonwealth buildings vulnerable to coastal erosion by municipality. Saipan has the greatest number of buildings in general and the greatest number vulnerable to coastal erosion. Because there are no building damage ratios for costal erosion in the CNMI, loss was estimated at 100% of the replacement cost value. However, this is likely an overestimate and loss will likely take years to actualize. The information on potential exposure and loss is more illustrative of future problems.

Table 4.5-9. Commonwealth building exposure and potential losses to coastal erosion by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	44	$17,329,424	$17,329,424	2%
Tinian	83	$140,347,469	28	$1,183,504	$1,183,504	0%
Rota	58	$123,032,676	17	$1,433,394	$1,433,394	0%
Total	**387**	**$972,324,643**	**89**	**$19,946,322**	**$19,946,322**	**2%**

Table 4.5-10 summarizes the Commonwealth buildings vulnerable to coastal erosion by agency. The Ports Authority is responsible for the greatest number of buildings vulnerable to coastal erosion, with an estimated loss value of $18 million. The Department of Land and Natural Resources is responsible for 28 facilities that are vulnerable to coastal erosion, with an estimated replacement cost of $1.6 million.

Table 4.5-10. Commonwealth buildings exposure and potential losses to coastal erosion by agency.

	Buildings Exposed			Estimated Potential Loss	
Agency	No. of Bldgs.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Dept. of Lands and Natural Resources	28	$1,629,208	0%	$1,629,208	0%
Dept. of Public Lands	1	$156,249	0%	$156,249	0%
Mayor's Offices	12	$142,000	0%	$142,000	0%
Ports Authority	48	$18,018,865	2%	$18,018,865	2%
Total	**89**	**$19,946,322**	**2%**	**$19,946,322**	**2%**

Northern Islands Commonwealth Facilities

The Commonwealth facilities on Agrihan, Alamagan, and Pagan are likely not vulnerable to chronic coastal erosion.

Commonwealth Road Exposure Coastal Erosion

Coastal erosion can compromise roadways and increase the need for hardening, maintenance, and repair. There are 6.3 miles (8%) of roadway in the area at high risk for coastal erosion (Table 4.5-11). Some of these coastal roads are primary corridors for people to access commercial areas, services, communities, and shoreline resources. Damage or closure of these roads may have cascading economic impacts and possibly isolate communities.

Table 4.5-11. Commonwealth road exposure to coastal erosion by municipality.

Municipality	Total Road Length (miles)	Exposed Road Length (miles)	% of Total Length
Saipan	87	2.8	3%
Tinian	67.1	3.5	5%
Rota	39.6	0	0%
Total	**193.8**	**6.3**	**8%**

Commonwealth Community Lifeline and Critical Facility Exposure to Coastal Erosion

The spatial analysis resulted in 3 critical facilities and community lifelines exposed to high-risk coastal erosion areas. These assets support transportation and water system lifelines. Table 4.5-12 summarizes the number of exposed critical facilities and community lifelines by municipality. Table 4.5-13 summarizes the critical facilities by lifeline category and provides total replacement costs and estimated losses for vulnerable assets. The estimated loss is ~$3.11 million for transportation and water system assets vulnerable to high-risk coastal erosion areas.

Table 4.5-12. Commonwealth community lifeline and critical facility exposure and potential losses to coastal erosion by municipality.

		Community Lifelines Exposed								
Municipality	Total No. of CLF	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety & Security	Transportation	Water Systems	Total No. Exposed
Saipan	138	0	0	0	0	0	0	0	1	1
Tinian	56	0	0	0	0	0	0	1	0	1
Rota	43	0	0	0	0	0	0	1	0	1
Total	**237**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**3**

Table 4.5-13. Commonwealth community lifeline and critical facility exposure and potential losses to coastal erosion by lifeline category.

Category	Total No. of CLF	Total Replacement Cost Value	Community Lifelines Exposed		Estimated Potential Loss	
			No. of CLF	Replacement Cost Value	Replacement Cost Value	% of Total RCV
Communications	4	$864,517	0	$0	$0	0%
Energy	46	$140,851,551	0	$0	$0	0%
Food, Water, Shelter	24	$37,356,099	0	$0	$0	0%
Hazardous Material	9	$48,091,161	0	$0	$0	0%
Health and Medical	19	$187,643,812	0	$0	$0	0%
Safety and Security	35	$38,639,592	0	$0	$0	0%
Transportation	48	$119,925,667	2	$1,467,504	$1,467,504	0%
Water Systems	52	$50,052,062	1	$1,682,183	$1,682,183	0%
Total	**237**	**$623,424,461**	**3**	**$3,149,687**	**$3,149,687**	**1%**

Northern Islands Commonwealth Facilities

The Commonwealth facilities on Agrihan, Alamagan, and Pagan are likely not vulnerable to coastal erosion.

Assessment of General Assets

This section discusses the vulnerability of exposed general building stock, socially vulnerable populations, and natural and cultural resources to hazards caused by event-based flooding, chronic coastal flooding, and coastal erosion.

Event-based Flooding in the SFHA

General Building Stock Exposure in the SFHA

The spatial analysis resulted in 1,413 general buildings exposed in the SFHA area. Table 4.5-14 summarizes the number of general buildings in the SFHA by municipality. The total estimated loss value due to a 1% annual chance flood is $520 million, representing about 8% of the total replacement cost value of the entire commonwealth building stock value. Saipan has the greatest number of exposed buildings (1,178), with a total estimated loss due to a 1% annual chance flood of $485 million.

Table 4.5-14. General building stock exposure and potential losses in the Special Flood Hazard Area by municipality.

			Buildings Exposed		Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Costs Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	1,178	$963,977,540	$485,202,044	7%
Tinian	908	$399,885,058	1	$241,601	$121,606	0%
Rota	1,261	$343,861,559	234	$69,027,750	$34,743,966	1%
Total	**14,953**	**$6,923,089,892**	**1,413**	**$1,033,246,890**	**$520,067,616**	**8%**

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.

The Commonwealth participates in the NFIP. Data from the NFIP can be helpful to determine areas at risk from event-based flooding. Although the Commonwealth does participate in the NFIP, as of 2024, there are only 4 active insurance policies. The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by NFIP within in any rolling 10-year period, since 1978. No Commonwealth structures are listed in the NFIP database as repetitive loss structures.

Socially Vulnerable and Total population Exposure in the SFHA

Socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Socially vulnerable populations include those who have special needs, such as, but not limited to, people without vehicles, people with disabilities, and older adults. Non-institutionalized residents with disabilities or with access and functional needs are vulnerable because they are more likely to have difficulty responding to a flood event than the general population. In the CNMI, persons with disabilities make up approximately 10% of the total civilian non-institutionalized population (US Census Bureau, 2024). Economically disadvantaged populations are likely to evaluate their risk and make decisions based on the major economic impact on their family and may not have funds to evacuate. In the CNMI, 38% of households had incomes below the poverty level. The elderly are also more likely to lack the physical and economic resources necessary to response to flood events and are more prone to suffer health-related disabilities that contribute to slower recovery. Elderly residents and their caregivers may have more difficulty evacuating their homes, which may lead to them being stranded in dangerous situations. In the CNMI, 6% of the population is 65–85 years old.

Floods also present threats to public health and safety, including unsafe drinking and washing water, poor sanitation, mold and mildew, mosquitos and other vermin, and mental stress and fatigue. The best preparation for these risks is awareness that they can occur, public education on prevention, and planning to address response to flooding events.

An estimated 4,040 people resided in the SFHA and are vulnerable to a 1% annual chance flood (Table 4.5-15). On Saipan, most of the population vulnerable to flooding in the SFHA has Social Vulnerability Index (SVI) scores from 3 to 5 indicting there is a moderate to high proportion of socially vulnerable people present in the exposed population.

Table 4.5-15. Commonwealth population based on 2020 Census data exposed in the Special Flood Hazard Area by social vulnerability index and municipality.

Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	Proportion of Estimated Population Exposed		
				No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	0	0	0%
	2	1,832	6,476	187	629	10%
	3	2,682	14,443	153	1,557	11%
	4	2,191	11,654	111	738	6%
	5	948	5,855	185	839	14%
No SVI Class	0	52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**636**	**3,763**	**9%**
Tinian	1	249	571	1	4	1%
	2	496	1,458	0	0	0%
Tinian Total		**745**	**2,029**	**1**	**4**	**0%**
Rota	1	409	749	135	271	36%
	2	561	1,116	5	3	0%
Rota Total		**970**	**1,865**	**140**	**274**	**15%**

SVI=Social Vulnerability Index

Natural Resources Exposure in the SFHA

Flood waters have the potential to impact terrestrial and marine ecosystems and other environmental resources. Adverse impacts may include the transport of sediment and contaminants from uplands to near shore waters degrading water quality and impacting marine ecosystems, beach erosion, loss or submergence of wetlands and other costal ecosystems, saltwater intrusion, and loss of coastal recreation areas, beaches, parks, and open space. Floods can also affect wastewater infrastructure located within the SFHA, including sewer lines, pump stations, and septic systems. Flood waters may cause a failure or backup of wastewater systems potentially diminishing water quality, impacting natural aquatic systems, and leading to human health exposure to these wastes.

The 1% annual chance flood event may impact suitable habitats for species of conservation concern. A spatial analysis was conducted to determine the square footage of suitable habitats in the SFHA. To assess vulnerability, the terrestrial index developed by Dobson et al. (2020) was used. Table 4.5-16 summarizes the results of the analysis by municipality. Saipan has the greatest number of square miles of suitable habitat within the SHFA and 48% of the suitable habitats in the SFHA are classed as 4 and 5 meaning these vulnerable habitats support high concentrations of species of conservation concern. On Tinian, the percentage of suitable habitats within the SFHA in index classes 4 and 5 is 78%. While the total area is not large, the impact of a flood within this area could potentially have a sizable effect on species of conservation concern.

Table 4.5-16. Suitable habitat for species of conservation concern exposure in the Special Flood Hazard Area by municipality.

			Suitable Habitat (SH) for Species of Conservation Concern Exposed	
Municipality	**SH Index No.**	**SH Total Area (sq miles)**	**SH Area (sq miles)**	**% of SH Total Area**
Saipan	1	26.5	1.14	2%
	2	14.5	0.33	0%
	3	27.8	3.89	5%
	4	4.0	1.33	2%
Saipan Total		**72.8**	**6.69**	**9%**
Tinian	1	1.8	0.02	0%
	2	35.8	0.89	2%
	3	7.8	2.74	6%
	4	0.1	0.04	0%
Tinian Total		**45.4**	**3.69**	**0.1**
Rota	1	10.5	0.45	1%
	2	2.0	0.12	0%
	3	13.5	1.18	3%
	4	15.6	0.14	0%
Rota Total		**41.6**	**1.9**	**5%**

Cultural Resources Exposure in the SFHA

Many cultural resources and heritage sites are located near the coast, including Chamorro and Carolinian historic sites. A spatial analysis was conducted to estimate the square miles designated as cultural resources sensitive areas by the Historic Preservation Office within the SHFA. Table 4.5-17 summarizes the square miles of area designated for cultural resources sensitivity by municipality. Saipan has the most square miles of protected resources with the SHFA.

A 1% annual chance flood has the potential to damage or destroy irreplaceable cultural resources. In Saipan, 2.1 square miles or 7% of the cultural resources land area is located in flood hazard areas, with 0.6 square miles or 4% of the area designated as a National Historic Landmark.

Coastal sites are particularly vulnerable to submersion, downstream movement of items due to undercut shoreline sediment, changes in pH of buried artifacts, reduced site integrity due to ground heave, increased risk of looting from exposure, increased erosion due to water levels and wet/dry cycles (Rockman et al., 2016). Historic landmarks are also susceptible to alteration and/or destruction of the historic landscape. Cultural landscapes are affected by flooding because it contributes to the loss of landscape features due to inundation, loss, or disruption of the use of foraging areas, loss of plant and animal species for subsistence, medicine, ceremony, etc. and degradation of vital cultural heritage resources. Loss of access to traditional places and cultural important sites (e.g., burial grounds, subsistence areas, etc.) and submersion of homelands are contributing stressors to and loss of social connections and interconnections. Post-flooding involves an increased risk of rot, fungal/insect attack, mold, and mildew on cultural resources. Swelling, distortion of wooden building materials and architectural features, spalling of wood, brick, and stone materials during drying and corrosion of masonry are adverse effects from flooding. For facilities that house collections, flooding may cause damage to collection storage areas and potential wetting of museum artifacts. This results in an added strain on existing museum facilities and staff due to salvage operations. Collections are particularly vulnerable to flooding events due to increased risk of mold, increase rusting/corrosion of metal objects, and damage and destruction from increased humidity and moisture.

During flooding, contaminated waters may deposit sediment within sites degrading site conditions and potentially exposing site users to contaminants (e.g., petroleum constituents, hazardous materials, or *Escherichia coli* bacteria from sewage or pet waste). Sensitive burial areas may also be at risk from wave energy and flooding. Preservation planners and advocates who wish to help historic properties withstand flooding will need to work collaboratively with floodplain managers, emergency management, and climate adaptation experts to develop mitigation plans that account for a changing climate.

Table 4.5-17. Cultural resources exposure in the Special Flood Hazard Area by municipality.

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	0.6	4%
Sensitive Area	16.0	1.5	10%
Saipan Total	**30.9**	**2.1**	**7%**
Tinian			
National Historic Landmark	0.0	0.0	0
Sensitive Area	16.6	0.1	1%
Tinian Total	**16.6**	**0.1**	**1%**

Table 4.5-17. Cultural resources exposure in the Special Flood Hazard Area by municipality (*cont'd*).

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Rota			
National Historic Landmark	0.4	0.0	1%
Sensitive Area	33.9	0.6	2%
Rota Total	**34.3**	**0.6**	**2%**

Chronic Coastal Flooding

General Building Stock Exposure Chronic Coastal Flooding

The spatial analysis resulted in 4 general buildings exposed in the high tide hazard area and all were located on Saipan (Table 4.5-18). The total replacement costs for the vulnerable buildings is $130 million. Potential loss was estimated at 43% of the structure value and 65% of the contents value. The total loss value for the 4 vulnerable buildings was estimated at $67 million.

Table 4.5-18. General building stock exposure and potential losses to chronic coastal flooding by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	Buildings Exposed		Estimated Potential Loss	
			No. of Bldgs.	Replacement Cost Value	Vale	% of Total RCV
Saipan	12,761	$6,179,343,275	4	$130,189,648	$67,264,651	1%
Tinian	908	$399,885,058	0	0	0	0%
Rota	1,261	$343,861,559	0	0	0	0%
Total	**14,953**	**$6,923,089,892**	**4**	**$130,189,648**	**$67,264,651**	**1%**

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update

Socially Vulnerable and Total Population Exposure to Chronic Coastal Flooding

The spatial analysis resulted in a single residence on Saipan within the coastal flooding hazard. An SVI class of 3 was assigned to the census block where this building is located, indicating there is a moderate probability the people are socially vulnerable to chronic coastal flooding from high tides.

Natural Resources Exposure to Chronic Coastal Flooding

Adverse impacts from chronic coastal flooding may include loss or submergence of wetlands and other costal ecosystems, higher water table, loss of recreation areas, beaches, parks, and open space. Wastewater infrastructure, including sewer lines, pump stations, and septic systems, may also be affected by chronic coastal flooding. Flood waters may cause a failure or backup of wastewater systems potentially diminishing water quality, impacting natural aquatic systems, and leading to human health exposure to these wastes.

To assess potential impacts to suitable habitats for species of conservation concern, the terrestrial index developed by Dobson et al. (2020) was overlaid with the high tide hazard areas. The exposure analysis resulted in low vulnerability of suitable terrestrial habitats to chronic coastal flooding. Square miles of suitable terrestrial habitat vulnerable to high tide flooding were 0.13 (0%) on Saipan, 0.03 (0%) on Tinian, and 0.37 (1%) on Rota (the percent of vulnerable suitable habitat area compared to the total area of suitable habitat for each island is given in parentheses). See Appendix D for data tables.

Cultural Resources Exposure to Chronic Coastal Flooding

Adverse impacts from chronic coastal flooding to cultural resources may include submersion of significant land with structures, damage or loss of organic and inorganic artifacts, traditional places, culturally important sites (e.g., burial grounds), and landscape features (Rockman et al., 2016). Reduced site integrity and loss of cultural value through habitat alteration caused by water level change and/or saltwater intrusion, erosion, and loss of recreation areas, beaches, parks, and other cultural landscapes.

To assess potential impacts to areas designated for cultural resources protection, polygons for cultural resource areas were overlaid with the high tide hazard area. The exposure analysis resulted in low vulnerability to areas designated sensitive for cultural resources by the Historic Preservation Office. Square miles of area designated as sensitive cultural resources vulnerable to high tide flood were 0.06 (0%) on Saipan, 0.01 (0%) on Tinian, and 0.02 (0%) on Rota (the percent of vulnerable suitable habitat area compared to the total area of suitable habitat for each island is given in parentheses). See Appendix D for data tables.

Coastal Erosion

General Building Stock Exposure to Coastal Erosion

The spatial analysis resulted in 4 general buildings within the area considered high risk for coastal erosion. These are the same facilities that are also vulnerable to high tide flooding discussed earlier. Table 4.5-19 summarizes the general buildings potential exposed to a high risk of coastal erosion. Because there are no building damage ratios developed for coastal erosion for the Commonwealth, loss is assumed to be 100% over time. The loss value for the 4 vulnerable buildings is $130 million, but this loss is expected to occur in the future.

Table 4.5-19. General building stock exposure and potential losses to coastal erosion by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	Buildings Exposed		Estimated Potential Loss	
			No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	4	$130,189,648	$130,189,648	2%
Tinian	908	$399,885,058	0	0	0	0%
Rota	1,261	$343,861,559	0	0	0	0%
Total	**14,953**	**$6,923,089,892**	**4**	**$130,189,648**	**$130,189,648**	**2%**

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.

Socially Vulnerable and Total Population Exposure to Coastal Erosion

Socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Economically disadvantaged populations are likely to evaluate their risk and decide based on the economic impact on their family and may not have funds to evacuate.

Coastal erosion can damage property and expose property to increased hazards from waves, including storm surge, other wind-driven waves, and tsunami. Economically challenged individuals may lack the resources or time to install erosion preventative measures to reduce impacts to property.

An estimated 491 people resided in areas at high risk for coastal erosion. Table 4.5-20 summarizes the total population vulnerable to coastal erosion by SVI index and by municipality. Although the most people potentially vulnerable to coastal erosion reside on Saipan (398 people or 1% of the total island population), the proportion of the total population vulnerable to coastal erosion is higher on Rota (4% of the total island population). Most of the vulnerable population on Rota is in the lowest SVI class suggesting a low proportion of socially vulnerable individuals are at risk from coastal erosion. On Saipan, an estimated 312 people in SVI classes 3 and 4, indicating a moderate proportion of socially vulnerable people, are vulnerable to coastal erosion.

Table 4.5-20. Commonwealth population based on 2020 census data exposed to coastal erosion by social vulnerability index and municipality.

Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	Proportion of Estimated Population Exposed		
				No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	2	2	0%
	2	1,832	6,476	28	84	0%
	3	2,682	14,443	21	162	0%
	4	2,191	11,654	27	150	0%
	5	948	5,855	0	0	0%
		52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**78**	**398**	**1%**
Tinian	1	249	571	0	0	0%
	2	496	1,458	4	12	1%
Tinian Total		**745**	**2,029**	**4**	**12**	**1%**
Rota	1	409	749	38	78	4%
	2	561	1,116	0	3	0%
	0	22	0	1	0	0%
Rota Total		**992**	**1,865**	**39**	**81**	**4%**

SVI=Social Vulnerability Index

Natural Resources Exposure to Coastal Erosion

Adverse impacts from coastal erosion may include loss of recreation areas, beaches, parks, and open space. Coastal erosion may also adversely affect habitats that harbor species of conservation concern. To assess potential impacts to suitable habitats for species of conservation concern, the terrestrial index developed by Dobson et al. (2020) was overlaid with area determined to be at high risk for coastal erosion. The exposure analysis resulted low vulnerability of suitable terrestrial habitats to costal erosion. Square miles of suitable terrestrial habitat vulnerable to coastal erosion were 1.4 (2%) on Saipan, 1.0 (2%) on Tinian, and 1.0 (2%) on Rota (the percent of vulnerable suitable habitat area compared to the total area of suitable habitat for each island is given in parentheses). See Appendix D for data tables.

Cultural Resources Exposure to Coastal Erosion

Adverse impacts from coastal erosion to cultural resources may include full loss of coastal sites and artifacts, partial loss of sites and artifacts, exposure of new and known archaeological sites, increased risk of looting from exposure. Facilities that house artifacts face storage capacity limitations as the number of at-risk artifacts increases. Added strain on existing museum facilities and staff due to salvage operations (Rockman et al., 2016). Destabilization of buildings or loss of structures with increased rusting, corrosion, and salt deposits due to increased saltwater intrusion, landscape alterations, and loss of recreation areas, beaches, parks, and other cultural landscapes.

To assess potential impacts to areas designated sensitive for cultural resources, the polygon for cultural resources areas were overlaid with areas designated as high risk for coastal erosion. The exposure analysis resulted in low vulnerability to areas designated sensitive for cultural resources by the Historic Preservation Office. Square miles of area designated for sensitive for cultural resources vulnerable to coastal erosion were 1.0 (3%) on Saipan, 0.3 (2%) on Tinian, and 0.9 (3%) on Rota (the percent of vulnerable suitable habitat area compared to the total area of suitable habitat for each island is given in parentheses). See Appendix D for data tables.

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate
- Potential or projected development
- Projected changes in population

Climate Change

As mentioned previously in this section as well as in Section 4.1 (Overview), climate change is expected to exacerbate future conditions which will increase exposure and vulnerability to this hazard. SLR is expected to increase the frequency of floods as well as the spatial extent of flood waters. There is ample scientific support and a high level of confidence that the Commonwealth will experience about 3 ft of SLR by 2100 under a moderate carbon emission scenario (USGCRP, 2023).

Future Event-based Flooding and Sea Level Rise

The 2018 State Standard Mitigation Plan (SSMP) presented nine coastal flooding and inundation models for Saipan that incorporated various SLR estimates and 10-year and 50-year storms (see Appendix C for a summary of the 2018 Saipan SLR flooding scenarios). The 2018 SSMP did not include SLR models for Rota or Tinian because bathymetry data were not available, and the Northern Islands were not analyzed for SLR. Now, SLR models for Saipan, Tinian , and Rota are available through NOAA's Digital Coast for various emission scenarios and time frames. However, SLR models are still not available for the Northern Islands. The NOAA digital Coast data does not incorporate wave driven flooding or elevated rainfall associated with storms.

Other data sources for SLR in the CNMI include NOAA Office for Coastal Management Sea Level Rise Inundation Database (Saipan coverage only), US Army Corps of Engineers SLR Curves, and special flood layers for Saipan (Greene, 2017) . Various reports have used these different data sources to evaluate the impacts to assets (buildings, infrastructure, lifelines, economy, vulnerable populations, natural and cultural resources). Reports include 1) *CNMI Coastal Resilience Assessment* (Dobson et al., 2020), 2) *CNMI Final Post Disaster Watershed Plan* (USACE, 2022), and 3) *CNMI Community Development Block Grant Mitigation Initial Action Plan* (NMHC, 2022). For the 2024 SHMP Update, the intermediate emission scenario of 3 ft of SLR by 2100 from the US *Fifth National Climate Assessment* (USGCRP, 2023) listed above will be used.

For the 2024 SHMP Update, future vulnerability in the Commonwealth to SLR in conjunction with flooding was spatially analyzed using data for the CNMI from NOAA Digital Coast Sea Level Rise View for 3 ft of sea level increase, flood mask data developed by Storlazzi et al. (2019) for storm driven waves, and the SFHA (A-zones and V-zones) for the current FIRM. These datasets were combined in the GIS and the boundaries between the polygons dissolved to delimit the future flood hazard area. GIS data for Commonwealth assets were then overlaid with the delimited future flood hazard area to assess vulnerability and potential losses, which were estimated using 2024 replacement values (building and contents). Total loss values for vulnerable buildings and structures were assumed to remain similar to today; total loss was estimated at 45% of the building/structure value and 65% of contents value.

Chronic Coastal Flooding

Chronic coastal flooding is expected to worsen as sea level continues to rise. As mean sea level increases, periodic astronomical high tides will inundate new areas (Figure 4.5-8). Other low-lying wetlands and marshes will also likely see increased flooding as sea level changes the level of the water table (Figure 4.5-5).

To assess the future vulnerability to chronic coastal flooding from SLR, a spatial analysis was conducted using data for the CNMI from NOAA Digital Coast Sea Level Rise View for 3 ft of sea level increase. GIS data for Commonwealth assets were overlaid in GIS with the SRL hazard area to assess vulnerability and potential losses, which were estimated using 2024 replacement values (building and contents). Total loss values for vulnerable buildings and structures were assumed to remain similar to today; total loss was estimated at 45% of the building/structure value and 65% of contents value.

Coastal Erosion

Coastal erosion is expected to worsen as sea levels continue to rise and storm intensity increases bringing stronger wave action and more intense flooding. However, there are no models to predict how climate change will influence where coastal erosion will occur or how the rate of erosion may change due to these climate stressors. Continuing beach and shoreline monitoring is recommended until other means to predict this hazard are developed in the future.

Assessment of Commonwealth Vulnerability

Future Event-based Flooding and Sea Level Rise

Commonwealth Buildings and Primary Roads

The spatial analysis for future SLR and event-based flooding resulted in 61 buildings located in the future flood hazard zone with a total replacement value of ~$198 million (Table 4.5-21). Compared to current conditions, 3 additional buildings on Tinian are considered vulnerable to future loss. The total loss value for the 61 vulnerable buildings was estimated at ~$103 million. Saipan had the greatest number of vulnerable buildings (37). Table 4.5-21 summarizes the Commonwealth building stock by municipality.

Table 4.5-21. Commonwealth building exposure and potential losses to the future event-based flood hazard and 3 feet of sea level rise by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	37	$184,655,254	$95,634,933	10%
Tinian	83	$140,347,469	13	$5,287,793	$2,650,142	0%
Rota	58	$123,032,676	11	$8,414,127	$4,248,207	0%
Total	**387**	**$972,324,643**	**61**	**$198,357,174**	**$102,533,282**	**11%**

Table 4.5-22 summarizes the Commonwealth building stock exposed in the future flood hazard area by agency. The outcome of this analysis for future conditions remained similar to the current extent of the SFHA.

Table 4.5-22. Commonwealth building exposure and potential losses to the future event-based flood hazard and 3 feet of sea level rise by agency.

Agency	Buildings Exposed			Estimated Potential Loss	
	No. of Bldgs.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Commonwealth Healthcare Corporation	1	$23,472,107	2%	$11,814,294	1%
Commonwealth Utilities Corporation	18	$41,811,219	4%	$23,998,656	2%
Dept. of Commerce	1	$241,400	0%	$110,050	0%
Dept. of Fire and Emergency Services	1	$670,000	0%	$347,060	0%
Dept. of Lands and Natural Resources	17	$90,435,260	9%	$45,690,061	5%
Dept. of Public Lands	1	$156,249	0%	$78,645	0%
Dept. of Public Safety	2	$1,639,970	0%	$825,452	0%
Mayor’s Offices	1	$297,031	0%	$149,506	0%
Office of the Governor	2	$2,022,012	0%	$1,017,746	0%
Office of Homeland Security & Emergency Management	1	$1,936,901	0%	$974,907	0%
Ports Authority	11	$21,351,512	2%	$10,746,928	1%
Private Entity	1	$1,638,849	0%	$824,887	0%
Public School System	4	$12,684,664	1%	$5,955,090	1%
Total	**61**	**$198,357,174**	**20%**	**$102,533,282**	**11%**

Future event-based flood conditions with 3 ft of SLR will impact an additional 0.3 miles of Commonwealth primary roads. Although SLR models are not available and flood hazards have not been mapped for Northern Islands; SLR rise will likely amplify any existing flooding effects.

Critical Facilities and Community Lifelines

Critical facilities located in the SFHA and near the coast will continue to be exposed to future event-based floods. With 3 ft of SLR, 2 additional facilities will be vulnerable and total estimated losses to all critical facilities in the future flood hazard area increases from $81 million to $83 million. Table 4.5-23 summarizes the critical facilities and community lifelines exposed to the future event-based flood hazard area by lifeline category.

Table 4.5-23. Commonwealth community lifeline and critical facility exposure and potential losses to the future flood hazard and 3 feet of sea level rise by lifeline category.

			Community Lifelines Exposed		Estimated Potential Loss	
Category	Total No. of CLF	Total Replacement Cost Value (RCV)	No. of CLF	Total Replacement Cost Value	Value	% of Total RCV
Communications	4	$864,517	0	$0	$0	0%
Energy	46	$140,851,551	15	$37,192,977	$21,674,141	3%
Food, Water, Shelter	24	$37,356,099	2	$3,569,389	$3,569,389	1%
Hazardous Material	9	$48,091,161	1	$4,579,212	$4,579,212	1%
Health and Medical	19	$187,643,812	1	$23,472,107	$23,472,107	4%
Safety and Security	35	$38,639,592	3	$2,685,910	$2,685,910	0%
Transportation	48	$119,925,667	11	$4,634,307	$4,634,307	1%
Water Systems	52	$50,052,062	11	$7,100,448	$7,100,448	1%
Total	**237**	**$623,424,461**	**44**	**$83,234,350**	**$67,715,514**	**11%**

Future Chronic Coastal Flooding and Sea Level Rise

Commonwealth Buildings and Primary Roads

Under the current scenario for high tide flooding, no Commonwealth buildings or roads were exposed to the chronic coastal flood hazard. With a rise of 3 ft in sea level, 4 Commonwealth facilities will be vulnerable to the chronic coastal flood hazard with estimated potential losses of $16 million. Table 4.5-24 summarizes the vulnerability and estimated losses by municipality. The Department of Land and Natural Resources is responsible for all the buildings that will potentially be vulnerable to chronic coastal flooding in the future (Table 4.5-25). A small segment of road on Saipan, 0.04 miles in length, will be exposed to chronic coastal flooding with 3 ft of sea level rise.

Table 4.5-24. Commonweatlh building exposure and potential losses to future chronic coastal flooding with 3 feet of sea level rise by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	2	$31,289,418	$15,749,007	2%
Tinian	83	$140,347,469	1	$241,906	$110,379	0%
Rota	58	$123,032,676	1	$851,145	$397,044	0%
Total	**387**	**$972,324,643**	**4**	**$32,382,469**	**$16,256,430**	**2%**

Table 4.5-25. Commonweatlh building exposure and potential losses to future chronic coastal flooding with 3 feet of sea level rise by agency.

Agency	Buildings Exposed			Estimated Potential Loss	
	No. of Bldgs.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Value	% of Total RCV ($972,324,643)
Dept. of Lands and Natural Resources	4	$32,382,469	3%	$16,256,430	2%
Total	**4**	**$32,382,469**	**3%**	**$16,256,430**	**2%**

Critical Facilities and Community Lifelines

Similar to the Commonwealth buildings, no critical facilities or community lifelines were exposed to chronic coastal flooding under current conditions. However, with 3 ft of SLR, 1 critical facility on Tinian that supports the transportation lifeline may be vulnerable to chronic coastal flooding. The total replacement cost value of the facility is estimated at $86, 719 and estimated losses due to chronic coastal flooding are $43,648.

Assessment of General Assets

Future Event-based Flooding and Sea Level Rise

General Building Stock

The spatial analysis for future SLR and event-based flooding resulted in 1,514 buildings located in the future flood hazard zone with a total replacement value of ~$1 billion (Table 4.5-26). This is an increase of approximately 100 buildings with most of them located on Saipan and some on Tinian. The increase in estimated loss is ~$100 million in 2024 dollar values. Because Saipan is heavily developed and populated along the low-lying western coast, it will likely continue to have the greatest number buildings and population vulnerable to event-based flooding hazards into the future.

Table 4.5-26. General building stock exposure and potential losses to the future event-based flood hazard and 3 feet of sea level rise by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Costs Value (RCV)	Buildings Exposed		Potential Loss	
			No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	1,274	$1,046,575,520	$526,776,349	8%
Tinian	908	$399,885,058	6	$2,336,070	$1,175,822	0%
Rota	1,261	$343,861,559	234	$69,027,748	$34,743,966	1%
Total	**14,953**	**$6,923,089,892**	**1,514**	**$1,117,939,338**	**$562,696,137**	**8%**

Total and Socially Vulnerable Populations

SLR is expected to intensify and expand the effects of event-based flooding. Flood waters have several negative impacts for the general population and for socially vulnerable populations including unsafe drinking and washing water, poor sanitation, mold and mildew, mosquitos and other vermin, and mental stress and fatigue. As sea level rises saltwater intrusion may impact property and affect drinking water. With 3 ft of sea level rise, over 30 residences will be vulnerable to event-based flooding compared to today (Table 4.5-27). The greatest increase in affected residences is in SVI class 4, (111 residences affected today compared to 140 residences affected in the future). An SVI index score of 4 indicated the census tracks where these residences are located have a greater proportion of people that are socially vulnerable.

Table 4.5-27. Commonwealth population based on 2020 census data exposed to future event-based flood hazard and 3 feet of sea level rise by social vulnerability index and municipality.

				Proportion of Estimated Population Exposed		
Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	0	0	0%
	2	1,832	6,476	187	629	10%
	3	2,682	14,443	155	1,573	11%
	4	2,191	11,654	140	911	8%
	5	948	5,855	185	839	14%
No SVI Class	0	52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**667**	**3,952**	**9%**
Tinian	1	249	571	1	4	1%
	2	496	1,458	1	3	0%
Tinian Total		**745**	**2,029**	**2**	**7**	**0%**
Rota	1	409	749	135	271	36%
	2	561	1,116	5	3	0%
Rota Total		**970**	**1,865**	**140**	**274**	**15%**

SVI=Social Vulnerability Index

Natural and Cultural Resources

Many natural and cultural resources are found along the coast in the Commonwealth and may become vulnerable to increased flood potential due to sea level rise. The spatial analysis show resulted in an increase in the number of square miles of suitable habitat for species of conservation concern and sensitive for cultural resources that may become vulnerable to the future flood hazard with 3 ft of SLR (Table 4.5-28 and Table 4.5-29). Effects to natural and cultural resources due to event-based flooding and food waters is discussed above, and these effects are expected to be similar in the future.

Table 4.5-28. Suitable habitat for species of conservation concern to future event-based flood hazard and 3 feet of sea level rise by municipality.

Municipality	SH Index No.	SH Total Area (sq miles)	Suitable Habitat (SH) for Species of Conservation Concern Exposed	
			SH Area (sq miles)	% of SH Total Area
Saipan	1	26.5	1.25	2%
	2	14.5	0.39	1%
	3	27.8	4.13	6%
	4	4.0	1.42	2%
Saipan Total		**72.8**	**7.19**	**10%**
Tinian	1	1.8	0.06	0%
	2	35.8	1.14	3%
	3	7.8	3.02	7%
	4	0.1	0.05	0%
Tinian Total		**45.4**	**4.27**	**9%**
Rota	1	10.5	0.56	1%
	2	2.0	0.17	0%
	3	13.5	1.79	4%
	4	15.6	1.47	4%
Rota Total		**41.6**	**4.0**	**10%**

Table 4.5-29. Cultural resources exposure to future event-based flood hazard and 3 feet of sea level rise by municipality.

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	0.7	2%
Sensitive Area	16.0	1.7	6%
Saipan Total	**30.9**	**2.4**	**8%**
Tinian			
National Historic Landmark	0.0	0.0	0
Sensitive Area	16.6	0.2	2%
Tinian Total	**16.6**	**0.2**	**2%**
Rota			
National Historic Landmark	0.4	0.0	0%
Sensitive Area	33.9	0.6	2%
Rota Total	**34.3**	**0.6**	**2%**

Future Chronic Coastal Flooding and Sea Level Rise

General Building Stock

SLR is expected to exacerbate flooding potential during periodic high tide events. As the mean elevation of the sea increases to 3 ft, it will cover a greater coastal area on all the islands. As tides shift daily and seasonally, the high and extremely high tides will have greater reach from an elevated mean level and saltwater will inundate additional areas. SLR will also increase the height of the water table and as tides change, the water levels in low-lying wetlands and marshes will also be affected.

The spatial analysis resulted in 52 general buildings exposed in the high tide hazard area with 51 on Saipan and 1 on Rota. Although the number of structures that become vulnerable to chronic coastal flood increased from 5 to 51 on Saipan, the replacement cost and loss values did not increase proportionally suggesting the additional vulnerable structures are low-cost structures. (Table 4.5-18 and Table 4.5-30). The total replacement cost for the buildings that may become vulnerable to chronic coastal flooding is $147 million in 2024 dollars. Potential loss was estimated at 43% of the structure value and 65% of the contents value. The total loss value for the 52 vulnerable buildings was estimated at $76 million in 2024 dollars.

Table 4.5-30. General building stock exposed to the future chronic flood hazard and 3 feet of sea level rise by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	51	$147,120,559	$76,012,289	1%
Tinian	98	$399,885,058	0	$0	0	0%
Rota	1,261	$343,861,559	1	$178,129	$42,750	0%
Total	**14,953**	**$6,923,089,892**	**52**	**$147,298,688**	**$76,055,040**	**1%**

Total and Socially Vulnerable Populations

The spatial analysis resulted in 30 residences being vulnerable to future chronic coastal flooding due to 3 ft of SLR compared to 1 residence under the conditions today. Most of the residences (29) that may become vulnerable are on Saipan with a single residence on Rota (Table 4.5-31). The highest number of residences (21) that may become vulnerable to chronic coastal flooding are located in census tracts with an SVI Index score of 5 suggesting a high proportion of socially vulnerable people may be affected.

Table 4.5-31. Commonwealth population based on 2020 census data to the future chronic coastal flood hazard and 3 feet of sea level rise.

Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	Proportion of Estimated Population Exposed		
				No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	0	0	0%
	2	1,832	6,476	5	16	0%
	3	2,682	14,443	1	12	0%
	4	2,191	11,654	2	14	0%
	5	948	5,855	21	87	1%
		52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**29**	**129**	**0%**
Tinian	1	249	571	0	0	0%
	2	496	1,458	0	0	0%
Tinian Total		**745**	**2,029**	**0**	**0**	**0%**
Rota	1	409	749	1	1	0%
	2	561	1,116	0	0	0%
	0	22	0	0	0	0%
Rota Total		**992**	**1,865**	**1**	**1**	**0%**

SVI=Social Vulnerability Index

Natural and Cultural Resources

Wetlands and coastal areas are important ecosystems and help attenuate the impacts from sea level rise, storm surge, and floods. However, SLR and chronic coastal flooding can reduce these protective functions and degrade these ecosystems, further moderating their functions. Chronic coastal flooding has the potential to affect infrastructure that can release wastewater from septic tanks, cesspools, or other on-site sewer disposal systems for residences that may become vulnerable in the future.

The spatial analysis for suitable habitats for species of conservation concern resulted a 5-fold increase on Saipan and a 3-fold increase on Tinian and Rota of square miles vulnerable to future chronic coastal flooding (Table 4.5-32). Loss or alteration would likely have negative effects to the species of conservation value and loss or alternation of coastal ecosystems would likely have cascading ecological and economic effects.

The number of square miles designated for cultural resources protection within the future chronic coastal flood hazard also increased. (Table 4.5-33). Cultural resources near the coast could be permanently lost or altered due to SLR and associated chronic coastal flooding. Effects to cultural resource sites exposed to flooding are described above and are expected to remain similar in the future.

Table 4.5-32. Suitable habitat for species of conservation concern to the future chronic coastal flood hazard and 3 feet of sea level rise by municipality.

Municipality	SH Index No.	SH Total Area (sq miles)	Suitable Habitat (SH) for Species of Conservation Concern Exposed	
			SH Area (sq miles)	% of SH Total Area
Saipan	1	26.5	0.22	0%
	2	14.5	0.12	0%
	3	27.8	3.50	5%
	4	4.0	1.37	2%
Saipan Total		**72.8**	**5.21**	**7%**
Tinian	1	1.8	0.01	0%
	2	35.8	0.53	1%
	3	7.8	2.82	6%
	4	0.1	0.04	0%
Tinian Total		**45.4**	**3.41**	**0.1**
Rota	1	10.5	0.23	1%
	2	2.0	0.12	0%
	3	13.5	1.44	3%
	4	15.6	1.44	3%
Rota Total		**41.6**	**3.24**	**8%**

Table 4.5-33. Cultural resource exposure to future event-based flood hazard and 3 feet of sea level rise by municipality.

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed	
		CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	0.53	2%
Sensitive Area	16.0	0.32	1%
Saipan Total	**30.9**	**0.85**	**3%**
Tinian			
National Historic Landmark	0.0	0.06	0%
Sensitive Area	16.6	0.00	0%
Tinian Total	**16.6**	**0.06**	**0%**
Rota			
National Historic Landmark	0.4	0.00	0%
Sensitive Area	33.9	0.06	0%
Rota Total	**34.3**	**0.06**	**0%**

Potential or Projected Development

The Department of Public Lands (DPL) has identified area of that may be developed in the future (DPL, 2019). For this spatial analysis, specific land use types selected for evaluation included lands identified for homesteads, agricultural and villages, school relocation sites, civic uses, energy production, and recreation. These land use types were selected because of the potential for people to be present (residences, civic uses, and recreation areas) and the vulnerability of the because power infrastructure to hazards. Future analyses should continue to include additional community lifelines and critical facilities.

To assess the vulnerability of planned future development to future event-based flooding and chronic coastal flood, each exacerbated by 3 ft of SLR, a spatial analysis was conducted by overlaying the flood hazard zones with parcels designated for future development by the DPL. Although there is no spatial model to predict future hazard areas for coastal erosion, a spatial analysis was conducted to determine if any parcels designed for future development are located within the current coastal erosion hazard areas.

The results tables for all three spatial analyses are in Appendix D. The spatial analyses for future event-based flooding with 3 ft of SLR and for chronic coastal flooding with 3 ft of SLR resulted in no exposure for designated parcels on Saipan and Rota and 0.01 square mile of area designated for village homestead development on Tinian.

The spatial analysis for exposure of parcels designated for development to current coastal erosion hazards resulted in less than 0.1 square mile of land each for parcels designated for renewable energy and school relocation on Saipan. On Tinian, a total of 0.07 square (sq) miles of parcels designated for agricultural (0.01 sq miles) and village (0.06 sq miles) homesteads are vulnerable to the current coastal erosion hazard.

Projected Changes in Population

The total population in the Commonwealth is expected to remain between 40,000 and 50,000 people through 2100 (United Nations, 2022). However, the number of people over 65 years is expected to increase, potentially increasing the vulnerability of this socially vulnerable demographic to future flood events. The effects of flooding on socially vulnerable populations are described in earlier sections.

4.5.3 Mitigation Success

Figure 4.5-17. Mitigation project to improve Beach Road (Route 33), which include repairing existing drainage to enhance flood plain development.
Source: Sipan Tribune, April 19, 2024. Photo Credit: Mark Rabago

In March 2023, DPW initiated a project to improve Beach Road (Route 33) and improve drainage. The project involved the reconstruction of 2.2 miles of road from the As Perdido Road intersection in Chalan Piao to the Atkins Kroll intersection in San Jose, and a 3-mile segment from Atkins Kroll to Micro Beach in American Memorial Park. This $19.7 million Beach Road project was funded by a grant from the Department of Housing and Urban Development Community Development Block Grant–Mitigation program (grant numbers B-19-DV-69-0001 and B-19-DV-69-0002). About 90% of the Breach Road project is located within the 100-year flood plain also designated as the SFHA on the FIRM. To comply with federal and Commonwealth law and regulations pertaining to flood plain management, the Commonwealth government engaged the public through the environmental review process and developed an 8-step process to ensure construction activities were compliant with flood plain and National Flood Insurance Program (NFIP) regulations and that the project would not negatively impact flood plain management. The project aimed at improving road safety and enhancing floodplain development by repairing existing surface drainage appurtenances such as curb/gutter and swales to streamline the flow and migration of runoff properly. Repairing existing drainage will help ensure that no potential standing water is retained and that the rate of runoff discharge to seawater is evenly dispersed. The project is expected to be completed by summer 2024.

References

Chowdhury, Md. R., Chu, P.-S., Zhao, X., Schroeder, T. A., & Marra, J. J. (2010). Sea level extremes in the US-Affiliated Pacific Islands—A coastal hazard scenario to aid in decision analyses. *Journal of Coastal Conservation*, *14*(1), 53–62. https://doi.org/10.1007/s11852-010-0086-3

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[FEMA] Federal Emergency Management Agency. (2021). *Region 9, the Commonwealth of the Northern Mariana Islands Discovery and Engagement Report. Risk Mapping, Assessment, and Planning Program: A Snapshot of Community Identified Risks and Risk Reduction Actions.* (p. 32). US Homeland Security, Federal Emergency Management Agency.

Fletcher, C. H., & Richmond, B. M. (2010). *Climate change in the Federated State of Micronesia: Food and water security, climate risk management, and adaptive strategies, report of findings 2010* (p. 32). Center of Island Climate Adaptation and Policy, University of Hawai‘i Sea Grant College Program.

Gingerich, S. B. (2002). *Geohydrology and Numerical Simulation of Alternative Pumping Distributions and the Effects of Drought on the Ground-Water Flow System of Tinian, Commonwealth of the Northern Mariana Islands* (Water-Resources Investigations Report 02–4077). US Geological Survey. https://doi.org/10.3133/wri20024077

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

Greene, R. (2017). *BECQ 2017 SLR map layer updates: Methodology for coastal flooding geoprocessing*.

Implementing the Limit of Moderate Wave Action in Coastal Communities | FEMA.gov. (2023, April 20). https://www.fema.gov/case-study/implementing-limit-moderate-wave-action-coastal-communities

Li, N., García Medina, G., Yang, Z., Cheung, K. F., Hitzl, D., & Chen, Y.-L. (2023). Wave climate and energy resources in the Mariana Islands from a 42-year high-resolution hindcast. *Renewable Energy*, *215*, 118835. https://doi.org/10.1016/j.renene.2023.05.093

Marra, J. J., & Kruk, M. C. (2017). *State of Environmental Conditions in Hawaii and the US Affiliated Pacific Islands under a Changing Climate: 2017* (p. 93). NOAA NSDIS National Centers for Environmental Information (NCEI). https://coralreefwatch.noaa.gov/satellite/publications/state_of_the_environment_2017_hawaii-usapi_noaa-nesdis-ncei_oct2017.pdf

Marra, J. J., Merrifield, M. A., & Sweet, W. V. (2012). Sea Level and Coastal Inundation on Pacific Islands. In V. W. Keener, J. J. Marra, M. L. Finucane, & D. Spooner (Eds.), *Climate Change and Pacific Islands: Indicators and Impacts*. Pacific Islands Regional Climate Assessment Center, DC: Island Press.

Marshall, A., Willsey, T., Reeves, M., Amidon, F., & Miller, S. (2020). Wetlands of the Mariana Islands. In *Reference Module in Earth Systems and Environmental Sciences*. https://doi.org/10.1016/B978-0-12-409548-9.12443-1

Mimura, M., Nurse, L., McLean, R., Agard, J., Briguglio, L., Lefale, P., Payet, R., & Sem, G. (2007). Small Islands. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Liden, & C. E. Hensen (Eds.), *Climate Change 2007: Impacts, Adaptations and Vulnerability* (pp. 678–716).

Mimura, N. (1999). Vulnerability of island countries in the South Pacific to sea level rise and climate change. *Climate Research*, *12*(2/3), 137–143. JSTOR.

Mycoo, M., Wairiu, M., Campbell, D., Duvat, D., Golbuu, Y., Maharaj, S., Nalau, J., Nunn, P., Pinnegar, J., & Warrick, O. (2022). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

[NOAA] National Oceanic and Atmosphere Administration. (n.d.). *What is high tide flooding?* Retrieved April 17, 2024, from https://oceanservice.noaa.gov/facts/high-tide-flooding.html

[NOAA] National Oceanic and Atmospheric Administration. (n.d.). *Hurricane Preparedness-Hazards* [National Hurricane Center and Central Pacific Hurricane Center]. Retrieved April 6, 2024, from https://www.nhc.noaa.gov/prepare/hazards.php

National Weather Service. (2010). *Floods: The Awesome Power* (p. 16). National Oceanic and Atmospheric Administration.

[NMHC] Northern Marianas Housing Corporation. (2022). *Commonwealth of the Northern Mariana Islands Community Development Block Grant Mitigation (CDBG-MIT) Program Initial Action Plan* (p. 152). Northern Marianas Housing Corporation.

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

Sea Engineering, Inc. (2018). *Saipan Shoreline Access and Shoreline Enhancement Assessment (SASEA), Island of Saipan, Commonwealth of the Northern Mariana Islands* (p. 281). CNMI Division of Coastal Resources Management.

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

University of Hawai‘i Sea Grant College Program. (2019). *University of Hawai‘i Sea Grant College Program Biennial Report 2018-2019* (p. 32). University of Hawai‘i. https://seagrant.soest.hawaii.edu/wp-content/uploads/2022/02/Hawaii-Sea-Grant-Biennial-Report-2018-19-web.pdf

[USACE] US Army Corps of Engineers. (2022). *The Commonwealth of the Northern Mariana Islands Final Post Disaster Watershed Plan* (p. 166). US Army Corps of Engineers, Honolulu District.

US Census Bureau. (2024). *2020 Island Areas Censuses: Commonwealth of the Northern Mariana Islands (CNMI)* [dataset]. https://www.census.gov/data/tables/2020/dec/2020-commonwealth-northern-mariana-islands.html

[USGS] US Geological Survey, US Department of Interior. (n.d.). *Floods: Recurrence intervals and 100-year floods*. Retrieved March 29, 2024, from https://www.usgs.gov/centers/new-jersey-water-science-center/floods-recurrence-intervals-and-100-year-floods

[USGCRP] US Global Change Research Program (2023). *Fifth National Climate Assessment*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023

Vitousek, S., Barnard, P., Fletcher, C., Frazer, N., Erikson, L., & Storlazzi, C. (2017). Doubling of coastal flooding frequency within decades due to sea-level rise. *Scientific Reports*, *7*. https://doi.org/10.1038/s41598-017-01362-7

Yuknavage, K., Iriarte, I., Maurin, L., & Perez, D. (2022). *2022 Commonwealth of the Northern Mariana Islands 305(b) and 303(d) Water Quality Assessment Integrated Report*. Bureau of Environmental and Coastal Quality.

Zhang, C., Wang, Y., Hamilton, K., & Lauer, A. (2016). Dynamical Downscaling of the Climate for the Hawaiian Islands. Part I: Present Day. *Journal of Climate*, *29*(8), 3027–3048. https://doi.org/10.1175/JCLI-D-15-0432.1

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.6 Health Risks

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.6 Health Risks

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Health Risk	Occasional	Extensive	Critical	Medium

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- In the 2024 State Hazard Mitigation Plan (SHMP) Update, for the first time, a profile for Health Risks was developed and the risks associated with these hazards is evaluated.
- Information on infectious diseases prevalent or probable in the Commonwealth was researched and briefly described to characterize current and future risks and vulnerabilities.
- The vulnerability of Commonwealth to Health Risks was assessed qualitatively.
- This section includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth to Health Risks.
- A mitigation success achieved since 2018 was included to demonstrate progress toward lowering the vulnerability of the Commonwealth to Health Risks.

Health-related impacts are associated with natural hazards, especially when water is contaminated. Climate-related extreme events can influence health-related problems such as heat-related illnesses. These and other health risks are discussed throughout Chapter 4.0 (Risk Assessment) in each hazard section. This section focuses on the severe acute respiratory syndrome, coronavirus-2 (SARS-CoV-2) that caused the coronavirus disease 2019 (COVID-19) pandemic and infectious diseases that may impact the Commonwealth.

4.6.1 Hazard Profile

Description

The following section provides a brief description of health risks of concern in the Commonwealth. This is not intended to be a comprehensive list of health risks that may impact residents and visitors alike. This is a brief overview of risks and vulnerability in the Commonwealth.

COVID-19

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus. The virus can spread in small liquid particles from the mouth or nose of infected persons when they cough, sneeze, speak, sing, or breathe. Most people infected with the virus experience mild to moderate respiratory illness and recover without requiring special treatment. However, some become seriously ill and require medical attention. Older people and those with underlying medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness. Anyone at any age can get sick with COVID-19 and become seriously ill and die (World Health Organization, 2024).

Tuberculosis

Tuberculosis (TB) is caused by bacteria that usually attack the lungs but can also affect any part of the body. The bacteria spreads when infected people cough or sneeze. This can put tiny droplets of water contaminated with bacteria into the air where other people can breathe the droplets. People with compromised immune systems are at greater risk of contracting TB. Most people that develop an active TB infection experience cough, cough up blood or mucus, chest pain, fever, chills, fatigue, and other symptoms. TB is treated with antibiotics, but some TB strains are now antibiotic resistant and require special medical attention to treat. Anyone can get TB; the very young, people aged 15–25, and people over 65 are more at risk of developing severe active TB infections.

Pandemic Influenza

There are numerous types of flu, and strains of the virus continue to mutate and change. The emergence of new influenza viruses represents a class of viruses against which there is little to no pre-existing immunity or vaccine. These uncommon or new types of flu can spread rapidly through populations and have the potential to develop into pandemics. Avian flu (H5N1) and swine flu (H1N1) are two such strains that have impacted the Commonwealth in recent history.

Pandemic flu has the potential to affect large segments of the population and cause a public health crisis that may disrupt normal social functions and disrupt the economy by requiring businesses to close.

Seasonal flu differs from pandemic flu in that human populations have developed some natural immunity and vaccinations are available for these more common flu strains. However, seasonal flu can still be dangerous for the elderly and very young and those with pre-existing medical conditions or compromised immune systems.

Vector-borne Disease

Living organisms, or vectors, can transmit diseases between humans and from animals to humans. In the Commonwealth, mosquitos have the potential to spread several serious diseases

(Table 4.6-1). Currently, there are several mosquito species in the Commonwealth capable of transmitting serious diseases (PacMOSSI, 2022). However, to date, these diseases are still relatively uncommon (i.e., non-endemic). See *Extent* below for definitions of the transmission scenarios in Table 4.6-1.

Table 4.6-1. Possible vector-borne diseases in the Mariana Islands.

Mosquito-borne Disease Situation Report		**Vectors Present in the Commonwealth**
Disease	**Transmission Scenario**	**Vectors**
Malaria	Non-endemic	*Anopheles indefinitus*
Dengue	No outbreaks reported	*Aedes albopictus*
Zika	No reported cases	*Aedes albopictus*
Chikungunya	No reported cases	*Aedes albopictus*
Lymphatic Filariasis	Non-endemic	*Culex quinquefasciatus*

Source: Pacific Mosquito Surveillance Strengthening for Impact (https://pacmossi.org/partners/northern-mariana-islands/).

Water-borne Disease

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*. Humans can get leptospirosis through direct contact with urine from infected animals or through water, soil, or food contaminated with their urine. In humans, leptospirosis causes a wide range of symptoms, and some infected persons may have no symptoms at all. Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhea, or a rash. If the disease is not treated, patients may develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, and respiratory distress. In rare cases, death occurs. Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of blood or urine samples.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, playing in contaminated streams and waterfalls, and navigating flood waters. The incidence is also increasing among children who live in urban areas.

Location

With tens of thousands of visitors arriving in the Commonwealth each year, there is considerable exposure to and potential for the introduction of new or re-emerging health risks, especially from Asia. Health events can cover a wide geographic area and affect many people, including populations on all the islands. The size and extent of disease outbreak depends on characteristics of the disease including mode of transmission, rate of spread, and how contagious the disease is. Locations with higher density populations are more susceptible to outbreaks because infected people are more likely to be in close contact with healthy people. In addition, facilities that group vulnerable populations, such as daycare centers, schools, care homes, and institutionalized populations may also contribute to disease transmission.

Extent

The US Centers for Disease Control and Prevention (CDC) have defined levels of disease as follows (CDC, 2024b):

- **Sporadic:** refers to a disease that occurs infrequently and irregularly.
- **Endemic:** refers to the amount of a particular disease that is usually present in a community. This level is not necessarily the desired level but rather is the observed level.
- **Non-endemic:** is sometimes used to describe diseases that are occasionally present in a community but are not continuously present.
- **Cluster:** refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected, even though the expected number may not be known.
- **Hyperendemic:** refers to persistent, high levels of disease occurrence.
- **Outbreak:** carries the same definition of epidemic but is often used for a more limited geographic area.
- **Epidemic:** refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.
- **Pandemic:** refers to an epidemic that has spread over several countries or continents, usually affecting many people.

The severity of a disease event depends on characteristics of the disease including mode of transmission, the presence and distribution of vectors, if required for transmission, rate of spread, how contagious the disease is, and community level factors such as access to healthcare, population density, demographics, and medical literacy.

The magnitude of an infectious disease outbreak is also related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause catastrophic numbers of deaths are infectious in nature, meaning that they are spread from person-to-person. The public health and health care providers in the Commonwealth routinely use known and established methods to reduce morbidity and mortality from infectious disease. However, the capacity of the health care system is limited.

Because of the highly transient nature of the tourism industry, the identification, containment, and treatment of disease outbreaks are challenging. Additional challenges include the delays in importing necessary medical supplies, medicines, equipment, and resources. Air travel can facilitate the disease spread and contribute to developing pandemics as happened with COVID-19. The CDC staff responds to reports of illnesses on airplanes, cruise, and cargo vessels at international ports of entry. The CDC operates a quarantine station at the Daniel K. Inouye International Airport in Honolulu. The station's jurisdiction includes all ports in Hawaiʻi, Guam, American Sāmoa, the Freely Associated States, and the Commonwealth of the Northern Mariana Islands (CDC, 2024a).

Warning Time

Warning time for a disease outbreak will depend on the origin of the virus, virus incubation time (the duration required before an individual begins to develop symptoms of an illness), and the amount of time needed to identify the virus.

Previous Occurrences and Losses

According to the Commonwealth Healthcare Corporation (CHCC), chronic lower respiratory diseases, influenza and pneumonia, and other bacterial diseases were among the 10 leading causes of death in the Commonwealth from 2008–2019 (CHCC, 2019).

COVID-19

The worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS2-CoV-2) reached the Commonwealth in March 2020 when the first 2 confirmed cases were reported. Prior to the arrival of the disease, the CNMI canceled flights from China and Hong Kong in early February 2020 leading to a drop in tourism and triggering an economic downturn, which lead to government austerity measures being enacted. The Commonwealth enacted strict border control measures and implemented mandatory quarantine for all people arriving in the CNMI, which brought the tourism industry on all three islands to an abrupt and extended halt.

In March 2020, Governor Torres created the COVID-19 Taskforce, bringing together key departments, agencies, and stakeholders to focus on three major concerns: tourism, residents, and schools and issued Memorandum GOV20-106 shutting down all government offices and non-essential government functions. In late March 2020, the Governor implemented a continued state of emergency and public health emergency, followed by an Enhanced Social Distancing Directive limiting business operating hours, prohibiting gatherings of more than 10 people, and closure of all parks in the Commonwealth. The Commonwealth also implemented a price freeze to protect consumers.

The COVID-19 pandemic had wide-ranging economic impacts in the Commonwealth. Following the COVID-19 pandemic, visitor numbers fell dramatically (-81.7%) and have been slow to recover to pre-pandemic numbers (e.g., 2019). The drastic reduction in spending by consumers, visitors, businesses, and government due to the COVID-19 pandemic substantially affected the Commonwealth economy. The COVID-19 pandemic led to large declines in the number of employees in the CNMI, which translated to a 13% drop in the number of workers from 2019 to 2020.

Tuberculosis

The CHCC also reported an on-gong tuberculosis epidemic in the Commonwealth (CHCC, 2019). Tuberculosis (TB) is one of the most important infectious diseases globally with an estimated 9.9 million people falling ill in 2020 (Yanagawa et al., 2023). TB is especially prevalent in the Western Pacific, including the Commonwealth where CHCC estimated in 2019 that the rate of TB was about 25 times higher in the Commonwealth compared to the US mainland (Figure 4.6-1). The number of cases has declined since 2019, but case numbers still remain higher in the Commonwealth compared to the US mainland. The Commonwealth participates in the US National Tuberculosis Coalition of America and has a clinic dedicated to assisting people with tuberculosis.

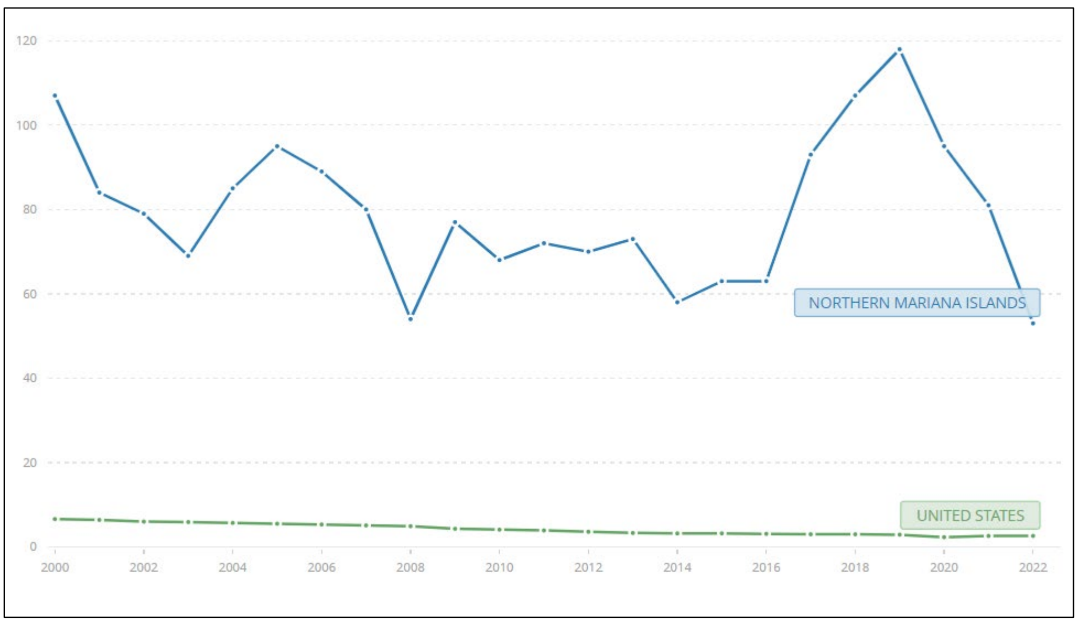


Figure 4.6-1. Incidence of tuberculosis (per 100,000 people–Northern Mariana Islands and the United States 2000–2022).
Source: The World Bank (https://data.worldbank.org/indicator/SH.TBS.INCD?end=2022&locations=MP-US&name_desc=false&start=2000&view=chart).

Pandemic Influenza

In spring 2009, a new strain of flu emerged, swine flu (H1N1), and developed into a pandemic (CDC, 2019). There was a surge of swine flu with many cases reported from Japan. In May 2009, 6 cases of H1N1 were reported in the Commonwealth. At the same time, Guam had 61 cases and one reported death due to swine flu. Although the global death rate for the 2009 swine flu pandemic was lower than other historic pandemics in during the 1900s (CDC, 2019), the 2009 pandemic was a reminder of the threat posed by novel strains of influenza.

Leptospirosis

Leptospirosis is endemic to the Commonwealth. Between 2000 and 2001, there were 10 reported cases. Eight cases required hospitalization and 3 resulted in death (Villagomez et al., 2001). Case reports available for four of the patients identified possible modes of exposures as swimming in freshwater, cleaning out roadside sewers after a tropical storm, slaughtering pigs, and occupational gardening (Guernier et al., 2018).

Disaster and Emergency Declarations

On March 23, 2020, Governor Torres requested a major disaster declaration due to the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020, and continuing. On April 1, 2020, President Trump declared that a major disaster exists in the Commonwealth of the Northern Mariana Islands (DR-4511-MP). According to John Hopkins University Coronavirus Research Center, there have been a total of 13,666 confirmed COVID-19 cases that resulted in 41 deaths in the Commonwealth (data retrieved in April 2024 from COVID-19 (John Hopkins Coronavirus Resource Center, 2024). Most confirmed cases occurred in 2022 (Figure 4.6-2). Approximately 77% of the Commonwealth population is vaccinated.

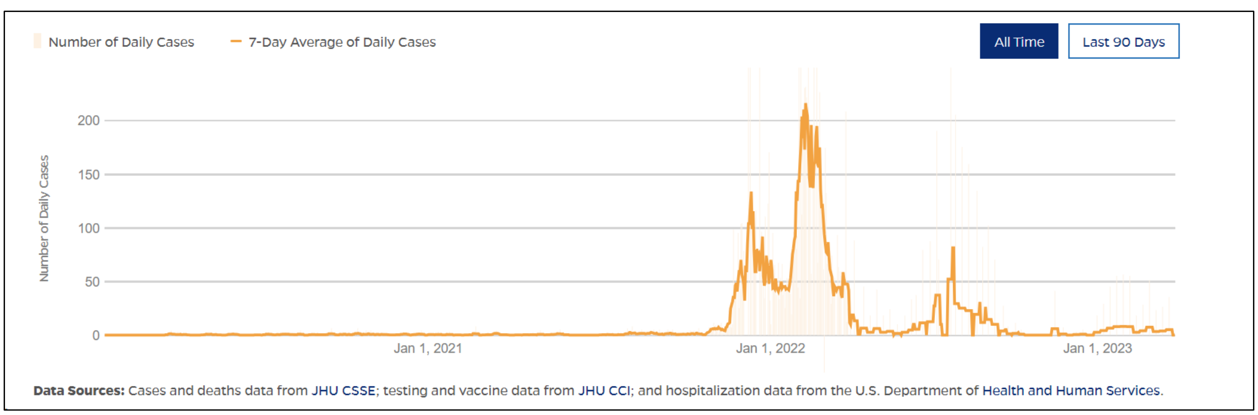


Figure 4.6-2. The number of daily confirmed COVID-19 cases in the CNMI.
Source: John Hopkins Coronavirus Research Center (https://coronavirus.jhu.edu/region/us/northern-mariana-islands).

Probability of Future Occurrence

Based on the history of occurrence of these diseases in the Commonwealth, the future probability is several hundred cases of COVID-19, influenza, and tuberculosis each year and several cases of vector-borne and water-borne diseases each year.

As a popular tourist destination, especially from the Asian market, the Commonwealth may be at higher risk to future health events. The possibility of disease transmission increases with the number of people traveling to and from the Commonwealth.

Additionally, the effects from natural hazards to the built and natural environments have the potential to adversely impact human health. Stressors resulting from natural hazards can increase the vulnerability of the Commonwealth to public health risks.

Climate Change Considerations

Climate change is likely to have direct and indirect effects on disease pathogens (Uwishema et al., 2023). Climate change can influence disease pathogens through effects on their life cycles, breeding, and survival. Climate change can also influence environmental conditions that support the disease pathogens and/or the vectors that transmit them (e.g., increased temperatures and rainfall can support larger mosquito populations for longer during the year).

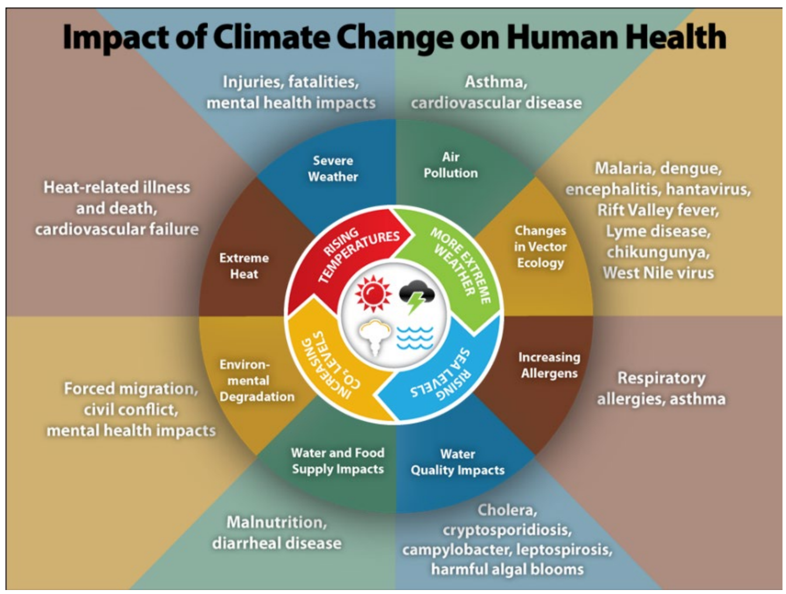


Figure 4.6-3. Impact of climate change on human health.
Source: Center for Disease Control

Research into modeling vector-borne diseases and climate change has shown an accelerating invasion potential of the *Aedes aegypti* mosquito (Iwamura et al., 2020) and subsequent potential spread of related illnesses. This species of mosquito has not been reported in the Commonwealth (Pacific Mosquito Surveillance Strengthening for Impact, 2022). In addition, infectious agents and chemical toxins in water will spread on a wider scale as more flooding results from climate change. Floodwaters that remain in small, still pools after flooding has subsided can provide additional habitat for mosquito reproduction. This leads to more mosquitoes that can carry diseases such as dengue fever, chikungunya, and Zika (Kulkarni et al., 2022). More flooding will also expose more people to waterborne infectious diseases such as leptospirosis.

4.6.2 Vulnerability Assessment

No spatial data was available to assess health risks vulnerability. A qualitative assessment was conducted.

Commonwealth Asset Vulnerability Assessment and Potential Losses

Commonwealth Buildings and Roads

Commonwealth buildings and roads are not exposed or vulnerable to health risks. While the actual structures will not be impacted, the effect of absenteeism on Commonwealth workers will impact the delivery of services. The impacts and potential losses from this hazard are largely economic and are dependent on the type, extent, and duration of the illness.

Community Lifelines and Critical Facilities

Similar to Commonwealth assets, community lifelines and critical facilities themselves will not be impacted; however, the delivery of critical services and the running of critical infrastructure will be impacted due to absenteeism of workers (e.g., dock employees, airport staff, and schoolteachers). Healthcare workers in public health and direct patient contact are essential during a health risk event. A shortage of healthcare workers would impact critical healthcare facilities and the services they provide. In addition, an increase in hospitalization and emergency room visits may take place because of a health risk, creating a greater demand for these critical facilities, their staff, and the resources.

General Asset Vulnerability Assessment and Potential Losses

General Building Stock

The impacts and potential losses from the health risk hazard are largely economic and are dependent on the type, extent, and duration of the illness. A pandemic outbreak could result in a temporary closure to ports of entry to the Commonwealth impacting the import and export of goods and vital resources.

The general building stock is not exposed or vulnerable to health risk hazard. While the actual structures will not be impacted, the impacts and potential losses from this hazard are largely economic and are dependent on the type, extent, and duration of the illness. The possible closure of businesses due to a public health event could have cascading economic effects similar to the impacts experienced during the COVID-19 event.

Socially Vulnerable and Total populations

The entire Commonwealth population (residents and visitors) is exposed and potentially vulnerable to any of the health risks discussed above. Health risks can cover a wide geographic area and can affect large populations. The size and extent of an infected population depends on how easily the illness is spread, mode of transmission, and amount of contact between infected and uninfected individuals. Locations with higher-density populations are more susceptible to outbreaks, as the disease can be transmitted more easily.

Vulnerable populations, especially the young, pregnant women, the elderly and those who have underlying health conditions or a weaken immune system, are at greater risk for both contracting a disease and suffering fatal or severe consequences. Economically disadvantage people may also be more vulnerable during public health events due to limited healthcare coverage, access to medical services, food insecurity, lack of health literacy, and loss of wages (Rikard et al., 2016).

Natural and Cultural Resources

Natural and cultural resources are at minimal risk due to health risk hazard; however, worker absenteeism will impact ongoing monitoring and enforcement of laws and regulations in place to protect fragile natural and cultural resources.

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

As stated above, the entire population of the Commonwealth is considered exposed to a public health risk event. All future changes in population are also expected to have a similar degree of exposure; however, the degree of exposure may depend on several factors, including demographics, socio-economic status, pre-existing health conditions, density of housing or population, and changes in environmental conditions that support disease pathogens, or their vectors, in new areas or for longer periods over the year.

Future exposure of socially vulnerable populations to public health risks is expected to change proportionally with changes in these populations. Factors that may increase vulnerability to public health events for socially vulnerable populations include limited access to health insurance or services, limited health literacy, pre-existing health conditions, and the physical ability to recover from infectious diseases.

The ability to withstand the impacts of future public health risk events will depend on the preparedness of the Commonwealth. In addition, the continued robust international tourism industry in the Commonwealth makes it more vulnerable to future health risks. Air travel could increase the speed of spread of new viruses and decrease the time available for implementing interventions, especially new viruses from Asia. Economically, another pandemic or a disease outbreak would likely have a significant impact on tourism as people decrease their travel. Scares of infectious disease and pandemic flu could collapse the tourism economy again.

4.6.3 Mitigation Success

At the start of the COVID-19 pandemic, a strict border policy was adopted to limit introduction and spread of the virus within the Commonwealth. This policy helped limit community outbreaks of the virus to two low-level community outbreaks—one in March 2020 and one in March 2021. At the end of 2021 and into 2022, a larger more prolonged outbreak occurred. Before this large outbreak and before border restrictions were relaxed, the Commonwealth Government was able to obtain adequate resources, train personnel and deliver a community-based vaccination program (Davis et al., 2023). The Commonwealth demonstrated a well-coordinated public health response including implementation of a successful vaccine campaign—where 73.4% of the population received vaccinations—and measures to ensure preparedness and efficient use of federal and partner emergency health system resources (Davis et al., 2023). According to Davis et al. (2023), "the alignment of political and health leadership with a community-based approach tempered many of the challenges faced on the US mainland, including overstretched hospitals and high mortality rates" (p. 9), and ultimately led to relatively low morbidity and mortality from the COVID-19 pandemic in the Commonwealth.

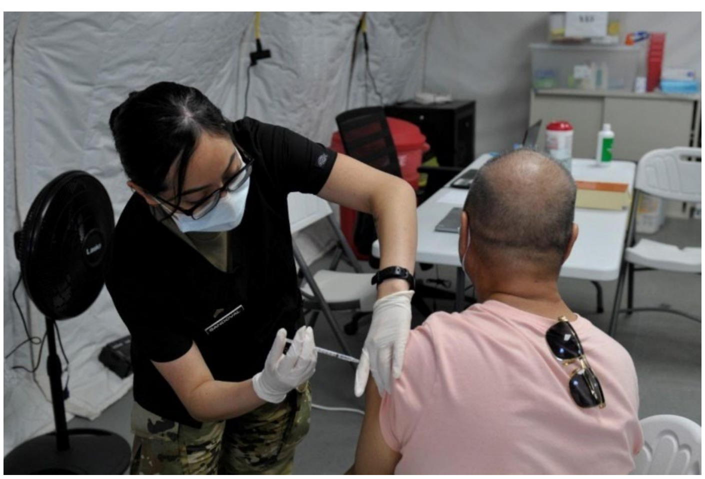


Figure 4.6-4. In April 2021, a sergeant with the 25th Infantry Division administers a COVID-19 vaccine in support of the Commonwealth Health Care Corporation.
Source: Saipan Tribune, April 3, 2021. Photo Credit: Brad Ruszala.

References

[CDC] Centers for Disease Control and Prevention. (2019). *2009 H1N1 Pandemic*. https://archive.cdc.gov/www_cdc_gov/flu/pandemic-resources/2009-h1n1-pandemic.html

[CDC] Centers for Disease Control and Prevention. (2024a). *CDC Port Health Stations and their Jurisdictions*. Port Health. https://www.cdc.gov/port-health/stations/port-health-station-contact-list.html

[CDC] Centers for Disease Control and Prevention. (2024b). *Center for Disease Control and Prevention*. https://www.cdc.gov/

[CHC] Commonwealth Healthcare Corporation. (2019). *Commonwealth Healthcare Corporation US Congressional Briefing Package*. Commonwealth Healthcare Corporation.

Davis, D., Kern-Allely, S., Muldoon, L., Tudela, J., Tudela, J., Raho, R., Pangelinan, H., Palacios, H., Tabaguel, J., Hinson, A., Lifoifoi, G., Villagomez, W., Fauver, J., Cash, H., Muña, E., Casey, S., & Khan, A. (2023). How the Commonwealth of the Northern Mariana Islands stalled COVID-19 for 22 months and managed its first significant community transmission. *Western Pacific Surveillance and Response Journal*, *14*(1), 76–85. https://doi.org/10.5365/wpsar.2023.14.1.965

Guernier, V., Goarant, C., Benschop, J., & Lau, C. L. (2018). A systematic review of human and animal leptospirosis in the Pacific Islands reveals pathogen and reservoir diversity. *PLOS Neglected Tropical Diseases*, *12*(5), e0006503. https://doi.org/10.1371/journal.pntd.0006503

Iwamura, T., Guzman-Holst, A., & Murray, K. A. (2020). Accelerating invasion potential of disease vector Aedes aegypti under climate change. *Nature Communications*, *11*(1), 2130. https://doi.org/10.1038/s41467-020-16010-4

John Hopkins Coronavirus Resource Center. (2024). *Northern Mariana Islands—COVID-19 Overview—Johns Hopkins*. Johns Hopkins Coronavirus Resource Center. https://coronavirus.jhu.edu/region/northern-mariana-islands

Kulkarni, M. A., Duguay, C., & Ost, K. (2022). Charting the evidence for climate change impacts on global spread of malaria and dengue and adaptive responses: A scoping review of reviews. *Global Health*, *18*(1), 1–18. https://doi.org/10.1186/s12992-021-00793-2

Pacific Mosquito Surveillance Strengthening for Impact. (2022, July 20). *PacMOSSI: Northern Mariana Islands*. PacMOSSI Project. https://pacmossi.org/partners/northern-mariana-islands/

Rikard, R. V., Thompson, M. S., McKinney, J., & Beauchamp, A. (2016). Examining health literacy disparities in the United States: A third look at the National Assessment of Adult Literacy (NAAL). *BMC Public Health*, *16*(1), 975. https://doi.org/10.1186/s12889-016-3621-9

Uwishema, O., Masunga, D. S., Naisikye, K. M., Bhanji, F. G., Rapheal, A. J., Mbwana, R., Nazir, A., & Wellington, J. (2023). Impacts of environmental and climatic changes on future infectious diseases. *International Journal of Surgery*, *109*(2), 167–170. https://doi.org/10.1097/JS9.0000000000000160

Villagomez, J. K., Brostrom, R., Diaz, E. P., Tagabuel, J., & Habib, F. (2001). *Leptospirosis in the Northern Mariana Islands*. Secretariat of the Pacific Community.

World Health Organization. (2024). *Coronavirus*. https://www.who.int/health-topics/coronavirus

Yanagawa, M., Morishita, F., Oh, K. H., Rahevar, K., Islam, T. A., & Yadav, S. (2023). Epidemiology of tuberculosis in the Pacific island countries and areas, 2000–2020. *Western Pacific Surveillance and Response Journal*, *14*(1), 28–39. https://doi.org/10.5365/wpsar.2023.14.1.996

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.7 Extreme Heat and Heat Wave

28 July 2024

Table of Contents

List of Figure

4.0 Risk Assessment

4.7 Extreme Heat and Heatwave

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Extreme Heat and Heatwave	Occasional	Extensive	Negligible	Low

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- In the 2024 State Hazard Mitigation Plan (SHMP) Update, for the first time, a profile for the extreme heat and heatwave hazards was developed and the risk associated with these hazards is evaluated.
- Weather data as well as current climate change information was incorporated to characterize current and future risks and vulnerabilities.
- The vulnerability of Commonwealth owned and operated assets as well as general assets was assessed qualitatively.
- This section includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth to extreme heat and heatwave hazards.
- A mitigation success achieved since 2018 was included in the final plan to demonstrate progress toward lowering the vulnerability of the Commonwealth to extreme heat and heatwave.

4.7.1 Hazard Profile

Description

Extreme heat is defined as a period of high heat and humidity with temperatures above 90°F for at least 2–3 days (US Department of Homeland Security, 2024). A heatwave results when these conditions persist for an extended period beyond 3 days.

The heat index, also known as the apparent temperature, is what the temperature feels like to the human body when relative humidity is combined with the air temperature. When relative humidity (i.e., the amount of moisture in the air) is high, it is more difficult for people to cool down through the process of evaporative cooling, which is when perspiration evaporates from the skin. The heat index values in the chart from the US National Weather Service (NWS) are for shady locations. Exposure to direct sunlight can increase the heat index values by up to 15°F.

NWS Heat Index — Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Source: US National Weather Service (NWS). (https://www.weather.gov/ama/heatindex).

Prolonged exposure to hot and humid conditions can result in heat-related illnesses. The are three heat-related illnesses: heat cramps, heat exhaustion, and heat stroke. Heat cramps are painful muscle cramps or spasms. Heat exhaustion results from the loss of water and salt from the body via perspiration and the body is unable to cool properly. Heat stroke is a life-threatening condition that occurs when the body's heat-regulating system is overwhelmed. The young (age 0–5), the elderly (age 65 and older), and people who have health challenges are more susceptible to heat-related illnesses (CDC, 2024).

Location

Air temperatures are fairly consistent across the Commonwealth of the Northern Mariana Islands (CNMI) (Grecni et al., 2021), and the exposure to extreme heat and heatwaves is relatively uniform across the Commonwealth. Exposure may be higher for residents living in low-lying leeward urban settings, such as the western coastal plain of Saipan. Structures such as buildings and roads and other infrastructure absorb and radiate the sun's heat more than natural landscapes. Pockets of localized enhanced heat are known as *heat islands* and can result in higher daytime and nighttime temperatures. The heat island effect is greater in humid regions like the CNMI.

Extent

Temperatures in the Commonwealth can remain elevated for a few days to a few weeks to prolonged periods with heatwaves lasting months—the longest heatwaves occurred in 2017 (~101 days), 2020 (~137 days), and 2022 (~107 days) where nearly every day was 90°F or above.

Warning Time

Predicting extreme heat events is challenging due to complex interactions in the atmosphere. Weather models are used to predict extreme temperatures that can develop into heatwaves. However, these models are most accurate about 10–14 days in advance. Scientists from the National Oceanic and Atmosphere Administration (NOAA) and the NWS are working to develop models to help predict extreme heat events in the future and some on-line predictive prototypes are available for the mainland US.

Previous Occurrences

In the CNMI, the average year-round temperature is 84°F with an average humidity of 79% (Pacific RISA, 2012). However, the number of days over 90°F increased between 2016 and 2021, with fewer, but a still significant number of hot days in 2022 and 2023 (Figure 4.7-1). Assuming an average humidity of 79%, the heat index on a day above 90°F is considered dangerous. In all years between 2016 and 2023, except 2018, temperatures were elevated above 90°F nearly every day for a 4-week-period or greater. In 2017, 2020, and 2021 CNMI experienced prolonged heatwaves with temperatures over 90°F nearly every day for more than 100 consecutive days.

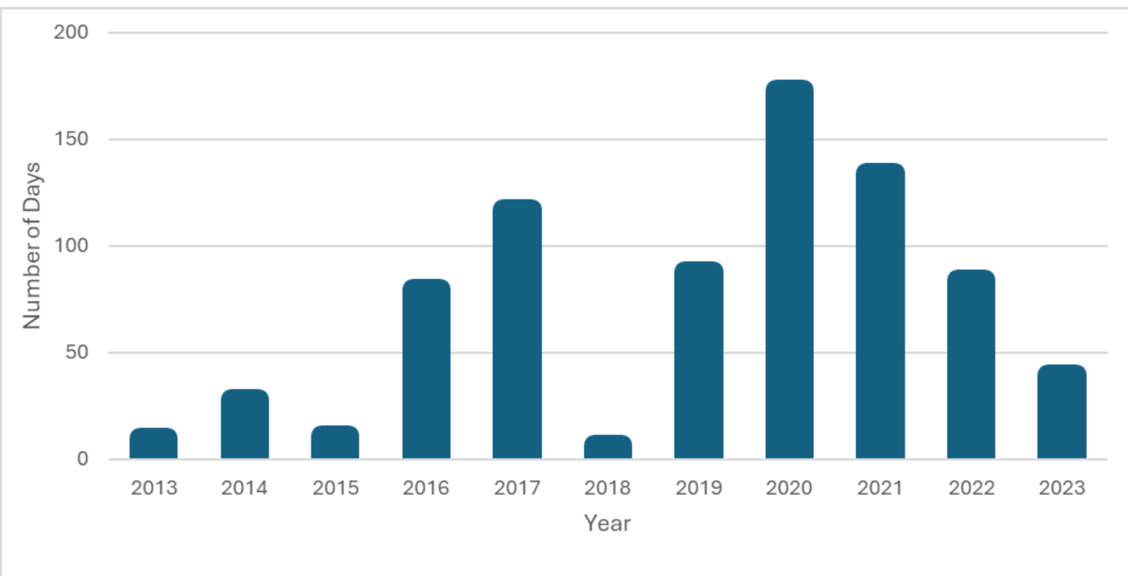


Figure 4.7-1. Annual number of days with maximum temperatures at or above 90°F—the 95th percentile of data record—at the Franscisco C. Ada Saipan International Airport from 2013–2023.
Source: Data from the NOAA GHCN-Daily database.

Probability of Future Occurrence

Between 2013 and 2023, an average of about 19% of days (69) were 90°F or over as measured at the Francisco C. Ada Saipan International Airport. However, it is difficult to project the exact number of hot days for any given year due to the wide range in number of days with elevated heat from year to year (interannual variance). For example, some years like 2018 had very few hot days and 2020 had a large number (Figure 4.7-1). Notwithstanding variability, there is high confidence that the number of extreme heat days will increase as the global average temperature continues to rise. It is very likely that the length and frequency of extreme heat and heatwaves in CNMI will increase as the average global temperature increases.

Climate Change Considerations

The number of extreme heat days is expected to increase as the world continues to warm due to greenhouse emissions (Grecni et al., 2021; IPCC, 2024). Compared to records of the pre-industrial period (1850–1900), global surface temperature rose on average by about 1.8°F between 2011 to 2020 (IPCC, 2024). The end-state amount the planet will warm depends on the level of continued greenhouse gas emissions, primarily CO_2. However, conditions are now set to ensure continued warming regardless of atmospheric CO_2 levels. Even if emission were drastically cut today, the Earth will continue to warm for many years until a new equilibrium for average global temperature is reached.

4.7.2 Vulnerability Assessment

Heat related hazards impact the Commonwealth regionally. A qualitative approach is used to assess vulnerability and losses due to extreme heat and heatwaves.

Some effects of extreme heat or heatwaves may be stronger in localized areas such as heat islands. Although research to evaluate heat islands in the Commonwealth was not available for this update, heat islands are assumed likely along the urbanized western shoreline of Saipan.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the Commonwealth asset exposure and potential losses due to extreme heat and heatwaves. Commonwealth assets include Commonwealth owned and operated buildings, Commonwealth primary roads and critical facilities.

Commonwealth Buildings

In general, heat does not affect buildings; therefore, little to no vulnerability is expected to Commonwealth buildings and expected losses are likely negligible.

Commonwealth Roads

In general, heat does not affect roads unless very extreme; therefore, little to no vulnerability is expected for Commonwealth roads.

Community Lifelines and Critical Facilities

Heat is not expected to affect critical facilities directly, but extreme heat and heatwaves could tax community lifelines as energy demands increase to cool buildings and residences. Increased energy demand can lead to rolling brownouts and blackouts, load shedding, and widespread power outages. Power loss during a heat event may increase the need for residents and visitors to seek shelter, cause school closures, and compromise the operation of other critical facilities such as the hospital. The loss or reduction in electrical power could increase the number of vulnerable people exposed to extreme heat or heatwaves. Water demand is expected to increase during extreme heat and heatwaves. This increased demand may reduce water availability within the water system and stress infrastructure. See Natural Resources below for further discussion about increased water demand.

General Asset Vulnerability Assessment and Potential Losses

This section provides a summary of Commonwealth-wide exposure and potential losses to general building stock, population, natural and cultural resources.

General Building Stock

As with the Commonwealth buildings, no direct impacts from extreme heat or heatwaves are expected for the general building stock, including any existing stock in the Northern Islands.

Socially Vulnerable and Total Population

Several health studies have found an association between extreme temperatures with increased hospital admissions, emergency room visits, and calls for ambulances. *Racial and socioeconomic disparities in heat-related effects and their mechanisms* (Gronlund, 2014) offers a review of the evidence for race, ethnicity, income, education, and occupation as indicators of vulnerability to extreme heat.

The young and the elderly are at greater risk from heat-related illness from extreme heat or heatwaves. According to the 2020 US Census Bureau, young children (age 0–5) represent 6.8% and the elderly (age 65+) represent 6% of the total CNMI population. Very young children are especially vulnerable to extreme heat because they do not understand what needs to be done to protect themselves from this natural hazard. The elderly are vulnerable because they are more likely to lack the physical and economic resources necessary to respond to extreme heat events and are more prone to suffer health-related disabilities.

Other vulnerable groups include people with health and mobility challenges, outdoor laborers, low income households, and institutionalized and/or incarcerated populations (0.4%). Persons with disabilities make up approximately 10% of the total civilian non-institutionalized population in the CNMI (US Census Bureau, 2024). Of this group, 4% of the population are under 18 years old, 9% of are 18–64 years of age, and 39% are 65 years and older. Occupational heat exposure for construction workers is particularly salient during extreme heat events and the most common cause of non-fatal emergency department admissions across all age groups (Gronlund, 2014). Twelve percent of the population in the CNMI is employed in the construction industry (US Census Bureau, 2024). People living in urban areas where heat islands may develop, increasing the temperatures another few degrees, are also vulnerable to extreme heat hazards. Low-income households, reluctant to operate an air conditioner due to concerns over utility costs, face a barrier to staying cool in extreme heat events. In the CNMI, 38% or 17,876 households had incomes below the poverty level (US Census Bureau, 2024). Elderly individuals over 65 years represent 26% of the population living below the poverty level.

Assessing the impact of extreme heat hazard on these socially vulnerable groups by census tract is challenging given the compressed timeframe for this plan update. On February 15, 2024, the US Census Bureau released demographic information on population and housing characteristics from the 2020 Census by census tract (or village); however, due to the condensed project timeline the data was not analyzed for the 2024 SHMP Update. A more nuanced assessment of socially vulnerable populations in the CNMI is recommended for the 2029 SHMP Update using census tract population and housing demographics from the decennial 2020 US Census.

Natural Resources

Extreme heat and heatwaves can impact natural resources in various ways. Increased heat can cause increased evaporation, which may contribute to drought and increased fire risk through the drying of vegetation. Heat coupled with drought may reduce groundwater recharge and stress the water system. Also, with increased heat, the demand for water will likely rise which can further strain the water system and water use can be a financial strain on households, especially those with low or fixed incomes.

Cultural Resources

Extreme heat may impact cultural heritage exposed to outside environments and the interiors of historic buildings as well as their collections. These cultural resources have always been and will continue to be subject to interactions with the environment. The threat of extreme weather conditions such as extreme heat and heatwave can exacerbate rates of decay in material culture such as organic collections (Sesana et al., 2021). Increased exposure to heat levels impacts relative humidity levels in exterior and interior environments. Exterior cultural resources such as stone architecture may experience accumulation of salt crystallization, structural damage of building materials overtime (e.g., micro-cracking of stone), and erosion of building materials during heatwave events. Prolonged exposure to increased temperatures and changes in relative humidity on collections can also result in mechanical damage to hygroscopic materials such as wood artifacts, mechanical stress in wooden objects, decay on painted wooden objects, and decay of pictorial layers on wooden panels. Additionally, paper and textiles artifacts, and photographs undergo chemical degradation. Extreme heat and drought conditions may cause increased risk of fires and their propagation (Rockman et al., 2016).

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

Climate Change

The same climate change considerations as discussed above would apply to future development and changes in demographics.

Potential or Projected Development

The number of days of extreme heat and heatwaves are expected to increase in the future. Heat is not expected to affect the built environment directly; however, indirect effects from potential increases in power and water demands are likely to occur when temperatures are high. In addition, extreme heat may increase the risk of fire and development in or near high-risk fire areas may become more vulnerable in the future.

Projected Changes in Population

The United Nations Population Division World Population Prospects projects the median population growth rate for the CNMI to be 0.30% in 2029. They also project the number of people over 65 year to increase through year 2100 (United Nations, 2022), thus there will be a greater number of individuals that will be vulnerable to increased extreme heat and heatwaves events.

4.7.3 Mitigation Success

Over the past 5 years, the potential threats from extreme heat and heatwaves due to climate change in the Commonwealth have been recognized and are starting to be considered in natural hazard risk planning efforts (Grecni et al., 2021). The *Saipan Tribune* published an article to inform the public about potential heat-related hazards (September 2, 2021). Also, new heat-risk data and visualization tools are available for practitioners and policy makers (World Bank Group, 2021). The consideration of extreme heat and heatwave is relatively new for CNMI, and although the risk is expected to manifest through years in the future, planning now to promote natural system and community resilience can help mitigate future effects from heat-related threats.


Hafa Adai! Saipan Tribune

Climate study warns of extreme heat in the CNMI

By Iva Maurin | Correspondent Sep 2, 2021 0

Figure 4.7-2. The *Saipan Tribune* published a story to help inform the public about the potential risks of extreme heat in the CNMI due to climate change.

References

[CDC] Centers for Disease Control and Prevention. (2024, June 21). *Extreme Heat and Your Health*. Extreme Heat. https://www.cdc.gov/extreme-heat/about/index.html

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

Gronlund, C. (2014). Racial and socioeconomic disparities in heat-related health effects and their mechanisms: A review. *Current Epidemiology Report*, *1*(3), 165–173. https://doi.org/10.1007/s40471-014-0014-4. PMID: 25512891

IPCC. (2024). Summary for Policymakers. In H. Lee & J. Romero (Eds.), *Climate Change 2023: Synthesis Report. Contribution of Working Groups I,II, and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (p. 34). IPCC.

Pacific RISA. (2012, February 3). *Northern Mariana Islands*. Pacific RISA - Managing Climate Risk in Pacific Islands. https://www.pacificrisa.org/places/commonwealth-of-the-northern-mariana-islands/

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

Sesana, E., Gagnon, A. S., Ciantelli, C., Cassar, J., & Hughes, J. J. (2021). Climate change impacts on cultural heritage. *WIREs Climate Change*, *12*(4), 1–29. https://doi.org/10.1002/wcc.710

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

US Census Bureau. (2024). *2020 Island Areas Censuses: Commonwealth of the Northern Mariana Islands (CNMI)* [dataset]. https://www.census.gov/data/tables/2020/dec/2020-commonwealth-northern-mariana-islands.html

US Department of Homeland Security. (2024). *Extreme Heat*. Ready.Gov. https://www.ready.gov/heat

World Bank Group. (2021). *Climate Change Knowledge Portal*. Climate Change Knowledge Portal for Development Practitioners and Policy Makers. https://climateknowledgeportal.worldbank.org/

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.8 Wildfire

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.8 Wildfire

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Wildfire	Occasional	Limited	Significant	Low

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP) Update, the hazard profile was updated with recent data and information regarding the impacts of wildfire on Commonwealth ecosystems.
- New and updated figures and information from federal agencies, non-governmental organizations, and recent reports were incorporated.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to flood is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.
- A mitigation success achieved since 2018 was included in the final plan to highlight continuous progress toward lowering the vulnerability of the Commonwealth to wildlife.

4.8.1 Hazard Profile

Description

Factors that contribute to increased wildfire activity in recent years includes changes in vegetation cover (specifically invasive grasses), increased dry periods due to climate change, and changes in where people live, work, and recreate (Figure 4.8-1). Most of the wildfires in the Commonwealth are human-caused and burn in grasslands with the abundance of fine fuels (Trauernicht et al., 2024). According to the Commonwealth of the Northern Mariana Islands (CNMI) *Draft CNMI State Wildland Fire Plan 2014-2024,* a wildfire is an uncontrolled fire in an area of combustible vegetation that occurs in the countryside or a wilderness area (Guerrero, 2014). Wildfire can burn extensive areas, spread quickly, behave erratically, and jump gaps in fuel such as roads, rivers, and firebreaks. Wildfires can cause extensive damage to infrastructure and human life throughout the year; however, wildfire is most common during the dry season between December and May. Wildfires are also strongly associated with drought and El Niño-Southern Oscillation (ENSO) conditions (Pacific Fire Exchange, 2024; Trauernicht et al., 2024).

Figure 4.8-1. Factors that contribute to increased wildfire today.
Source: Pacific Fire Exchange
(https://pacificfireexchange.org/regions/)

Recent research suggest that naturally occurring fires were relatively rare on Pacific islands until people arrived (Bubb & Williams, 2022; Trauernicht et al., 2024). Native forests on these islands are not adapted to frequent fires. Prior people in the Mariana Islands, evidence suggest fire-prone grasslands and savannas were smaller than today and likely only existed as small patches (Frager et al., 2020). Today, most of the grassland areas in the Commonwealth are dominated by invasive species such as *Miscanthus floridulus,* which forms mono-typic stands at high density creating high fuel loads prone to burning.

Wildfire has become more of a concern in the Commonwealth as more development is located near fire-prone areas (Guerrero, 2014). Although wildfires in the Commonwealth are relatively small in area compared to wildfires on the US mainland, they still burn about 2% of the land area on each island each year, which is comparable to the percent area burn in the fire-prone western US states (Figure 4.8-2).

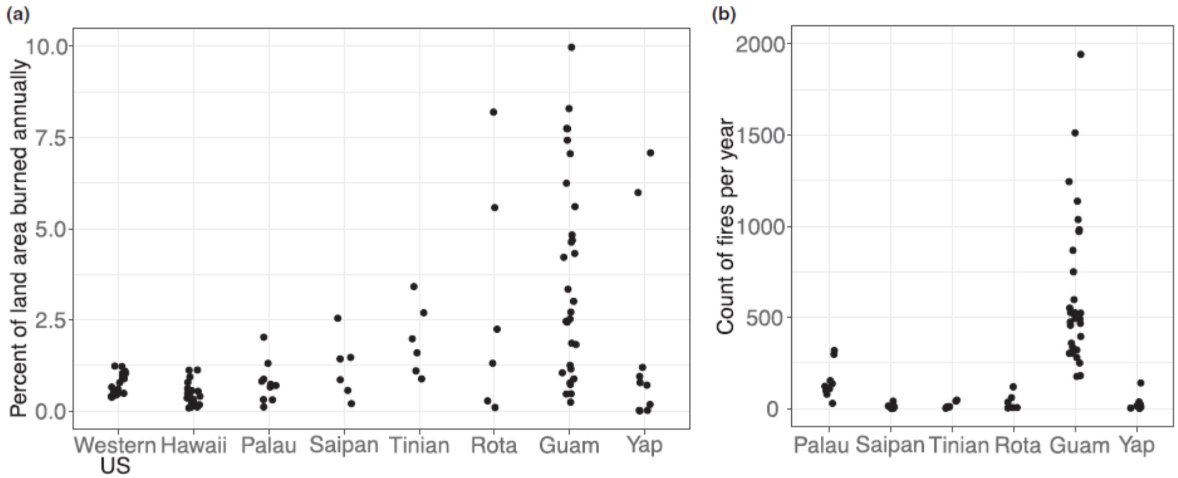


Figure 4.8-2. The (a) percent of total land area burned for each island/island group as well Hawai'i and the 12 westernmost states on the US continent (including Alaska) and (b) count of fires per year per island/island group.
Source: Trauernicht et al. (2024).

The human application of fire, be it accidental or intentional, maintains the grasslands, otherwise these areas would revert to forest overtime. Wildfire can have several negative effects to ecosystems including damage to soil via combustion of the litter layer and organic material in the soil. When organic material is removed from the soil by an intense fire, erosion can occur. Heat from intense fires can also cause soil particles to become hydrophobic so that less rainwater infiltrates the soil increasing run off and erosion potential. Rain sheeting over burned areas can carry loosened topsoil into streams and the ocean. This sediment is washed into near shore waters where it is deposited over the seagrass and coral reefs, eventually smothering, and killing large areas of habitat. Sedimentation on corals may also cause stress and contribute to coral bleaching.

Wildfire can also increase grassland cover over time by killing trees on the forest edge and allowing space for grasses to invade (Figure 4.8-3). These areas become more fire-prone preventing trees from re-establishing. The replacement of the trees with grass increases the future fire risk of the area in a positive feed-back loop. By removing existing vegetation, wildfire facilitates invasion of the burned area by quick growing invasive plant species.

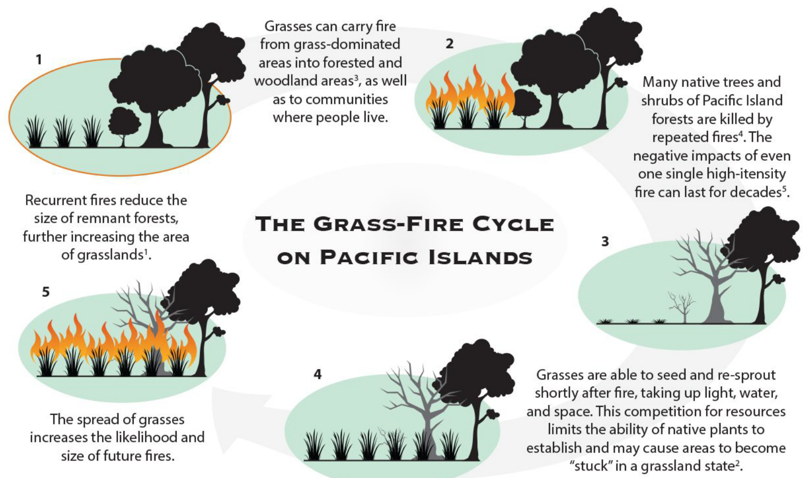


Figure 4.8-3. The grass-fire cycle on Pacific Islands.
Source: Pacific Fire Exchange (https://pacificfireexchange.org/about-the-

Historically, 10% of fires are caused by lightning but may also be caused by volcanic eruptions or earthquakes. Approximately 90% of wildfires in the last decade were caused by people through accidental ignitions, such as unattended fire, or intentionally set fires (Guerrero, 2014). Hunters burn grasslands to promote new plant growth favored by deer and other feral ungulates. The temporarily cleared areas provide easy access for hunting. This practice has increased savanna cover on the islands by about 2% per year by converting adjacent forest cover to grasslands (Guerrero, 2014). In recent years, the Department of Coastal Resources Management (DCRM) has implemented programs to reduce the number of fires set for hunting purposes. Education campaigns such as *Real Hunters Don't Burn* have been successful in curtailing intentionally set fires (Figure 4.8-4). Additionally, DCRM facilitates the conversion of grasslands back to forest through conservation action plans for key watersheds with the aim of reducing the number of wildfires (Bickel, 2012; DEQ, 2013; Herrmann & Gombos, 2009). Revegetating with plants resistant to burning in the Laolao and the Talakhaya watersheds has helped decrease the damage that fires have on these landscapes.

Figure 4.8-4. Fire information/prevention sign in the Talakhaya watershed, Rota.

Location

All of the Mariana Islands are susceptible to wildfires, especially during prolonged drought and high winds. As shown in Figure 4.8-5, most wildfires occur in grassland (i.e., savanna) on Saipan, Tinian, and Rota, which is similar to other Pacific Islands (Trauernicht et al., 2024).

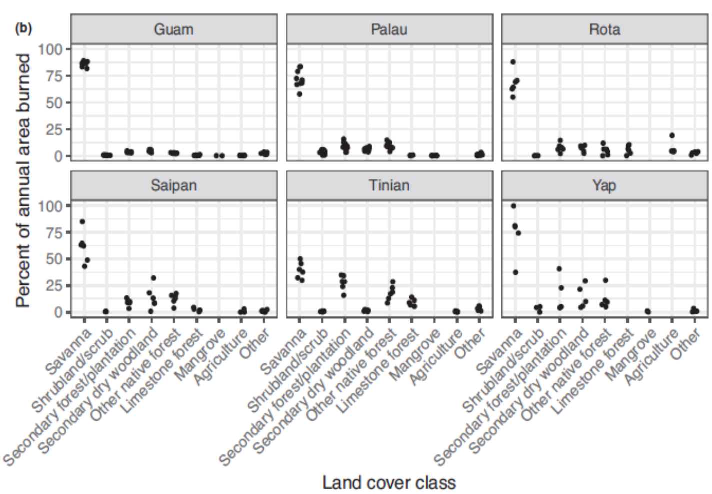
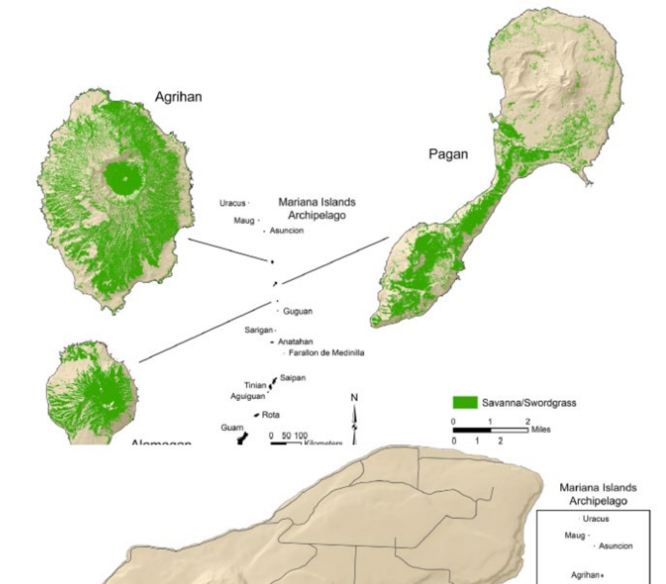


Figure 4.8-5. The distribution of burned area across simplified land cover types (from LANDFIRE) for islands with fire perimeter data.
Source: Trauernicht et al., 2024

In general, the savannas of the Mariana Islands occur on steep slopes and comprise approximately 17% of the land on Saipan, 1% on Tinian, and approximately 2% on Rota. Additionally, there are sword grass savannas growing on the peaks of several of the northern islands (Figure 4.8-6). Along the southern portion of Mount Tapochau on the island of Saipan, there is a sword grass savanna that grows in Chinen soils, which develops over limestone instead of volcanic rock like the Akina and Laolao soils. Savanna lands that are comprised of Chinen soils frequently burn during the dry season.



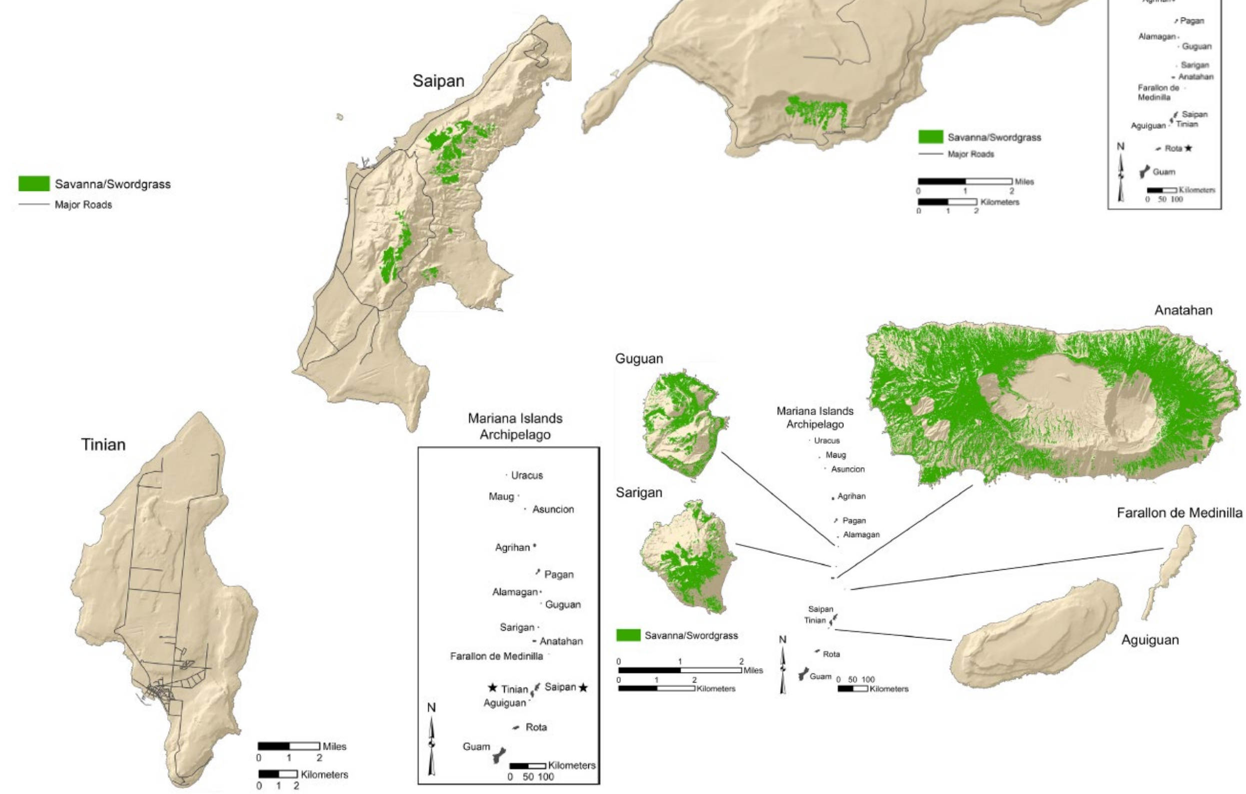


Figure 4.8-6. Maps of grassland (i.e., savanna) habitat in the Mariana Islands
Source: Frager et al. (2020).

For Saipan, Tinian, and Rota, fire probability maps were recently developed to show areas of greatest relative risk of burning in the future (Bubb & Williams, 2022; NMHC, 2023). Although similar maps are not available for the Northern Islands, fire risk can is likely highest in the grasslands (Figure 4.8-7).

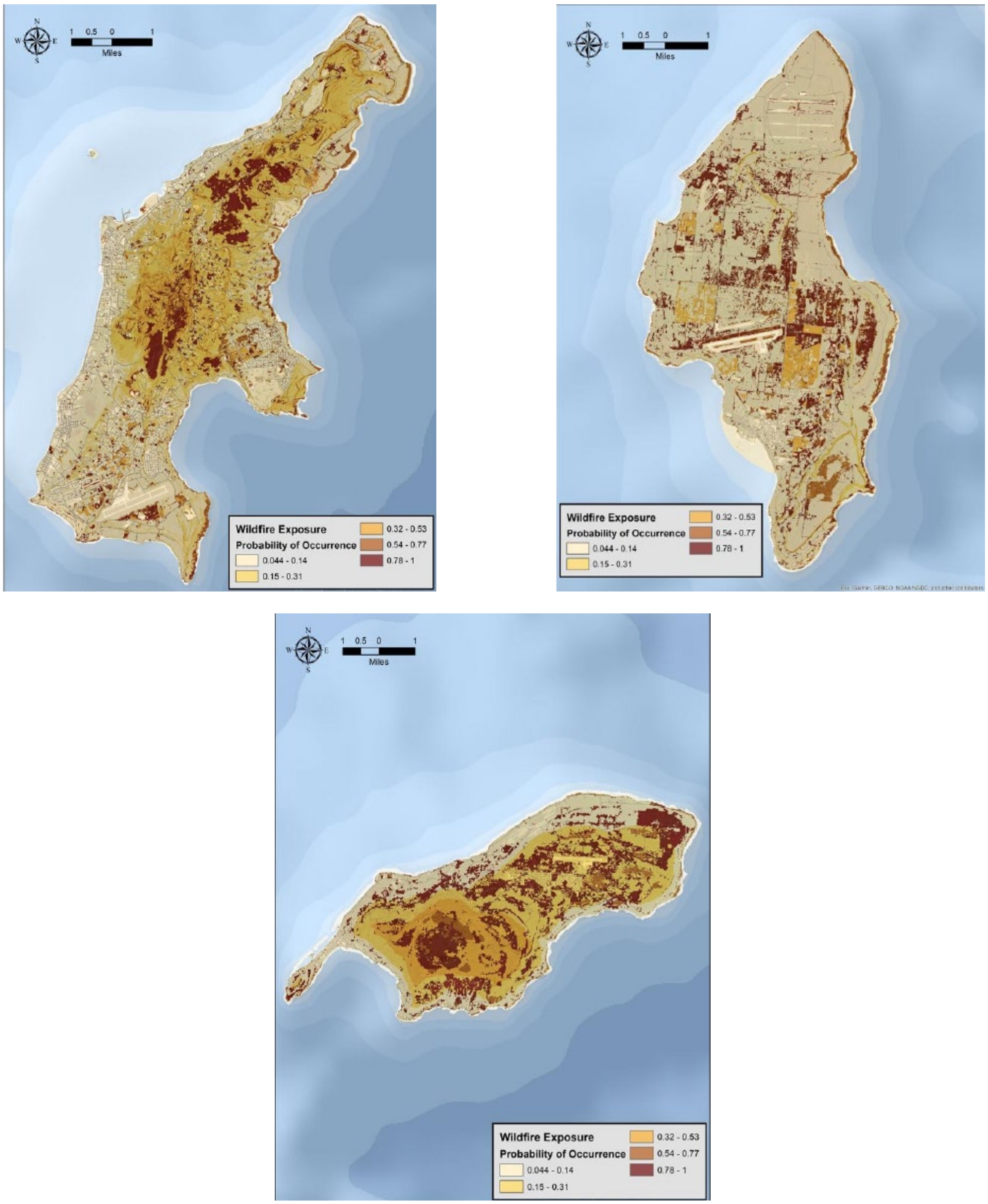


Figure 4.8-7. Maps of wildfire probability of occurrence for Saipan, Tinian, and Rota
Source: NMCH (2023)

The greatest danger of wildfire is where wildlands border urban areas, especially in areas where traditional firefighting equipment cannot be utilized such as mountaintops, steep ridges and valleys. The amount of natural fuel (grasses, trees, and brush) near human populations contributes to increasing the risk to life and property. Other threatened locations include agricultural areas that are adjacent to wildlands where downed trees and flammable brush are prevalent. According to a report by the US Forest Service and the Commonwealth, a cooperative fire protection program is administered and implemented at an annual shared cost of $419,000.

The current public awareness and community outreach campaign is used to inform the community of existing seasonal potential of wildfire hazards occurring (Figure 4.8-8).


Saipan Tribune

DFEMS responds to four fires as CNMI enters dry season

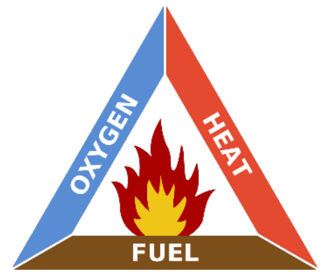
By KIMBERLY B. ESMORES
kimberly_esmores@saipantribune.com
REPORTER
Mar 26, 2024

Figure 4.8-8. Newspaper articles help raise public awareness of the dry season and elevated fire-risk.

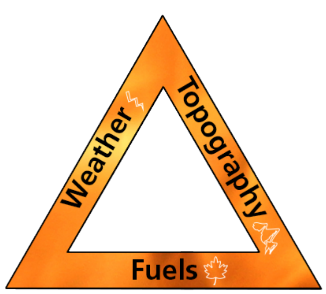
Figure 4.8-9. Wildfire in Talofofo Watershed on Saipan in 2021.
Source: NMHC (2023)

Extent

All fires require heat, fuel, and oxygen to ignite and be sustained (see definitions below). The fire triangle or combustion triangle, shown to the right, is a simple model for understanding the necessary ingredients for fires. Fire also requires a chemical reaction between the components. Fire is extinguished when any of the three components is removed or the chemical reaction between the components is suppressed. Techniques to extinguish fire include application of water to reduce heat, removal or isolation of fuels, and control of oxygen by chemicals.



- **Heat**: A heat source is needed for the initial ignition of fires. Heat is also generated by the fire. For a fire to grow, heat must be transferred to the initial and surrounding fuel. It allows fire to spread by removing the moisture from the nearby fuel, enabling it to ignite or travel more easily.
- **Fuel**: The fuel side of the triangle (as shown in the image above) refers to both the external and internal properties of the fuel. External properties refer to the type and the characteristics of the fuel material. Internal properties of fuel address aspects of fuel chemistry. Fuel is characterized by its moisture content, size and shape, quantity, and the location of the fuel type (ground, surface, ladder, or aerial).
- **Oxygen**: Air contains about 21% oxygen. Most fires require air with at least 16% oxygen content to burn under most conditions. Oxygen supports the chemical processes that occur during a land fire. When fuel burns, it reacts with oxygen from the surrounding air, releasing heat and generating combustion products (National Park Service, 2023).



All wildfires begin with an ignition source. Fire behavior describes how fuels ignite, flames develop, and fire spreads. The fire behavior triangle (shown to the left) illustrates how the three primary factors influence wildfire behavior: fuel, topography, and weather. Each point of the triangle represents one of the three factors; the sides represent the interplay between the factors. For example, drier and warmer weather combined with dense fuel loads and steeper slopes will cause more hazardous fires than light fuels on flat ground (National Park Service, 2017). In the Commonwealth, grasslands are often located on steep slopes, which can influence more extreme fire behavior.

Warning Time

There is no way to predict when a wildfire might break out. However, weather conditions can be monitored and used to identify periods of greater fire risk. Fire weather watches and red flag warnings are used to convey the possibility of severe fire weather to wildfire agencies. The National Weather Service (NWS) issues Fire Weather Watches and Red Flag Warnings to alert fire departments and residents of the onset, or possible onset, of critical weather and dry conditions that could lead to rapid or dramatic increases in wildfire activity. Fire weather forecasts are available on the NWS website accessed at https://www.weather.gov/fire/.

- **Fire Weather Watch**: The NWS issues a Fire Weather Watch when potentially dangerous fire weather conditions are possible over the next 12 to 72 hours.
- **Fire Weather/Red Flag Warning**: The NWS issues a Fire Weather Warning or Red Flag Warning when fire danger exists and weather patterns that support extreme fire behavior are either occurring or expected to occur within 24 hours. Authorities may issue a Fire Weather Watch before a Warning, but a Warning may also be the initial notification.
- **Evacuation Notice**: If the danger is imminent, local authorities may issue an evacuation notice to alert residents that a fire is nearby, and it is important to leave the area. Evacuation orders vary by state and community and may range from voluntary to mandatory. When authorities issue a mandatory evacuation notice, leave the area immediately (FEMA, n.d.).

Previous Occurrence

FMAG1-a. Does the risk assessment provide an overview of the location and previous occurrence of wildfire hazards in the state?

Wildfires are a common occurrence during the dry season, often spreading to populated areas within the islands. Although fires may be common, there has never been a federal Emergency Declaration or Major Disaster Declaration issued for wildfire in the Commonwealth.

In 1972, a major wildfire occurred on Pagan. However, no deaths or injuries were attributed to the fire. In 1998, a wildfire on Mount Tapochau burned for two days threatening nearby residential areas and farm lots. In 2001, very dry conditions lead to increased wildfire activity on Saipan and Tinian. Lake Susupe has high-risk areas, especially during droughts. As the margins of the marshland retreat and grasses and sedges dry up, they become tinder for brushfires which threaten nearby homes in this highly populated area of the island.

The number of recent fires per year that occurred on each island was not readily available. The US Forest Service mapped fires on Saipan and Tinian from 2016 through 2022 and provided the number of fires per year (Figure 4.8-2) (*CNMI Wildfires 2016–2022*, n.d.). In addition, the Pacific

Fire Exchange used satellite data available from LANDFIRE, an online database hosted by the US Geological Survey, to produce maps of where fires occurred on Saipan, Tinian, and Rota between 2015 and 2023 (Figure 4.8-10 and Figure 4.8-11); however, the number of fires per year were not provided with the maps. From the maps it is apparent that fire occurs on these islands annually. The *CNMI Community Development Block Grant–Mitigation Initial Action Plan* (NMHC, 2023), reports 120 wildland/brush fires in the CNMI between 2015 and 2017.

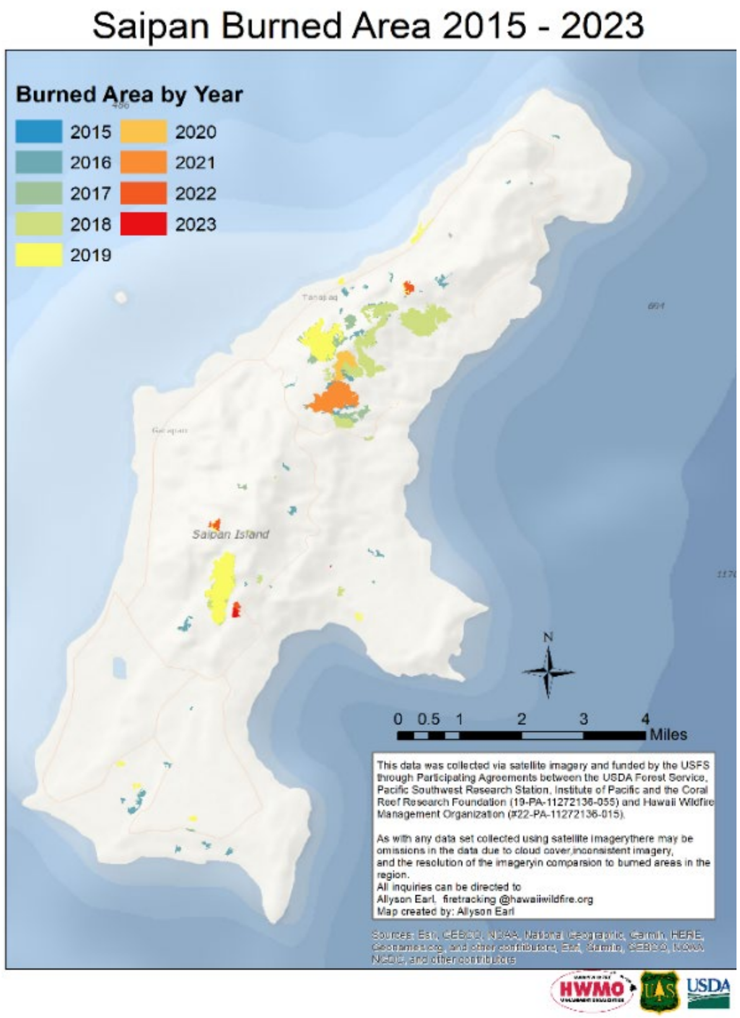


Figure 4.8-10. Wildfires on Saipan from 2015–2023.
Source: Pacific Fire Exchange (https://pacificfireexchange.org/)

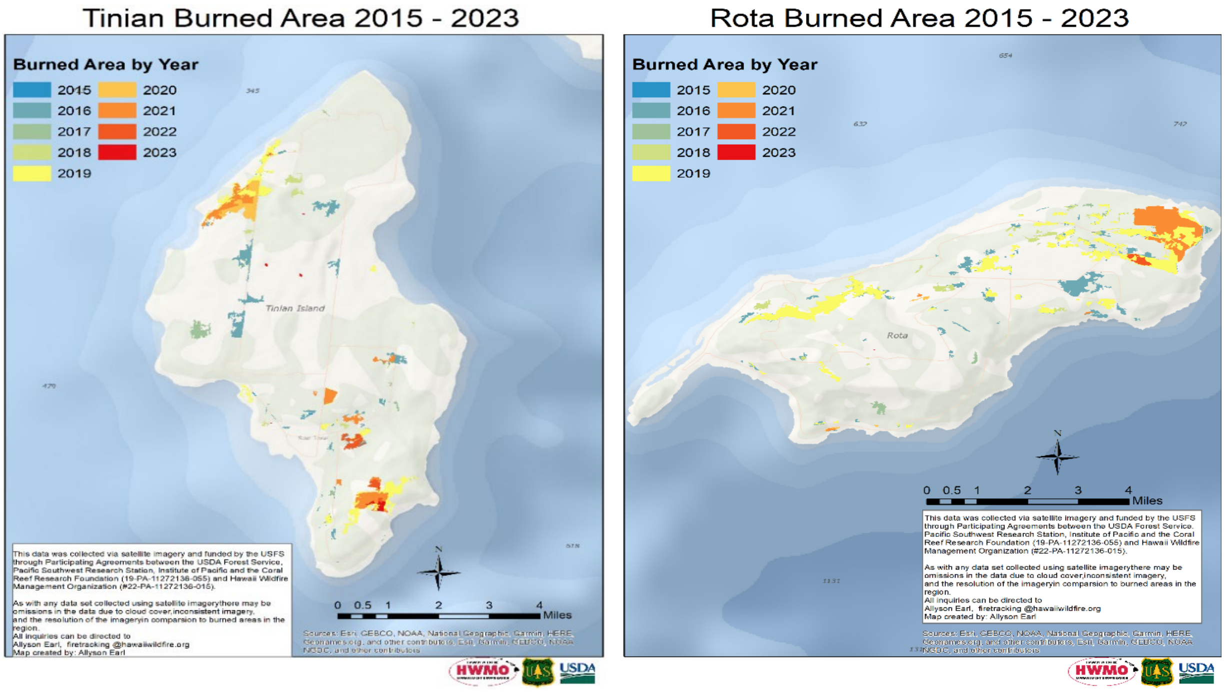


Figure 4.8-11. Wildfires on Tinian, and Rota from 2015–2023.
Source: Pacific Fire Exchange (https://pacificfireexchange.org/)

Probability of Future Occurrence

FMAG1-b. Does the risk assessment provide an overview of the probability of future wildfire events that includes projected changes in the locations, intensity, frequency and/or duration of wildlife hazards?

Each year, wildfire occurs in the Mariana Islands. Based on the accounting of wildfires by the US Forest Service with discernable perimeters from 2016–2022 (Table 4.8-1), each year on average there are 3 wildfires on Saipan and 2.5 wildfires on Tinian (*CNMI Wildfires 2016–2022*, n.d.). Trauernicht et al. (2024), show that Rota has a slightly greater number fires per year compared to Saipan and Tinian (Figure 4.8-2). Wildfires are expected to be more frequent during the dry season and periods of little or no rainfall.

Table 4.8-1. Number of fires for Saipan and Tinian from 2016–2022.

Year	2022	2021	2020	2019	2018	2017	2016
Saipan	4	2	1	4	4	4	4
Tinian	1	2	2	3	4	2	4

Source: *CNMI Wildfires 2016–2022* (n.d.).

With the continuing growth of the tourist industry and the resident population within the Commonwealth, the potential of fire impacts becomes a greater risk. The Department of Fire and Emergency Servies are the primary responders to wildfire events. There is limited capability to deal with major wildfires in the CNMI due to limited personnel and equipment. If such an incident should occur, assistance from some outside source would be necessary. Table 4.8-2 illustrates the firefighting resources that are available on each major island.

Table 4.8-2. Firefighting Resources within the CNMI

CNMI Government Department or Agency	Type of Equipment	Number of Vehicles or Pieces of Equipment Available
Saipan		
Department of Fire & Emergency Medical Services	Fire Engine (1,000 gal)	1
	Forestry Truck (150 gal)	2
	Rescue Utility Vehicle Fire Boat	1
	Fire Boat	1
	Hazmat Vehicle	1
	Ambulance	4
Commonwealth Ports Authority (CPA), Aircraft Rescue & Firefighting (ARFF)	Rescue Vehicle	1
	Fire Engine	4
Rota		
Department of Fire & Emergency Medical Services,	Fire Engine (1,000 gal)	1
	Hazmat Vehicle	1
	Ambulance	2
CPA ARFF, Rota	Fire Engine	1
Tinian		
Department of Fire & Emergency Medical Services	Ladder Truck (750 gal)	1
	Pump Truck (2,000 gal)	1
	Rescue Vehicle	1
	Brush Rig	1
	Ambulance	1
CPA ARFF, Tinian	Fire Truck w/ generator	2

Note: Several public and private agencies have earthmovers and water pumps, which could be utilized in the event of fire hazard.

Climate Change Considerations

Climate change will likely impact several key factors that influence wildfire ignition frequency and behavior. Trauernicht et al. (2015) anticipate there will be a 35% increase in days with high fire danger across the world by the mid-century.

Across the Pacific Islands region, the air temperature has increased by 2ºF between 1951 and 2020 (USGCRP, 2023) and temperatures are expected to continue to increase. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes.

Wildfire is strongly associated with rainfall patterns and ENSO events in the Commonwealth (Bubb & Williams, 2022; Guerrero, 2014; Trauernicht et al., 2015). Although there is uncertainty how climate change will affect the amount and frequency of rainfall, wet seasons will likely get wetter and the dry seasons drier with variable rainfall from year-to-year (Greene & Skeele, 2014). Also, ENSO events are expected to increase in frequency as the climate continues to change (Cai et al (2014) in Mycoo et al., 2022). According to Grecni et al. (2021), future projections for drought frequency and intensity are not available for the Commonwealth. Downscaled climate projections for nearby Guam indicate drought conditions (defined here as more than 20% below mean annual historic rainfall) are projected to occur in 4 out of 10 years on average in 2080–2099 under a high emissions scenario. This is an increase from the historic rate of 1.6 years out of 10 years on average (Gingerich et al., 2019; Zhang et al., 2016). In recent years the Commonwealth has experienced several drought periods, some periods reaching extreme levels. All of which lead to perfect conditions for wildfires throughout the Commonwealth.

The risk of wildfire in the Commonwealth is expected to rise under additional climate warming. A wide body of literature links increasing droughts and temperatures to increased fire risk (USGCRP, 2023).

4.8.2 Vulnerability Assessment

FMAG1-c. Does the risk assessment address the vulnerability of state assets located in wildfire hazard areas and estimate the potential dollar losses to those assets?

FMAG1-d. Does the risk assessment include an overview and analysis of local government's vulnerability to wildlife and the potential losses to vulnerable structures?

In the Commonwealth, wildfires are related to rainfall patterns and more fires occur during the dry season and during ENSO events. Climate change is expected to amplify the risk of wildfire fires through altered rainfall patterns and increased frequency of ENSO events, drought, and the number of hot days. Each year wildfires burn significant proportions of Saipan, Tinian, and Rota. Fire probability maps were used to determine areas with a high probability of burning (i.e., high fire risk). For this analysis, areas that were classes as having a 75% or greater probability of wildfire occurring were considered high wildfire risk. An exposure analysis was conducted in the Geographic Information System (GIS) and any assets that occurred within the high wildfire risk areas were considered vulnerable and loss was assumed to be 100%.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the Commonwealth asset exposure and potential losses due to wildfire. Commonwealth assets include Commonwealth owned and operated buildings, primary roads, and critical facilities and community lifelines.

Commonwealth Buildings

The exposure analysis identified 9 buildings in areas considered high wildfire risk with a total replacement cost value of ~$8.3 million. Most of these buildings were located on Rota and the estimated loss for these buildings is $5.9 million or 1% of the total replacement cost value of the commonwealth building stock. Table 4.8-3 and Table 4.8-4 summarize Commonwealth buildings located in areas with high wildfire risk by municipality and agency, respectively.

Table 4.8-3. Commonwealth building exposure and potential losses to wildfire by municipality.

			Buildings Exposed		Estimated Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	246	$708,944,498	2	$1,379,590	$1,379,590	0%
Tinian	83	$140,347,469	4	$990,124	$990,124	0%
Rota	58	$123,032,676	3	$5,920,206	$5,920,206	1%
Total	**387**	**$972,324,643**	**9**	**$8,289,920**	**$8,289,920**	**1%**

Table 4.8-4. Commonwealth building exposure and potential losses to wildfire by agency.

	Buildings Exposed			Estimated Potential Loss	
Agency	No.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Replacement Cost Value	% of Total RCV ($972,324,643)
Commonwealth Utilities Corporation	3	$1,025,822	0%	$1,025,822	0%
Dept. of Public Works	1	$85,638	0%	$85,638	0%
Judiciary	1	$4,910,987	1%	$4,910,987	1%

Table 4.8-5. Commonwealth building exposure and potential losses to wildfire by agency (*cont'd*).

	Buildings Exposed			Estimated Potential Loss	
Agency	No.	Replacement Cost Value (RCV)	% of Total RCV ($972,324,643)	Replacement Cost Value	% of Total RCV ($972,324,643)
Mayor's Offices	1	$183,102	0%	$183,102	0%
Office of Homeland Security & Emergency Management	2	$1,379,590	0%	$1,379,590	0%
Public School System	1	$704,781	0%	$704,781	0%
Total	**9**	**$8,289,920**	**1%**	**$8,289,920**	**1%**

Northern Islands

On the Northern Islands, Commonwealth buildings are located on Agrihan, Alamagan, and Pagan. Buildings include satellite Mayor's offices, which also serve as medical dispensaries, typhoon shelters, and communication hubs, and other storage facilities. Fire risk has not been mapped for the Northern Islands. However, grasslands cover large proportions of the Northern Islands and fire risk is assumed high in these areas (Figure 4.8-6). Any facilities located in areas or adjacent to grasslands are considered at risk. The total estimated value of the critical facilities and community lifelines in the Northern Islands is estimated to be ~$1.8 million. However, this estimate does not account for the added costs to construct facilities in the Northern Islands due to the extreme isolation and logistical challenges of transporting construction materials and equipment and lack of port facilities.

<u>Commonwealth Roads</u>

Wildfires are not expected to directly impact roads; however, wildfires can lead to road closures, which may have significant impacts to communities and each island. There are 16.2 miles (30%) of primary roads within high-risk wildfire areas (Table 4.8-6).

Table 4.8-6. Commonwealth roads exposure and potential losses to wildfire by municipality.

Municipality	Total Road Length (miles)	Exposed Road Length (miles)	% of Total
Saipan	87	3.4	4%
Tinian	67.1	6	9%
Rota	39.6	6.8	17%
Total	193.8	16.2	30%

Community Lifelines and Critical Facilities

Table 4.8-7 summarized the number of critical facilities by community lifeline category for each municipality. Table 4.8-8 summarizes the number of critical facilities in high-risk wildfire areas by lifeline category. Five critical facilities that support communications, safety and security, and water system lifelines are vulnerable to wildfire and estimated losses for these facilities is $2.4 million.

Table 4.8-7. Commonwealth community lifeline and critical facility exposure and potential losses to wildfire by municipality.

		Community Lifelines Exposed								
Municipality	Total No. of CLF	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety & Security	Transportation	Water Systems	Total No. Exposed
Saipan	138	1	0	0	0	0	1	0	0	2
Tinian	56	0	0	0	0	0	0	0	2	2
Rota	43	0	0	0	0	0	0	0	1	1
Total	237	1	0	0	0	0	1	0	3	5

Table 4.8-8. Commonwealth community lifeline and critical facility exposure and potential losses to wildfire by lifeline category.

			Community Lifelines Exposed		Estimated Potential Loss	
Category	Total No. of CLF	Total Replacement Cost Value (RCV)	No. of CLF	Replacement Cost Value	Value	% of Total RCV
Communications	4	$864,517	1	$57,903	$57,903	0%
Energy	46	$140,851,551	0	0	0	0
Food, Water, Shelter	24	$37,356,099	0	0	0	0
Hazardous Material	9	$48,091,161	0	0	0	0
Health and Medical	19	$187,643,812	0	0	0	0
Safety and Security	35	$38,639,592	1	$1,321,687	$1,321,687	0%
Transportation	48	$119,925,667	0	0	0	
Water Systems	52	$50,052,062	3	$1,025,822	$1,025,822	0%
Total	**237**	**$623,424,461**	**5**	**$2,405,412**	**$2,405,412**	**0%**

Northern Islands

On the Northern Islands, Commonwealth buildings are located on Agrihan, Alamagan, and Pagan are considered critical facilities that provide essential community lifelines for island residents. Fire risk has not been mapped for the Northern Islands. However, grasslands cover large proportions of the Northern Islands and fire risk is assumed high in these areas (Figure 4.8-6). Any facilities located in areas or adjacent to grasslands are considered at risk. The total estimated value of the critical facilities and community lifelines in the Northern Islands is estimated to be ~$1.8 million.

General Asset Vulnerability Assessment and Potential Losses

Wildfires often destroy property, valuable forested watersheds, native species and their habitats, and recreational and scenic resources. Impacts from wildfire may extend beyond residents, visitors, and valued resources, to potentially impact the Commonwealth's economy, which relies heavily on the tourism industry. This section provides a summary of vulnerability and potential losses to general building stock, socially vulnerable and total populations, and natural and cultural resources assets.

General Building Stock

Like the analysis for the Commonwealth building stock, an exposure analysis was conducted in the GIS to identify buildings from the general stock within areas with a 75% or greater probability for wildlife (i.e., high-risk wildfire areas). Table 4.8-9 summarize the buildings located in high-risk wildfire areas by municipality. Saipan and Rota have a similar number of buildings in high-risk wildfire areas, which represents about ~$43 million (1%) of the total replacement cost value for the general building stock. Buildings in the high-risk wildfire areas are assumed to be 100% lost and this is reflected in the total replacement cost values provided.

Table 4.8-9. General building stock exposure and potential losses to wildfire by municipality.

			Buildings Exposed		Potential Loss	
Municipality	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	No. of Bldgs.	Replacement Cost Value	Value	% of Total RCV
Saipan	12,761	$6,179,343,275	83	$20,292,435	$20,292,435	0%
Tinian	98	$399,885,058	13	$5,136,806	$5,136,806	0%
Rota	1,261	$343,861,559	82	$22,920,253	$22,920,253	0%
Total	**14,120**	**$6,923,089,892**	**178**	**$48,349,494**	**$48,349,494**	1%

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5-year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.

Socially Vulnerable and Total populations

Total population and socially vulnerable populations exposed to wildfire were determined by the number of residences that occurred within the area identified as having a 75% or greater probability of wildfire (i.e., high-risk wildfire area). In general, communities and populations that are especially vulnerable to wildfires, include low-income communities, migrant populations, populations whose primary language is not English, communities of older adults, and those with respiratory and other health concerns. Wildfires can also pose significant threats to the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Table 4.8-10 lists the total population and population by Social Vulnerability Index (SVI) living within areas considered at high-risk to wildfire. An estimated 253 people on Saipan, Tinian, and Rota live in areas considered high-risk wildfire areas with the greatest number on Saipan. In addition, an estimated 47 people in SVI class 4 are considered at high risk from wildfire on Saipan.

Table 4.8-10. Commonwealth population based on 2020 census data exposed to wildfire by social vulnerability index and municipality.

				Proportion of Estimated Population Exposed		
Municipality	SVI Index No.	Total No. Residences	Total Estimated Population	No. Residences	Estimated Population	% of Total Est. Pop. by SVI Index
Saipan	1	1,670	4,652	41	86	2%
	2	1,832	6,476	9	29	0%
	3	2,682	14,443	6	26	0%
	4	2,191	11,654	14	47	0%
	5	948	5,855	0	0	0%
		52	61	0	0	0%
Saipan Total		**9,375**	**43,141**	**70**	**188**	**0%**
Tinian	1	249	571	11	6	1%
	2	496	1,458	1	3	0%
Tinian Total		**745**	**2,029**	**12**	**9**	**0%**
Rota	1	409	749	20	18	2%
	2	561	1,116	20	38	3%
	0	22	0	7	0	0%
Rota Total		**992**	**1,865**	**47**	**56**	**3%**

SVI=Social Vulnerability Index

Populations living adjacent to grasslands and other high-risk wildfire areas may have limited roads for egress in the event of a wildfire emergency. Some of these roads are unpaved and maybe in poor repair, increasing vulnerability during an evacuation. Older adults may be more vulnerable if evacuation is required because they do not have the mobility many others have. Warnings and evacuation notices may take time to translate to other languages thus increasing the vulnerability of migrant communities or communities that speak English as a second language. Health problems related to wildfire smoke exposure can be as mild as eye and respiratory tract irritation and as serious as worsening of heart and lung disease, including asthma, and even premature death (Ammann et al., 2021).

Natural and Cultural Resources

Wildfires can have tremendous impacts on the environment through physical, chemical, and biological pathways. Wildfires threaten air quality, water quality, soil properties, nutrient cycling, vegetation, and wildlife habitat. During periods of heavy rainfall, the burned areas can erode thereby increasing sedimentation loads in streams and increase sediment in nearshore marine waters impacting water quality, fisheries, and long-term coral health.

The natural role of fire in native Commonwealth ecosystems is not well understood, but fire was believed to be less frequent prior to the arrival of humans in the archipelago. Wildfire degrades native forests and treeland cover in favor of grassland or savanna cover (grasslands mixed with shrubs or trees). This slow conversion of forested area to grasslands reduces the resilience of Commonwealth forests, which provide critical ecosystem services as watersheds and habitats for many endemic and native species.

To evaluate the risk of wildfire to species of conservation concern, the terrestrial index developed by Dobson et al. (2020) was overlaid with fire probability in the GIS to determine the vulnerability of suitable species habitats to wildfire. The total area (square miles) of suitable habitat for species of conservation concern identified by the terrestrial index that were within high-risk wildfire areas is reported in Table 4.8-11. The total area of suitable habitats is summarized by municipality and by the assigned terrestrial index class where 1 is a low concentration of species of conservation concern and 5 is a high concentration of species of concern. Thus, the hazard has a greater impact on a greater number of species of conservation concern in higher index classes.

The greatest total area of suitable habitats for species of conservation concern is on Saipan, followed by Tinian and Rota. This is likely a result of total island area. Rota has the most area of suitable habitat exposed to high wildfire risk and a large proportion of the vulnerable suitable habitat is in the top two index classes indicating high quality habitats. As mentioned earlier, DCRM has implemented public outreach efforts to help reduce the number of intentionally set wildfires on Rota and is implementing watershed restoration projects to help reduce wildfire hazards.

Wildfire also threatens watersheds on Saipan, Tinian, and Rota. Wildfires impact watersheds in many ways that include, but are not limited to, removal of vegetation, increased soil erosion, altered vegetation communities, changes in soil chemistry, decreased capacity for water infiltration for ground water recharge. During heavy rainfall, loose sediment from burn areas can be transported downstream and deposited in near shore marine waters degrading water quality and affecting marine ecosystem.

Table 4.8-11. Suitable habitats for species of conservation concern exposure to wildfire by municipality.

Municipality	SH Index No.	SH Total Area (sq miles)	Suitable Habitat (SH) for Species of Conservation Concern Exposed	
			SH Area (sq miles)	% of SH Total Area
Saipan	1	26.5	2.3	9%
	2	14.5	1.8	7%
	3	27.8	0.2	1%
	4	4.0	0.0	0%
Saipan Total		**72.8**	**4.3**	**6%**
Tinian	1	1.8	0.1	0%
	2	35.8	4.7	10%
	3	7.8	0.1	0%
	4	0.1	0.0	0%
Tinian Total		**45.4**	**4.8**	11%
Rota	1	10.5	3.9	9%
	2	2.0	0.5	1%
	3	13.5	2.7	6%
	4	15.6	1.7	4%
Rota Total		**41.6**	**8.8**	**21%**

Table 4.8-12. Area of watershed exposed to wildfire by municipality.

Municipality	Watershed (sq miles)	Watershed Exposed to High Wildfire Risk (sq miles)	% of Total Watershed Exposed
Saipan	45.9	4.3	9%
Tinian	39.1	4.8	12%
Rota	33.0	8.8	27%
Total	**118.0**	**17.9**	

Wildlife also threatens cultural resources. Direct and indirect impacts from wildfire and firefighting activities can be swift and detrimental (National Park Service, 2021). For example, buildings, structures, pictographs, and rock paintings can burn, historic landmarks or other sensitive areas can be impacted by firefighting activities such as the construction of fire breaks, fire roads, release of fire retardant and post-fire runoff and erosion, tree fall, carbon contamination, and looting can compromise or destroy cultural resource assets. Cultural resource assets most directly vulnerable to wildfire have material components that can be damaged by fire (e.g., wood, natural fibers, and other combustible materials). Even the application of pressurized water to combat wildfire can disturb or destroy cultural resource assets.

To evaluate the vulnerability of cultural resources to wildfire hazards, cultural resources data layers were overlaid with the fire probability data in GIS. The total area identified as sensitive for cultural resources that intersected with areas of high fire probability are considered vulnerable to wildfire.

Table 4.8-13 summarizes the total area designated for cultural resources on Saipan, Tinian, and Rota. The most vulnerable cultural resources areas are on Saipan followed by Rota and then Tinian. The greatest area for cultural resource assets vulnerable to high-risk wildfire areas is on Saipan.

Table 4.8-13. Cultural resources exposure to wildfire by municipality.

		Cultural Resources (CR) Exposed	
Municipality	**CR Total Area (sq miles)**	**Area (sq miles)**	**% of CR Total Land Area**
Saipan			
National Historic Landmark	14.9	0.0	0%
Sensitive Area	16.0	3.0	10%
Saipan Total	30.9	3.0	10%
Tinian			
National Historic Landmark	0.0	0.0	
Sensitive Area	0.9	0.5	56%
Tinian Total	**0.9**	**0.5**	**56%**
Rota			
National Historic Landmark	0.0	0.0	0%
Sensitive Area	3.0	1.2	39%
Rota Total	**3.0**	**1.2**	**39%**

The National Park Service recommends advance planning to protect cultural resources during wildfire events (National Park Service, 2021). Planning includes cultural resources protection training for fire personnel to recognize and avoid cultural resources to minimize unwanted effects of fire management such as redirecting work or modifying suppression techniques.

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

Climate Change

As described earlier, climate change is expected to amplify conditions that promote wildfire. Anticipated changes in climate in the CNMI region that will likely facilitate future wildfires includes, altered rainfall patterns, with drier dry seasons and wetter wet seasons, increased frequency and duration of drought conditions and ENSO events, and increased air temperature with more hot days (> 90°F). In addition, changes in climate could potentially facilitate changes in vegetation communities favoring species adapted for hotter weather with long dry periods, such as grassland species. It is plausible that the frequency and intensity of wildfires will increase in the future under changing climate conditions.

Potential or Projected Development

The Department of Public Lands (DPL) has identified areas that may be developed in the future (DPL, 2019). For this spatial analysis, specific land use types selected for evaluation included lands identified for homesteads, agricultural and villages, school relocation sites, civic uses, energy production, and recreation. These land use types were selected because of the potential for people to be present (residences, civic uses, and recreation areas) and the vulnerability of the power infrastructure to hazards. Future analyses should continue to include additional community lifelines and critical facilities.

To evaluate the potential effects of wildfire, parcels identified by the DPL Lands for future development were overlaid in the GIS with areas designated as high-risk wildfire areas. Because models to predict future wildfire risk are not available, the exposure analysis used contemporary high-risk wildfire areas for the analysis.

Spatial analysis showed that parcels designated for homesteads, village, and agriculture development, may be vulnerable to wildfire. On all three islands the percentage of areas designated for potential village homesteads had the largest proportion of area in high-risk wildfire areas. On Rota areas designated for civic use and renewable energy projects may also be vulnerable. These results emphasize the importance of planning for existing hazards and anticipating how those hazards may be influenced by climate change. Future development can incorporate design elements to help reduce vulnerability to future wildfires.

Table 4.8-14. Parcels designated for future development exposed to the wildlife hazard by municipality.

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed	
		Land Use Type (sq miles)	% Land Use Type Exposed for total Area of Each Land Use Type
Saipan			
Agricultural Homestead	0.07	0.00	0.0%
Civic Uses	0.04	0.00	0.5%
Homestead Village	0.10	0.02	19.3%
Recreation	0.36	0.01	2.7%
Renewable Energy	0.24	0.00	0.6%
School Relocation	0.11	0.01	6.5%
Saipan Total	**0.91**	**0.04**	**4.1%**
Tinian			
Agricultural Homestead	1.57	0.28	17.6%
Homestead Village	2.92	0.17	5.8%
Tinian Total	**4.48**	**0.44**	**9.9%**
Rota			
Civic Uses	0.14	0.02	13.7%
Cultural Visitor Center	0.01	0.00	6.9%
Homestead Village	2.62	0.40	15.2%
Power Plant	0.03	0.00	0.0%
Renewable Energy	0.10	0.01	14.6%
Rota Total	**2.90**	**0.43**	**14.9%**

Projected Changes in Population

The total population of the Commonwealth is expected to remain similar through the end of the century. However, the number of older adults is expected to increase proportionally. Older adults, especially those with existing respiratory issues, are likely to be more vulnerable to smoke and ash from wildfire. Also, older adults are often less mobile and may lack transportation resources in the event of a wildfire evacuation.

4.8.3 Mitigation Success

Over the past 5 years, the threats and cascading effects of wildfire in the Commonwealth have been researched and published (Bubb & Williams, 2022; Frager et al., 2020; Trauernicht et al., 2024). A key area of progress was determining spatial and temporal patterns of wildfire on Saipan, Tinian, and Rota. Bubb and Williams (2022) developed a process to map fire vulnerability and determined that wildfires occur most often in grasslands and during the dry season. Fire vulnerability maps are now available online via a web map hosted by the Bureau of Environmental and Coastal Quality (BECQ-DCRM, 2020). These maps can inform stakeholders on potential development risks, emergency response planning, and environmental planning and research (Figure 4.8-7). The maps will also aid in developing conservation action plans and to help BECQ, the Department of Land and Natural Resources, and the Department of Fire and Emergency Medical Services manage and respond to wildfires.

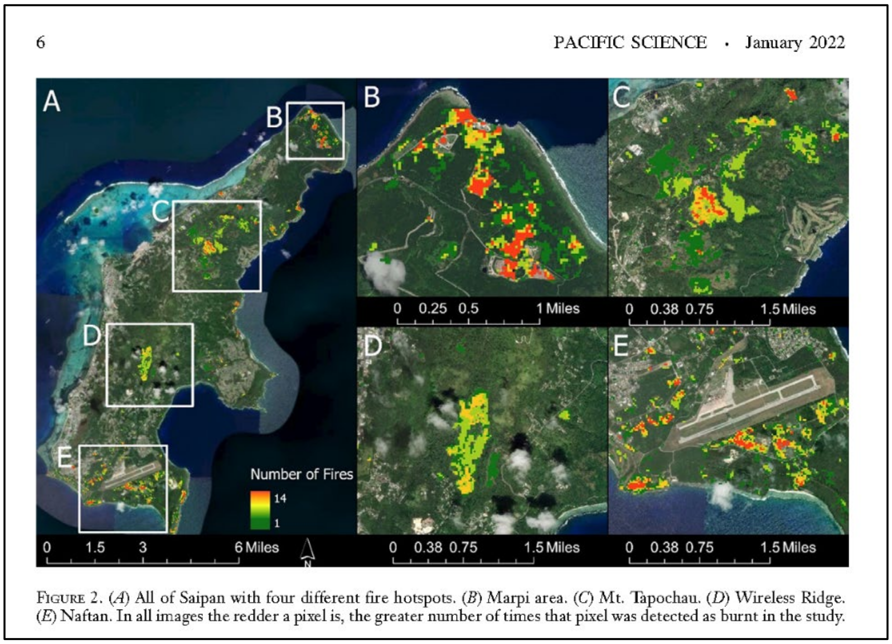


Figure 4.8-12. Excerpt from Bubb and Williams (2022) showing wildfire hotspots on Saipan that were used to model wildfire probability.

4.8.4 Opportunities to Improve the Requirements for the Fire Management Assistance Grants

FEMA provided recommendations for improvement of the SHMP (see Appendix G). Many of these recommendations were incorporated in the 2024 SHMP Update. To improve the requirements for the Fire Management Assistance Grants, the following recommendations will be incorporated in the 2029 SHMP Update:

- Consider expanding on the data in Table 4.8-2. The narrative prior to the table states that the territory has limited capability to respond to wildfires. However, it is not clear if this is related to technical equipment or staffing and/or if it is limited to a specific island. Identifying limitations and gaps in the CNMI can also lead to potential mitigation actions for the territory to implement.
- Consider including additional actions that are unique to reducing the vulnerabilities of the territory related to wildfire impacts. For example, pull in the forest restoration actions referenced Action 2024-6-15.

References

Ammann, H., Blaisdell, R., Lipsett, M., Lyon Stone, S., & Therriault, S. (2021). *Wildfire Smoke, A guide for public health officials* (EPA-452/R-21-901; p. 88). US Environmental Protection Agency.

Bickel, A. (2012). *Talakhaya/Sabana Conservation Action Plan* (p. 74). Bureau of Environmental and Coastal Quality, Division of Environmental Quality.

Bubb, I. E., & Williams, Z. B. (2022). Spatial and Temporal Patterns of Fire on Saipan, CNMI. *Pacific Science*, *76*(1). https://doi.org/10.2984/76.1.1

[DEQ] CNMI Division of Environmental Quality. (2013). *Garapan watershed Conservation Action Plan* (p. 40). CNMI Office of the Governor, Division of Environmental Quality.

CNMI Wildfires 2016–2022. (n.d.). Retrieved April 4, 2024, from https://crrf.maps.arcgis.com/apps/webappviewer/index.html?id=5e59ab808510428a9e3adbbc5aeabf41

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[FEMA] Federal Emergency Management Agency. (n.d.). *Wildfire | Alerts and Warnings*. Preparedness Community. Retrieved April 4, 2024, from https://community.fema.gov/ProtectiveActions/s/article/Wildfire-Alerts-and-Warnings

Frager, R., Reeves, M. K., Amidon, F., Pe‘a, R., Miller, S. E., Brunson, C., Flores, J., & Galsim, F. (2020). Savannas of the Mariana Islands Archipelago. In *Encyclopedia of the World's Biomes* (pp. 948–970). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.11986-4

Gingerich, S. B., Adams, A. G., Rosa, S. N., Marineau, M. D., Wright, S. A., Hay, L. E., Windlasky, M. J., Jenson, J. W., Wong, C. I., Banner, J. L., Keener, V. W., & Finucane, M. L. (2019). *Water Resources on Guam-Potential Impacts of and Adaptive Response to Climate Change* (Scientific Investigations Report 2019–5095; Scientific Investigations Report). US Geological Survey.

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Guerrero, V. C. D. Jr. (2014). *Draft Commonwealth of the Northern Mariana Islands State Wildland Fire Plan 2014-2024* (p. 38). Department of Land and Natural Resources.

Herrmann, K., & Gombos, M. (2009). *Laolao Bay Conservation Action Plan, Draft* (p. 45). CNMI Office of the Governor, Division Environmental Quality, Coastal Resources Management Office, and Division of Fish and Wildlife.

Mycoo, M., Wairiu, M., Campbell, D., Duvat, D., Golbuu, Y., Maharaj, S., Nalau, J., Nunn, P., Pinnegar, J., & Warrick, O. (2022). *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009325844

National Park Service. (2017). *Wildland Fire Behavior*. https://www.nps.gov/articles/wildland-fire-behavior.htm

National Park Service. (2021). *Cultural Resource Data for Fire Management*. NPS Archaeology Guide: Cultural Resources and Fire. https://www.nps.gov/articles/cultural-resource-data-for-fire-management.htm

National Park Service. (2023). *Wildland Fire Facts: There Must Be All Three*. https://www.nps.gov/articles/wildlandfire-facts-fuel-heat-oxygen.htm

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

Pacific Fire Exchange. (2024). *Guam and the Northern Mariana Islands*. https://pacificfireexchange.org/region/guam-and-the-northern-mariana-islands/

Trauernicht, C., Frazier, A. G., Dendy, J., Bubb, I., Camacho-Fejeran, C., Friday, J. B., King, R., Manglona, J., Ruegorong, F., Singeo, A., Giardina, C. P., & Cordell, S. (2024). How people, rainfall and vegetation shape tropical island fire regimes across Micronesia. *Journal of Biogeography*, *51*(3), 422–438. https://doi.org/10.1111/jbi.14763

Trauernicht, C., Pickett, E., Giardina, C. P., Litton, C. M., Cordell, S., & Beavers, A. (2015). The Contemporary Scale and Context of Wildfire in Hawai'i 1. *Pacific Science*, *69*(4), 427–444.

[USGCRP] US Global Change Research Program. (2023). *Fifth National Climate Assessment*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023

Zhang, C., Wang, Y., Hamilton, K., & Lauer, A. (2016). Dynamical Downscaling of the Climate for the Hawaiian Islands. Part I: Present Day. *Journal of Climate*, *29*(8), 3027–3048. https://doi.org/10.1175/JCLI-D-15-0432.1

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Chapter 4.0

Section 4.9 Earthquake

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.9 Earthquake

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Earthquake	Occasional	Extensive	Significant	Low

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

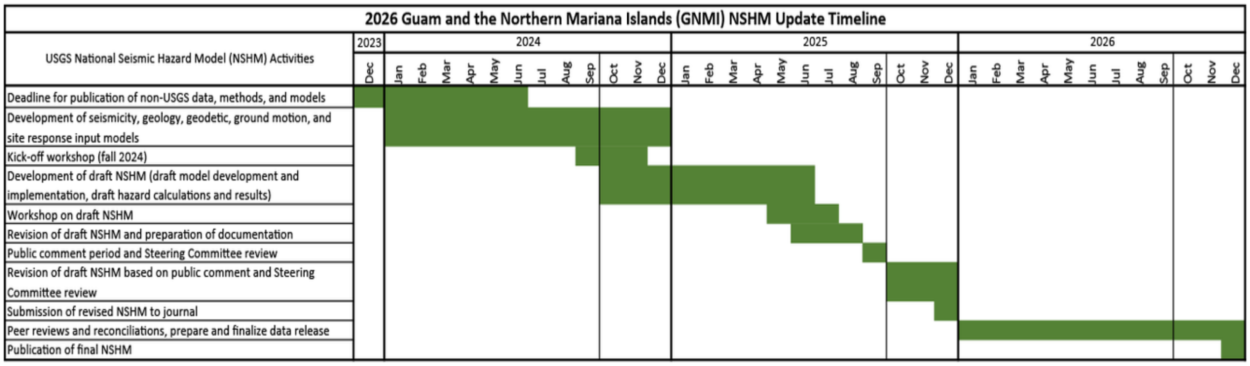
- For the 2024 State Hazard Mitigation Plan (SHMP) Update, earthquake activity from 2013 through 2023 for the Commonwealth of the Northern Mariana Islands (CNMI) region from the US Geological Survey, Earthquake Hazards Program was incorporated.
- New and updated figures and information from federal agencies were incorporated.
- The hazard profile is now combined with the vulnerability assessment and loss evaluations into a single section.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of general assets, general buildings, vulnerable populations, and natural and cultural resources to seismic activity is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth.
- A mitigation success achieved since 2018 was included in the final plan to demonstrate progress toward lowering the vulnerability of the Commonwealth to earthquakes.

4.9.1 Hazard Profile

Description

The Mariana Islands are situated in a tectonically active region characterized by the northwestward subduction and under thrusting of the Pacific Plate beneath the Mariana plate along the Mariana Trench, and the eastward spreading of oceanic crust from the Mariana Trough (Figure 4.9-1). Although no great earthquake has yet been associated with the Mariana plate, the megathrust interface west of the trench may be capable of a sizable event (Figure 4.9-2) (Muller et al., 2012).

The USGS is preparing to update the seismic hazard information for the Commonwealth. The updated process began in 2023 and will take about 2 years to complete. A public kick-off workshop will be held in the fall of 2024.



Source: USGS (2023), https://www.usgs.gov/media/images/gnmiupdateschedulepng.

Seismic hazards are those related to ground shaking. Landslides, ground cracks, rockfalls, tsunami are all seismic hazards. Generally, hazard definitions of earthquakes are equated to damage to structures and their contents. Earthquakes are generally measured in terms of magnitude and intensity.

Earthquake Mechanics

As with oceanic-continental convergence processes, when two oceanic plates converge, one is usually subducted under the other and in the process a trench is formed. The Mariana Trench (paralleling the Mariana Islands), for example, marks the edge where the fast-moving Pacific Plate converges against the slower moving Philippine Plate. The Challenger Deep, at the southern end of the Mariana Trench, plunges deeper into the Earth's interior (nearly

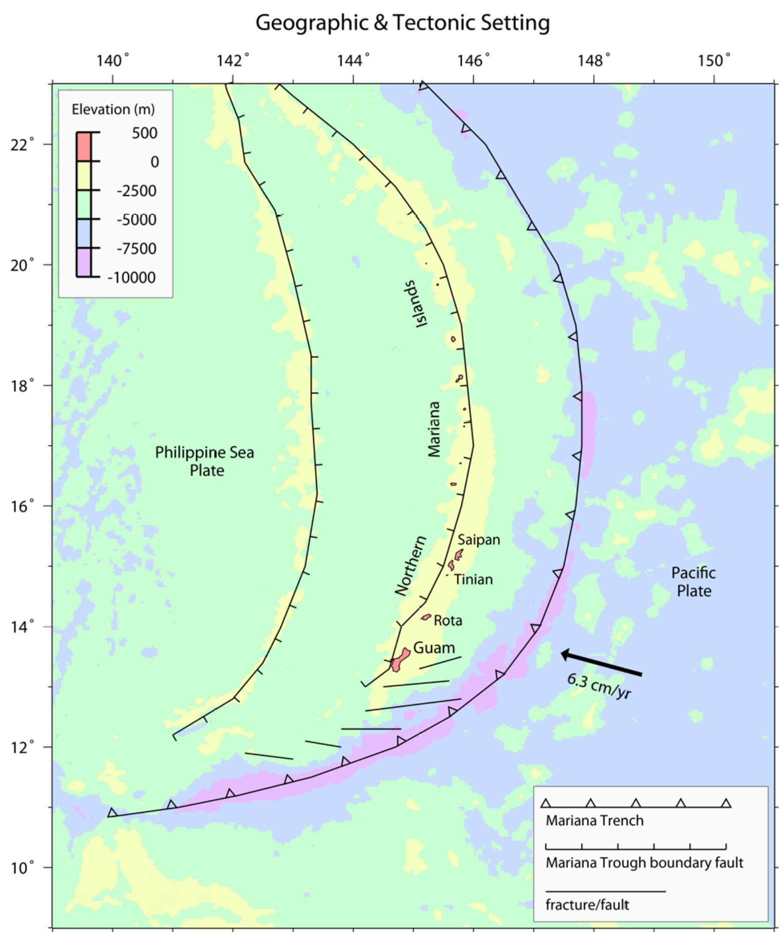


Figure 4.9-1. Geographic and tectonic region of the CNMI.
Source: Mueller et al. (2012).

36,089 ft) than Mount Everest, the world's tallest mountain that rises above sea level (about 29,048 ft).

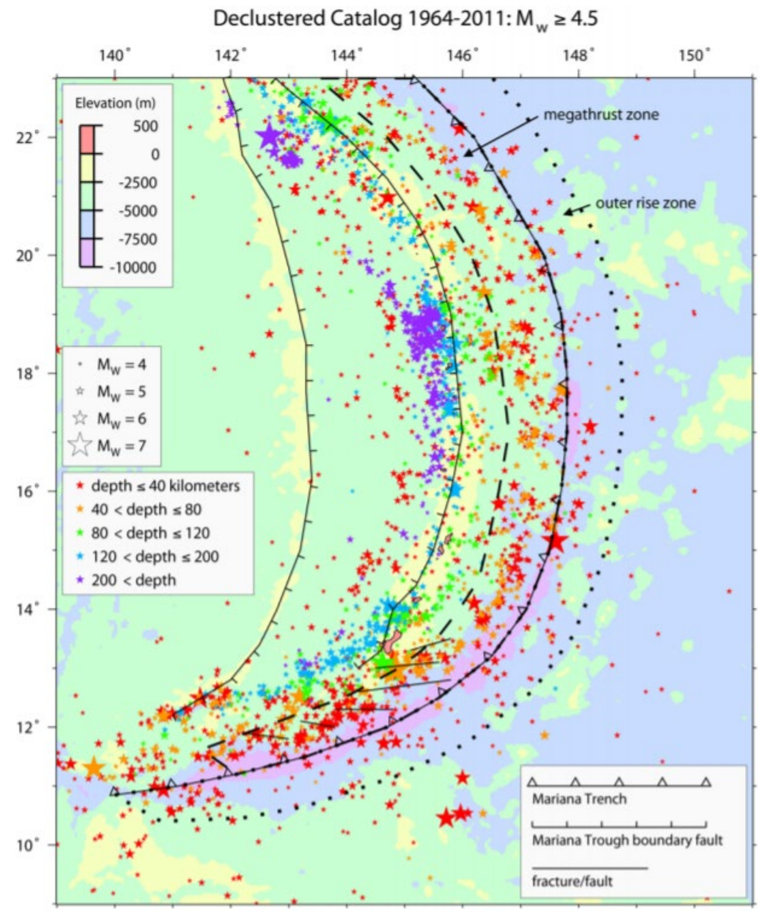


Figure 4.9-2. Seismicity catalog earthquakes 1964-2011 with moment magnitude (M_W) ≥ 4.5.
Source: Mueller et al. (2012).

Subduction processes in oceanic plate convergence also result in the formation of volcanoes. Over millions of years, the erupted lava and volcanic debris pile up on the ocean floor until a submarine volcano rises above sea level to form an island volcano. Such volcanoes are typically strung out in chains called island arcs. As the name implies, volcanic island arcs, which closely parallel the trenches, are generally curved. The trenches are the key to understanding how island arcs such as the Mariana and the Aleutian Islands have formed and why they experience numerous strong earthquakes. Magma that forms island arcs is produced by the partial melting of the descending plate and/or the overlying oceanic lithosphere. The descending plate also provides a source of stress as the two plates interact, leading to frequent moderate to strong earthquakes. Seismic activity also results as magma moves through volcanic conduits and the number of seismic events and earthquakes increase when volcanic activity is high.

Engineers, seismologists, architects, and planners have carefully evaluated seismic hazards related to building construction, devising a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The shaking is quantified in terms of earth's gravitational acceleration. The results are included in the International Codes (I-codes, inclusive of the International Building Code [IBC] and the International Residence code [IRC]) seismic provisions. In the 2018 I-codes, the seismic hazard for the CNMI was classed as Very High (Zone E) and the Federal Emergency Management Agency (FEMA) considered the total population of Commonwealth exposed to seismic risks (FEMA, 2020). FEMA has recently updated seismic design categories for buildings and residences to align with the 2024 update to the International Building Code as shown in Figure 4.9-3 (FEMA, 2023). Building designs in the I-Codes are based on the peak ground acceleration (PGA) caused by a seismic event compared to ground acceleration caused by gravity. Building codes prescribe how much horizontal force buildings should be able to withstand during an earthquake. Therefore, PGA is used to estimate vulnerability of the built environment to seismic hazards for the 2024 SHMP Update. According to the US Geological Survey (USGS) Earthquakes Hazard Program, the probabilistic ground motion measurement of PGA for the CNMI region, in % gravity, is 39.8 with a 10% probability of exceedance in 50 years. See information below for earthquake severity for more information about PGA.

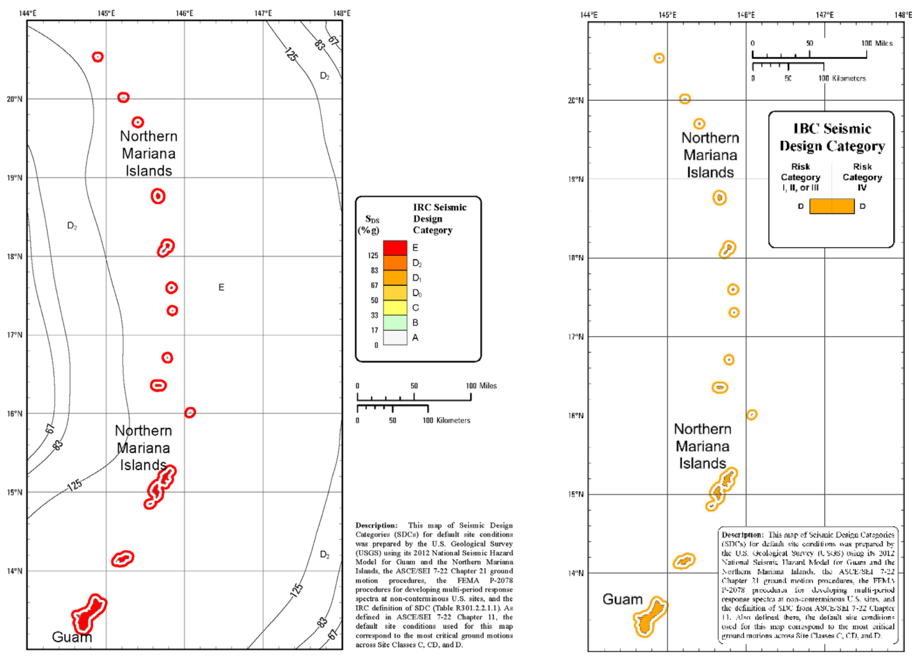


Figure 4.9-3. Seismic design categories for CNMI based on the International Residential and Building codes.
Source: FEMA (2023).

To help reduce the potentially devastating effects of earthquakes nationwide, the US Congress authorized the National Earthquake Hazards Reduction Program (NERPH) in 1977 (Public Law 95-124). NERPH was most recently authorized in 2018 (Public Law 115-307). The NERPH is a collaborative effort between four federal agencies to improve the understanding of earthquake hazards and risks and to reduce the nation's vulnerability to earthquakes. The four federal agencies are:

- Federal Emergency Management Agency (FEMA)
- National Institute of Standards and Technology (the lead agency for NERPH)
- National Science Foundation
- US Geological Survey

The NERPH provides information and tools to help evaluate earthquake hazards and to reduce risks.

Location

Earthquakes can occur anywhere within the tectonic region of the Marianas (Figure 4.9-1) along the subduction zone of the Mariana Trench. Seismic activity in the Mariana Region is available near-real time on the USGS Earthquake Hazards Program, Earthquake web page (https://www.usgs.gov/programs/earthquake-hazards/earthquakes).

Seismic activity is also associated with volcanic activity. The USGS monitors seismic activity at Anathan Island and has previously monitored seismic activity on Pagan Island. About 56% of the earthquakes < 5.0 magnitude reported by USGS occurred in the Northern Mariana Islands (see earthquake list in Appendix C [Hazard Profile Supplement]). Seismic activity related to volcanic activity is available from the USGS in near-real time on the USGS Volcanic Hazards, Alaska Volcano Observatory website (https://www.usgs.gov/observatories/avo).

According to the USGS, one problem in assigning seismic hazard zones within the CNMI is that the ground shaking during a strong earthquake may vary within a small area. This variation is due to the nature of the underlying ground; for example, whether it is mainly lava bedrock or soil. Two homes in the same neighborhood may suffer different degrees of damage depending on the ground where the properties were built. In addition, local topography strongly affects earthquake hazards. Steep slopes composed of loose material may produce large landslides during an earthquake. The risk from living in a seismically active area depends to a large degree on the type of construction used in each home. Earthquake shaking may damage certain types of houses, while leaving other types of construction unscathed. For all these reasons, earthquake hazards are highly localized, and it is difficult to define broad zones with the same relative degree of hazard.

Fault line information is available for Saipan only. Although this information is available, the correlation to these fault lines and increased earthquake risk is not sufficiently developed for use in the 2024 SHMP Update.

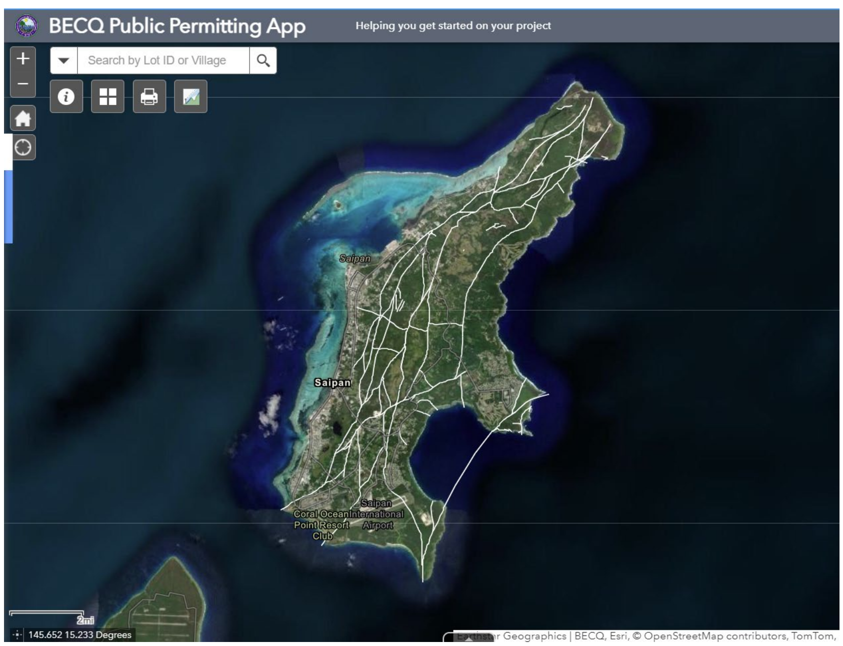


Figure 4.9-4. Fault lines on Saipan

Extent

The severity of an earthquake is classified by its magnitude and intensity. An earthquake has a single magnitude, the intensity of the shaking it causes has many values that can vary from place to place.

Magnitude

Earthquake magnitudes scales measure the size of an earthquake at its source and an earthquake has only one magnitude. Earthquake magnitudes are often reported using the Richter scale. However, the seismological authorities use the moment scale to measure earthquake magnitudes (Figure 4.9-6). The moment magnitude (M_w) scale is more accurate for measuring large earthquake events and has mostly replaced the Richter Scale (USGS, 2020). Muller et al. (2012) report historic earthquake information and seismic hazards using the moment magnitude scale (M_w). Magnitude reported below are in the M_w scale unless otherwise noted.

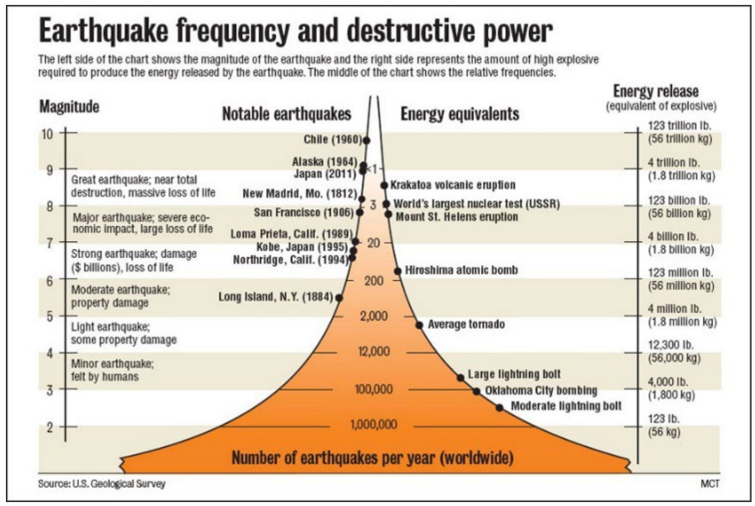


Figure 4.9-5. Moment magnitude scale for earthquakes

Intensity

As the waves from an earthquake radiate out from the event epicenter, different shaking intensities can be felt across the affected geographic region. The intensity of an earthquake is a measure of shaking at each location (USGS, n.d.). Intensity is mostly influenced by distance from the epicenter but also depends on the direction of earthquake rupture and the type of surface geology directly below a specific location. The USGS uses the modified Mercalli (MMI) scale to report earthquake intensities. The MMI scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII. Figure 4.9-7 summarizes earthquake intensity as expressed by the MMI scale and lists damage potential and perceived shaking by PGA factors, compared to the MMI scale.

Severity

Earthquake severity is often described as the acceleration of the event compared to the acceleration due to gravity. PGA measures the rate of change in motion to the earth's surface and is expressed as a percent of the established rate of acceleration due to gravity (~32 ft per second squared [ft/sec^2]). PGA is expressed as a percent acceleration force of gravity (%g). For example, 100%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. Ten percent PGA means that the ground acceleration is 10% that of gravity.

According to USGS Earthquake Hazards Program, PGA maps (also known as earthquake hazard maps) are used as planning tools when designing buildings, bridges, highways, and utilities so that they can withstand shaking associated with earthquake events. These maps are also used as planning tools for the development of building codes that establish construction requirements appropriate to preserve public safety. Figure 4.9-6 shows contours of PGA for all modeled sources for exceedance probabilities of 10% in 50 years. As mentioned previously, the USGS is in the process of updating the seismic hazard maps for the CNMI.

Warning Time

Under the Disaster Relief Act of 1974, the USGS has the federal responsibility to issue alerts for earthquakes, enhance public safety, and reduce losses through effective forecasts and warnings. Currently, there is no reliable way to predict the day or month that an earthquake will occur at a given location. However, advanced warning systems are currently a reality, following an earthquake, the USGS issues rapid, automatic notices via the internet, which provides information on the magnitude, intensity, and severity of the earthquake (USGS, n.d.).

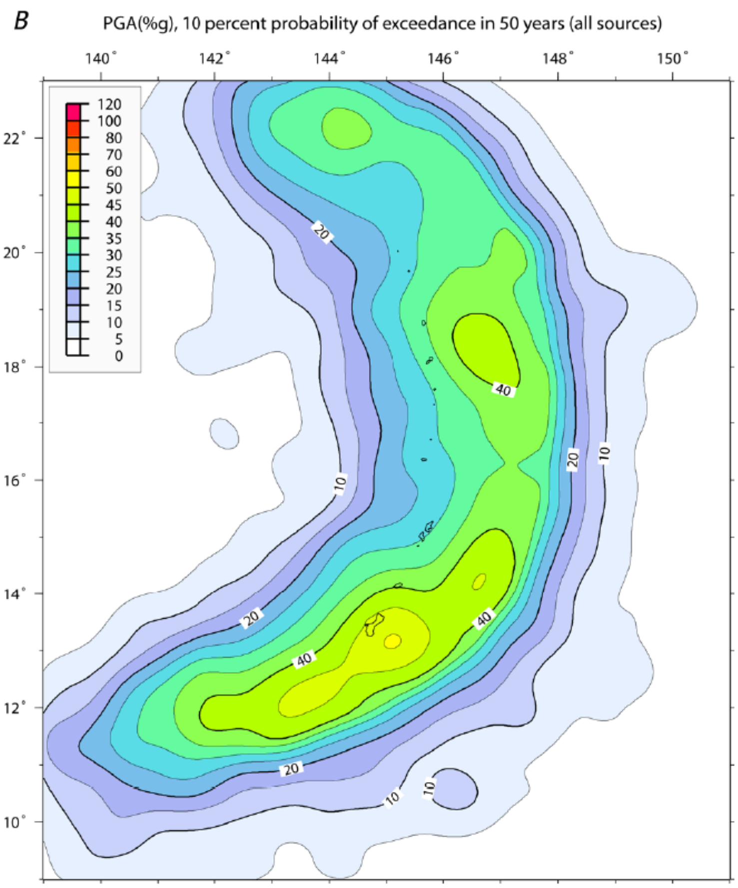


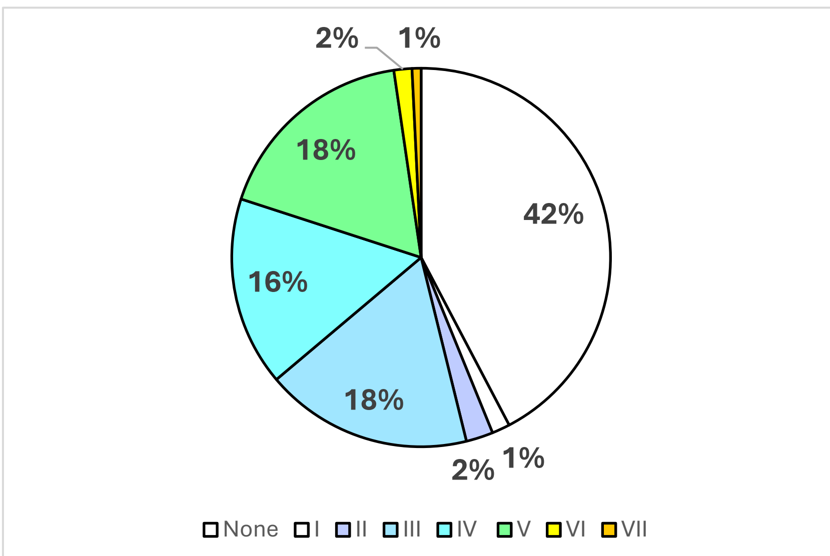
Figure 4.9-6. Probabilistic peak ground acceleration for all modeled sources for exceedance probabilities of 10 percent in 50 years.
Source: Mueller et al., 2012

Previous Occurrences

The earthquake history tables provided in the 2018 Standard State Mitigation Plan (SSMP) Appendix L were updated. New tables provide earthquake history for all earthquakes > 5.0 magnitude that occurred from January 2013 through January 2024 for the general CNMI region and the region around the main islands of Saipan, Tinian, and Rota

(Appendix C [Hazard Profile Supplement]). During this 10-year period there were 197 earthquakes in the general CNMI region, which includes the Northern Islands. Of these earthquakes, 26 occurred within the region of Saipan, Tinian, and Rota.

The earthquake history of Saipan since 1800 includes two major events, one in 1849 and the other in 1902, (actual magnitudes are not known). In April 1990, an underwater earthquake measuring 7.5 on the Richter Scale was recorded as occurring 225 miles east of Saipan. This caused a small tsunami which did not exceed 9.4 inches. From January 2013 through January 2024, 197 earthquakes > 5.0 magnitude have occurred in the CNMI region (Appendix C [Hazard Profile Supplement]). Fifty-five of the earthquakes exceeded 5.4 magnitude and received a ShakeMap rating from USGS (Figure 4.9-7). Most of these events were categorized as weak to light shaking with no potential for damage. However, 6 of the 55 quakes exceeded 6.0 magnitude and were categorized from moderate to very strong shaking with very light to moderate potential for damage (see Figure 4.9-7). These quakes also triggered tsunami watches. However, recent earthquakes in the Commonwealth have not caused significant damage to the built environment and there has never been a major disaster declaration in the Commonwealth for an earthquake.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	***<0.02***	***0.1***	***1.4***	***4.7***	***9.6***	***20***	***41***	***86***	***>178***
INSTRUMENTAL INTENSITY	**I**	**II–III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X+**

Scale based upon Worden et al. (2012)

Figure 4.9-7. Earthquakes in the CNMI region from January 2013 through January 2024 exceeding 5.0 magnitude and assigned a USGS ShakeMap earthquake intensity category.

Probability of Future Occurrence

The epicenters of most earthquakes are located on the Pacific Ocean floor and intensities generally diminish before reaching the Mariana Islands. In 2012, Mueller et al. (2012) developed seismic hazards maps and risk curves for Saipan, Tinian, and Rota (Figure 4.9-6). USGS estimates there is a 10% chance of exceeding a PGA value of 0.398 in a 50-year period.

Muller et al. (2012) also provided data regarding earthquake rates outside the megathrust zone by magnitude for shallow earthquakes (≤ 25 miles deep). The estimated recurrence for shallow ground-shake seismic events (≤ 25 miles) was interpolated from the graph provided in Figure 4B in Muller et al. (2012) and reproduced in Table 4.9-1.

Table 4.9-1. Estimated earthquake recurrence for various shallow earthquake (≤ 25 miles) magnitudes outside the megathrust zone.

Magnitude (M_w)	Estimated Recurrence
4–5	35 per year
5–6	~1 every 2–5 years
6-7	~1 every 5–25 years
7-8	~1 every 25-100 years

Source: Muller et al. (2012, Figure 4*B*)

Climate Change Considerations

Because earthquakes are a geological hazard, climate change will not influence the magnitude and severity of future earthquake events.

4.9.2 Vulnerability Assessment

The USGS developed probabilistic earthquake data for the Commonwealth in 2012 and is currently in the process of updating the information and hazard maps. The earthquake hazard for a 10% chance of exceedance in a 50-year period (the expected design life for a building) was used for the exposure analysis. The 10% probability of exceedance in 50 years equates to a 475-year return period and is the most common standard used for assessing seismic risk (Gould, 2003). Currently, tools to model earthquake damage in the CNMI are not readily available. Also, information about building design and construction materials is still under development and was largely unavailable for this analysis. Therefore, all buildings were assumed to be vulnerable to earthquake hazards and the PGA value of 0.398 was used to assess exposure and potential losses.

For the 2024 SHMP Update, a generalized approach was used to estimate replacement costs values (building and contents) for buildings. USGS estimates there is a 10% chance of exceeding a PGA value of 0.398 in a 50-year period. A building damage ratio was developed from Hazus calculations that derive estimates for percentage damage ratios based upon a relationship between building types to PGA values. For a PGA value of 0.398 the estimated building damage ratio is 24%. The replacement costs for building contents were either derived from Hazus 6.0 information provided by FEMA or, where Hazus information was not available for a structure, the content replacement cost was assumed to be 50% of the structure value. The total replacement costs provided below combine building and content replacement costs.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the vulnerability of exposed Commonwealth buildings, roads, and community lifelines and critical facilities to the earthquake hazard.

Commonwealth Buildings

The total replacement cost value for Commonwealth buildings on Saipan, Tinian, and Rota is an estimated $927 million; all of which are exposed to an earthquake event. Table 4.9-2 summarizes these values by municipality. The potential damage estimated to Commonwealth buildings from a 475-year probabilistic earthquake event with a 10% chance exceedance of 0.398 PGA in a 50-year period is $233 million. Saipan has the greatest estimated potential losses (17%) to Commonwealth buildings.

Table 4.9-2. Commonwealth buildings exposure and potential losses to a 475-year probabilistic earthquake event by municipality.

	Buildings Exposed		Estimated Potential Loss	
Municipality	No.	Total Replacement Cost Value (RCV)	Value	% of Total RCV
Saipan	246	$708,944,498	$170,146,680	17%
Tinian	83	$140,347,469	$33,683,393	3%
Rota	58	$123,032,676	$29,527,842	3%
Total	**387**	**$972,324,643**	**$233,357,914**	**24%**

Buildings operated by the Commonwealth Healthcare Corporation and the Public School System represent the largest proportion of the Commonwealth buildings and the estimated total replacement value costs for these two agencies combined is ~$97 million (10%) of the total Commonwealth building inventory (Table 4.9-3).

Table 4.9-3. Commonwealth buildings exposure and potential losses to 475-year probabilistic earthquake event by agency.

			Buildings Exposed			Estimated Potential Loss	
Agency	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	Total No. of Bldgs.	Total Replacement Cost Value	% of Total RCV	Value	% of Total RCV
Commonwealth Healthcare Corporation	14	$181,464,259	14	$199,653,476	21%	$47,916,834	5%
Commonwealth Legislature	1	$5,242,485	1	$5,242,485	1%	$1,258,196	0%
Commonwealth Utilities Corporation	63	$153,383,911	63	$108,877,902	11%	$26,130,696	3%
Council on Developmental Disabilities	1	$519,635	1	$519,635	0%	$124,712	0%
Dept. of Commerce	5	$3,421,968	5	$3,500,069	0%	$840,016	0%
Dept. of Community and Cultural Affairs	28	$24,015,434	28	$24,081,708	2%	$5,779,610	1%
Dept. of Finance	8	$7,915,060	8	$8,157,881	1%	$1,957,891	0%
Dept. of Fire and Emergency Services	14	$9,895,634	14	$9,158,634	1%	$2,198,072	0%
Dept. of Labor	8	$6,528,748	8	$6,349,685	1%	$1,523,924	0%
Dept. of Lands and Natural Resources	30	$95,816,661	30	$95,124,485	10%	$22,829,876	2%
Dept. of Public Lands	2	$1,118,710	2	$1,118,711	0%	$268,491	0%
Dept. of Public Safety	24	$25,124,204	24	$17,393,199	2%	$4,174,368	0%
Dept. of Public Works	11	$48,113,859	11	$54,791,931	6%	$13,150,063	1%
Judiciary	2	$5,165,804	2	$5,165,804	1%	$1,239,793	0%
Mariana Public Land Trust	1	$1,481,202	1	$1,481,202	0%	$355,488	0%
Marianas Visitors Authority	3	$531,864	3	$681,600	0%	$163,584	0%
Mayor's Offices	17	$17,954,221	17	$21,373,776	2%	$5,129,706	1%
Northern Marianas College	1	$7,810,000	1	$4,260,000	0%	$1,022,400	0%
Office the Attorney General	4	$2,442,400	4	$1,917,000	0%	$460,080	0%
Office of the Governor	15	$18,726,151	15	$18,726,150	2%	$4,494,276	0%
Office of Homeland Security & Emergency Management	10	$10,280,100	10	$10,422,101	1%	$2,501,304	0%

Table 4.9-3. Commonwealth buildings exposure and potential losses to 475-year probabilistic earthquake event by agency (*cont'd*).

Agency	Total No. of Bldgs.	Total Replacement Cost Value (RCV)	Buildings Exposed			Estimated Potential Loss	
			Total No. of Bldgs.	Total Replacement Cost Value	% of Total RCV	Value	% of Total RCV
Office of the Public Auditor	3	$2,064,533	3	$2,064,533	0%	$495,488	0%
Ports Authority	44	$134,249,711	44	$104,533,404	11%	$25,088,017	3%
Private Entity	6	$11,031,784	6	$11,031,783	1%	$2,647,628	0%
Public Library	2	$5,529,788	2	$5,529,789	1%	$1,327,149	0%
Public School System	55	$178,506,127	55	$201,909,450	21%	$48,458,268	5%
Women's Association	1	$1,481,202	1	$1,481,202	0%	$355,488	0%
Other	14	$12,509,189	14	$13,644,338	1%	$3,274,641	0%
Total	**387**	**$972,324,643**	**387**	**$938,191,928**	**96%**	**$225,166,063**	**23%**

Northern Islands Commonwealth Facilities

In the Northern Islands, public facilities and typhoon shelters were rebuilt on Agrihan, Alamagan, and Pagan after being damaged by Super Typhoon *Yutu.* All facilities in the Northern Islands are considered exposed and vulnerable to earthquakes. The estimated replacement cost value for the facilities on the three islands is ~$1.8 million (Table 4.9-4). However, this estimate does not account for the added costs to construct facilities in the Northern Islands due to the extreme isolation and logistical challenges of transporting construction materials and equipment and the lack of port facilities.

Table 4.9-4. Commonwealth buildings vulnerable to volcanic activity and potential losses.

Northern Islands	Total No. of Bldgs.	% of Total Bldgs.	Total Replacement Costs Value (RCV)	% of Total RCV
Agrihan	9	39%	$774,222	21%
Alamagan	5	22%	$288,394	23%
Pagan	9	39%	$702,307	56%
Total	**23**		**$1,764,923**	

Commonwealth Roads

All roads are assumed exposed to earthquake hazards. The seismic hazard for different soil layers is lacking for the Commonwealth so a more-refined analysis of the highway network is not achievable for the 2024 SHMP Update. The road network does not include large bridges or overpasses that may be at higher risk to seismic activity. The disruption to the road network is assumed to be minimal from seismic activity and losses are assumed to be minimal.

Community Lifelines and Critical Facilities

All critical facilities and community lifelines are assumed to be exposed to the earthquake hazard. As demonstrated in Table 4.9-2 and Table 4.9-5, the potential damage to critical facilities and community lifelines from an earthquake event with a 10% chance exceedance of 0.398 PGA in a 50-year period is ~$150 million. Saipan has the greatest estimated potential losses (17%) to critical facilities and community lifelines.

Table 4.9-5. Commonwealth community lifeline and critical facility exposure to 475-year probabilistic earthquake event by municipality.

		Community Lifelines Exposed								
Municipality	**Total No. of CLF**	**Communications**	**Energy**	**Food, Water, Shelter**	**Hazardous Materials**	**Health and Medical**	**Safety & Security**	**Transportation**	**Water Systems**	**Total No. CLF Exposed**
Saipan	138	2	29	18	6	16	21	18	28	138
Tinian	56	0	9	2	2	1	3	20	19	56
Rota	43	2	8	4	1	2	11	10	5	43
Total	**237**	**4**	**46**	**24**	**9**	**19**	**35**	**48**	**52**	**237**

Critical facilities associated with energy and healthcare lifelines represent the largest proportion of the Commonwealth inventory. Estimated losses for these two lifeline categories combined represent ~14% of the total replacement cost value for all critical facilities.

Table 4.9-6. Commonwealth community lifeline and critical facility exposure and potential losses to 475-year probabilistic earthquake event by lifeline category.

			Community Lifelines Exposed		Estimated Potential Loss	
Category	Total No. of CLF	Total Replacement Cost Value (RCV)	Total No. of CLF	Total Replacement Cost Value (RCV)	Value	% of Total RCV
Communications	4	$864,517	4	$864,517	$207,484	0%
Energy	46	$140,851,551	46	$140,851,551	$33,804,372	6%
Food, Water, Shelter	24	$37,356,099	24	$37,356,099	$8,965,464	2%
Hazardous Material	9	$48,091,161	9	$48,091,161	$11,541,879	2%
Health and Medical	19	$187,643,812	19	$187,644,079	$45,034,579	8%
Safety and Security	35	$38,639,592	35	$38,639,592	$9,273,502	2%
Transportation	48	$119,925,667	48	$119,925,667	$28,782,160	5%
Water Systems	52	$50,052,062	52	$50,052,062	$12,012,495	2%
Total	**237**	**$623,424,461**	**237**	**$623,424,728**	**$149,621,935**	**26%**

Fires may also follow earthquakes, often occurring in developed areas. They may be caused by broken power lines or leaking combustibles that find a source of ignition. Response may be affected due to losses incurred to critical facilities and services, including communication service, isolated or damaged equipment, water supply access and other competing emergency demands on available facilities and resources.

Northern Islands Commonwealth Facilities

In the Northern Islands, all Commonwealth owned and operated buildings on Agrihan, Alamagan, and Pagan are considered critical facilities that provide essential community lifelines for island residents. In addition to facilities, the drinking water supply for residents is stored in concrete water tanks on Agrihan, Alamagan, and Pagan. Water tank capacity is 10,000 gallons on Agrihan and Alamagan and 20,000 gallons on Pagan. Earthquakes could damage critical facilities and disrupt their essential lifeline functions to provide communications via radio towers and equipment, healthcare dispensaries, shelter, and drinking water supply. The total estimated value of the critical facilities and community lifelines in the Northern Islands is estimated to be ~$1.8 million.

General Asset Vulnerability Assessment and Potential Losses

This section provides a summary of vulnerability and potential losses to general building stock, socially vulnerable and total populations, and natural and cultural resources.

General Building Stock

The total replacement cost value of general building stock is an estimated $6.9 billion, all of which are exposed to an earthquake event. Table 4.9-7 summarizes these values by municipality. The potential damage estimated to general building stock as a result of an earthquake with a 10% chance exceedance of 0.398 PGA in 50-years is ~$1.7 billion. Saipan has the greatest number of buildings and may experience the greatest damage (~1.5 billion or 21% of the total Commonwealth general building stock inventory replacement cost).

Table 4.9-7. General building stock exposure and potential losses to 475-year probabilistic earthquake event by municipality.

Municipality	Total No. of Bldgs.	Total Replacement Costs Value (RCV)	Buildings Exposed: No. of Bldgs.	Buildings Exposed: Replacement Cost Value (RCV)	Potential Loss: Value	Potential Loss: % of Total RCV
Saipan	12,761	$6,179,343,275	12,761	$6,179,343,275	$1,483,042,386	21%
Tinian	908	$399,885,058	98	$399,885,058	$95,972,414	1%
Rota	1,261	$343,861,559	1,261	$343,861,559	$82,526,774	1%
Total	**14,930**	**$6,923,089,892**	**14,120**	**$6,923,089,892**	**$1,661,541,574**	**24%**

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5-year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.
Earthquakes have the potential to generate large amounts of debris. Debris management is challenging in the Commonwealth due to its location and isolation. With limited landfill capacity, the ability to forecast the generation of debris from an earthquake would help improve planning for processing large amounts of debris at the landfill. The FEMA Hazus earthquake model can estimate the volume of debris that may be generated from a specified earthquake scenario. It is strongly recommended to continue developing information for the CNMI in the Hazus tool so the Commonwealth can benefit from this critical resource.

Socially Vulnerable and Total populations

The risk from earthquakes is similar within and across all the Mariana Islands; therefore, the entire population is considered exposed to earthquake hazards. However, the degree of exposure may depend on several factors, including the age and type of construction of residences and the intensity of the earthquake. Other indirect impacts from earthquakes to residents may include business closures and loss of function of critical facilities and utilities.

While the total population is considered exposed and potentially vulnerable, socially vulnerable populations include the very young, elderly, functionally challenged, and those experiencing poverty. These socially vulnerable populations are most susceptible based on many factors, including their physical and financial ability to react or respond during an earthquake and the ability to be self-sustaining for prolonged periods of time after an incident because of limited ability to stockpile supplies.

To estimate the number of socially vulnerable people to earthquake hazard, social vulnerability indices (SVI) developed for Saipan (Greene & Skeele, 2014), Tinian, and Rota (Dobson et al., 2020) were used in conjunction with the 2020 Census data. Based on detailed 2014 Census data, SVI classes were assigned to census tracts on Saipan, Tinian, and Rota. The 2014 SVI indices were not updated for the 2024 SHMP Update because census tract level data was not made available until mid-February 2024. Therefore, the 2014 SVI scores and 2020 total population numbers for a given census block were used to estimate the number of people by SVI class vulnerable to the hazard (see Section 4.1 Overview for details).

For Saipan, about 17,510 people (~41% of the island total population) were estimated in the highest two SVI classes (4 and 5) and are considered vulnerable to earthquake hazards. On Tinian and Rota, the entire population on these islands were in the lowest two SVI classes (1 and 2) (Table 4.9-8).

Table 4.9-8. Commonwealth population based on 2020 census data exposed to a 475-year probabilistic earthquake event by social vulnerability index and municipality.

Municipality	SVI Classes	Estimated Total Population 2020 Census	Proportion of Estimated Population Exposed	
			Total No. Residences	Total Estimated Population
Saipan	1	4,652	1,670	4,652
	2	6,476	1,832	6,476
	3	14,443	2,682	14,443
	4	11,654	2,191	11,654
	5	5,855	948	5,855
		61	52	61
Saipan Total		**43,141**	**9,375**	**43,141**
Tinian	1	571	249	571
	2	1,458	496	1,458
Tinian Total		**2,029**	**745**	**2,029**
Rota	1	749	409	749
	2	1,116	561	1,116
Rota Total		**1,865**	**992**	**1,865**

SVI=Social Vulnerability Index

The earthquake section of the CNMI Emergency Operations Plan is currently under development and estimates for shelter requirements for a 475-year probabilistic earthquake are not currently available for the CNMI.

Natural and Cultural Resources

Earthquakes can impact the environment directly and indirectly. Some impacts include landslides, soil failures, tsunami, damage to vegetation, and changes in water quantity and quality. Earthquakes can cause ground water levels to oscillate and sometimes water levels can be affected long-term. Water quality can also be affected if shaking dislodged sediment into wells. Power lines downed during an earthquake can ignite wildfires. Damage to hazardous materials storage facilities may cause accidental release of toxic substances into the environment and threaten the population as well as natural resources.

Cultural resources including historic buildings, monuments, structures, artifacts, and artwork are vulnerable to earthquakes. Cultural resources can be vulnerable due to their location and structure-specific characteristics such as construction materials, quality of construction, or architectural design (Stanton-Geddes & Soz, 2017). In the CNMI, historic Chamorro and Carolinian sites with stone architecture may be especially vulnerable to ground shaking. Fragile artifact collections held by museums are vulnerable to damage or destruction from an earthquake. Objects may be overturned or dropped to the ground during the event. Rock art sites may also sustain damage from earthquakes (Rockman et al., 2016). The loss of these resources is particularly difficult when a community looks to these tangible and intangible resources to reinforce their connection to their culture.

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate.
- Potential or projected development
- Projected changes in population

Climate Change

As stated above, climate change will not have an effect on the magnitude and severity of future earthquake events because earthquakes are a geological hazard and not influenced by climate change. With climate change, the frequency of weather-related hazards is increasing, but the frequency of geophysical hazards has not changed (Hoeppe, 2016).

Potential or Projected Development

All future development will be exposed to earthquake hazards similar to existing development. In 2019, the Commonwealth adopted the 2018 International Building Code (IBC) and International Residential Codes (IRC) by enacting Public Law No. 21-14, which repealed and re-enacted 2 CMC §7142 and §7145. Following Super Typhoon *Yutu* , FEMA (2021) made several recommendations to improve building codes, which will help to increase the resistance of future development to earthquake and other natural hazards. Recommendations include: 1) update CNMI Building Safety Code Rules and Regulations (Sec. 155.10.1-615) to remove the earthquake and typhoon amendments because they conflict with the adopted IBC and IRC and 2) adopt the latest International Codes on a recurring three-year basis. The seismic hazard for the CNMI is classed as Very High and the adopted 2018 I-Codes have stringent seismic standards for new construction. Therefore, future development will be constructed to standards that will reduce vulnerability to earthquakes.

Projected Changes in Population

As stated above, the entire population of the Commonwealth is considered exposed to high earthquake risk. All future changes in population are also expected to have a similar degree of exposure; however, the degree of exposure may depend on several factors, including the age and type of construction of residences and the intensity of the earthquake.
Future exposure of socially vulnerable populations to earthquakes is expected to change proportionally with changes in these populations. Socially vulnerable populations include the very young, elderly, functionally challenged, and those experiencing poverty. The proportion of adults over 65 years in the population is expected to increase through the year 2100 and will likely contribute to increased vulnerability of this demographic (United Nations, 2022). Factors that increase the vulnerability of these populations include their physical and financial ability to react or respond during a hazard and the ability to be self-sustaining for prolonged periods of time after an incident because of limited ability to stockpile supplies.

4.9.3 Mitigation Success

CNMI continues to regularly participate in *The Great CNMI ShakeOut* earthquake preparedness and response drill (Table 4.9-9). During this annual event hosted by the NEHRP, FEMA, Ready.gov, and the CNMI Office of Homeland Security and Emergency Services (HSEM), participants practice how to be safer during big earthquakes using the *Drop, Cover and Hold On* strategy. The annual drill is also a time for individuals, communities, and organizations to review emergency preparedness plans and supplies.


Marianas Variety News & Views
MICRONESIA'S LEADING NEWSPAPER SINCE 1972

Community participates in "The Great CNMI ShakeOut"

Variety News Staff Oct 15, 2020 Updated Dec 29, 2020 Comments

Figure 4.9-8. The *Marianas Variety* published an article to highlight community participation in the Great *CNMI ShakeOut* in 2020.

Photo Credit: Department of Public Lands

Table 4.9-9. *The Great CNMI ShakeOut* earthquake drill participation 2019–2023.

Year	No. Registered Participants
2019	10,500
2020	10,574
2021	12,785
2022	14,266+
2023	11,977

References

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

[FEMA] Federal Emergency Management Agency. (2020). *Seismic Building Code Provisions for New Buildings to Create Safer Communities* (p. 9) [FEMA Fact Sheet]. US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2021). *Codes, Standards, and Permitting: Mitigation Assessment Team Summary Report and Recommendations, Commonwealth of the Northern Mariana Islands, Super Typhoon Yutu* (p. 23). US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2023). *2020 NEHRP Recommended Seismic Provisions: Seismic Design Category Maps for 2024 International Residential Code (IRC) and International Building Code (IBC)* (p. 35). US Department of Homeland Security. https://sites.google.com/site/seismicdesignmaps/

Gould, N. (2003, July 1). *Understanding the Language of Seismic Risk Analysis*. https://www.irmi.com/articles/expert-commentary/understanding-the-language-of-seismic-risk-analysis

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Hoeppe, P. (2016). Trends in weather related disasters – Consequences for insurers and society. *Weather and Climate Extremes*, *11*, 70–79. https://doi.org/10.1016/j.wace.2015.10.002

Muller, C. S., Haller, K. M., Luco, N., Peterson, M. D., & Frankel, A. D. (2012). *Seismic Hazard Assessment for Guam and the Northern Mariana Islands* (Open-File Report, p. 56) [Open-File Report]. US Department of the Interior, US Geological Survey.

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

Stanton-Geddes, Z., & Soz, S. A. (2017). *Promoting Disaster Resilient Cultural Heritage*. Washington, DC: World Bank. https://doi.org/10.1596/28955

United Nations. (2022). *Probabilistic Population Projections based on the World Population Prospects 2020*. World Population Prospects 2022. https://population.un.og/wpp/

[USGS] US Geological Survey, US Department of Interior. (n.d.). *Earthquake Magnitude, Energy Release, and Shaking Intensity*. Earthquake Hazards Program. Retrieved April 12, 2024, from https://www.usgs.gov/programs/earthquake-hazards/earthquake-magnitude-energy-release-and-shaking-intensity

[USGS] US Geological Survey, US Department of Interior. (n.d.). *Earthquakes*. Earthquake Hazards Program. Retrieved April 12, 2024, from https://www.usgs.gov/programs/earthquake-hazards/earthquakes

[USGS] US Geological Survey, US Department of Interior. (2020). *How Big Was That Earthquake?* https://www.usgs.gov/observatories/yvo/news/how-big-was-earthquake

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.10 Volcanic Activity

28 July 2024

Table of Contents

List of Tables

List of Figures

4.0 Risk Assessment

4.10 Volcanic Activity

Hazard	Frequency	Spatial Extent	Severity	Overall Significance
Volcanic Activity	Likely	Limited	Negligible	Low

See table 4.1-1 for criteria definitions.

2024 State Hazard Mitigation Plan (SHMP) Update Changes

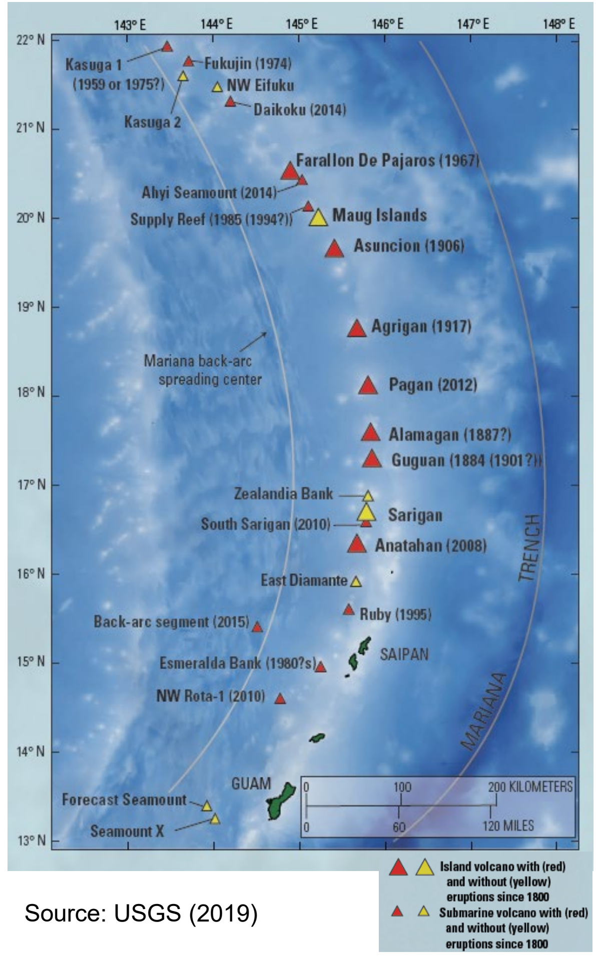
- For the 2024 State Hazard Mitigation Plan (SHMP) Update, volcanic activity from 2018 to the present was researched and incorporated.
- New and updated figures and information from federal agencies were incorporated.
- The volcanic hazard now considers the effects of volcanic gases and ash on community lifelines, vulnerable populations, the economy, and natural and cultural resources.
- Commonwealth owned and operated critical facilities are now organized and assessed by community lifelines.
- The vulnerability of Commonwealth assets, general buildings, vulnerable populations, and natural and cultural resources to the effects of volcanic activity is assessed and where data/information are available loss or impacts are evaluated or described.
- This section now includes a discussion about how future changes in development, demographics, and other factors such as climate change may impact the vulnerability of the Commonwealth to volcanic activity.
- A mitigation success achieved since 2018 was included in the final plan to demonstrate progress toward lowering the vulnerability of the Commonwealth to volcanic activity.

4.10.1 Hazard Profile

Description

The Mariana region is on the boundary of the Philippine Plate and the Pacific Plate and is one of the most active volcanic regions on Earth. Located in a tectonic subduction zone, the Mariana Island Arc System is comprised of all the Mariana Islands located along the Mariana Ridge, seamounts, the Mariana Trench, and the Mariana Trough. For the Mariana Island Arc System, volcanism is concentrated along the Mariana Ridge, a submerged topographic rise on the sea floor, situated about 30 to 60 miles off the Mariana Trench and the Mariana Island Arc System.

The Mariana Island Arc System is divided into two distinct geological histories—islands from Anatahan north (the Northern Islands) and islands south of Anatahan. The six islands south of Anatahan, including the island of Guam, while volcanic in origin, are considered extinct and are capped by uplifted limestone derived from coral reefs.



Source: USGS (2019)

In the north, there are nine volcanic islands and about 60 submarine volcanoes (also called seamounts), some of which are within the Mariana Trench Marine National Monument (USGS, 2019). Of these, six island volcanoes and six submarine volcanoes had confirmed eruptions since the 1800s. Eruptions pose potential hazards to aircraft, ocean traffic, and local and regional populations in the Commonwealth and Guam. The USGS has ranked 57 volcanoes in the US as Very High or High risk; two Commonwealth islands are considered high risk—Pagan and Agrihan (Ewert et al., 2018).

Island volcanoes pose a direct threat to people living on them. Inhabitants of Pagan Island were evacuated during the 1981 eruption, which persisted through 1985. In 1990, residents of Anatahan Island were evacuated in anticipation of an eruption after an increase in seismic activity. Despite the hazards, residents of the Northern Islands are working to establish homesteads on Agrihan, Alamagan, Anatahan, and Pagan.

Figure 4.10-1. Ash plume from the 1981 Pagan eruption.
Photo credit: Allan Sauter (2003).

Eruptions from island and submarine volcanoes can be hazardous to aircraft and nearby ships and fishing boats. Explosive eruptions can send ash plumes high into the atmosphere, creating a hazard to aircraft and possibly depositing ash on the populated islands and international airports of Guam and Saipan. Gases and ash expelled from Mariana volcanoes have reached populated areas as far as the Philippines, leading to poor air quality and health issues. Landslides can also occur during or after volcanic eruptions. Though landslides are typically only a hazard to people living near them, under certain conditions they can potentially cause a tsunami that affect a wider area, though such an event is exceptionally rare.

Figure 4.10-2. Ash plume from the 2003 Anatahan eruption.
Photo credit: Allan Sauter (2003).

Submarine eruptions can sometimes breach the sea surface and present hazards to ship and aircraft. When South Sarigan seamount erupted in 2010 from ~ 500 ft below sea level, it produced a steam and ash plume that reached over 39,000 ft into the atmosphere and eventually passed over Saipan and Guam. Volcanic emissions and ash threaten young, asthmatic, and elderly people. Fishermen and other marine vessels have also reported underwater explosions, discolored water, or suddenly being surrounded by disturbed water at various places along the island arc. Such activity is commonly associated with submarine eruptions.

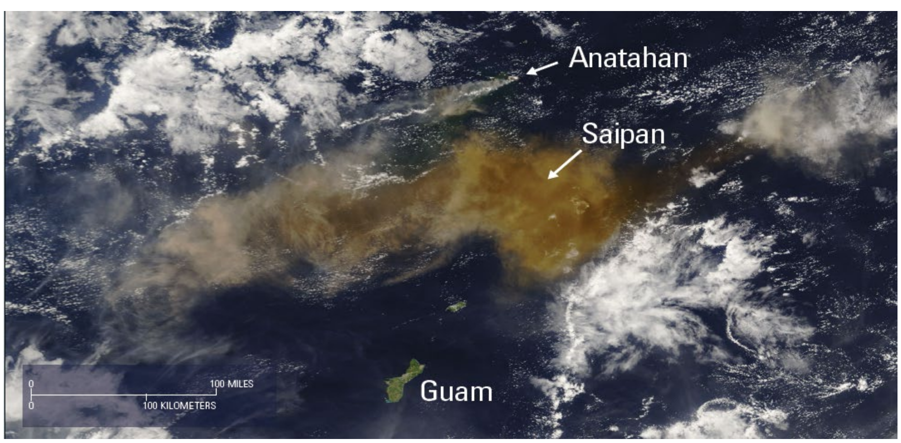


Figure 4.10-3. Satellite image of an ash plume from the April 6, 2005, Anatahan Island eruption that rose to about 49,000 ft. The image was captured about 8 hours after the eruption began and shows the ash plume covering Saipan Island, demonstrating the far-reaching hazards of volcanoes.
Source: USGS (2019). Image from the National Aeronautics and Space Administration Moderate Resolution Imaging Spectroradiometer Rapid Response image gallery.

Location

Volcanic activity occurs mostly on islands and seamount located along the Mariana Arc north of Anatahan. Hazards are generally limited to areas near the eruption; however, plumes of volcanic gases and ash can extend great distances from the eruption site and affect populated areas on Rota, Tinian, Saipan, Guam, and other countries. These plumes can also impact aviation across a large expanse of the Pacific. Volcanic activity, though effects are mainly localized, should be considered a regional hazard.

Extent

The extent (the magnitude or severity) of volcanic hazards in the Commonwealth vary widely. Volcanic eruptions in the Commonwealth range from almost imperceptible to major events, such as the eruptions on Pagan (1981) and Anatahan (2003).

Warning Time

In recent years, some eruptions from Mariana volcanoes have been forecasted due to increased seismic activity. However, volcanic activity often occurs with little advanced warning. Volcano-alert notifications are produced by volcano observatory scientists and are based on analysis of data from monitoring networks, direct observations, and satellite sensors. Notifications are issued for both increasing and decreasing volcanic activity and include text about the nature of the unrest or eruption and about potential or current hazards and likely outcomes. The USGS employs a nationwide volcano alert-level system for characterizing conditions (Normal, Advisory, Watch, Warning) at US volcanoes. Notifications about the status of activity at US volcanoes are issued through the five regional US Volcano Observatories, including the Mariana Volcano Observatory. The USGS alert-level system for volcanic activity has two parts: (1) Ranked terms to inform people about a volcano's status (Table 4.10-1), and (2) ranked colors to inform the aviation sector about airborne ash hazards (Table 4.10-2). The Washington D.C. Volcanic Ash Advisory Center (VAAC), operated by the National Weather Service, also issues ash-related notices for airspace in the Commonwealth of the Northern Mariana Islands (CNMI).

Table 4.10-1. Alert categories for volcanic activity used by US Volcano Observatories.

Alert Level	Details
Normal	Volcano is in typical background, non-eruptive state or, after a change from a higher level, volcanic activity has ceased, and volcano has returned to non-eruptive background state.
Advisory	Volcano is exhibiting signs of elevated unrest above known background level or, after a change from a higher level, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Watch	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, or eruption is underway but poses limited hazards.
Warning	Hazardous eruption is underway, imminent, or suspected.

Table 4.10-2. Aviation Alert color codes for volcanic activity used by US Volcano Observatories.

Aviation Colour Codes recommended by the International Civil Aviation Organization (ICAO)	
GREEN	Volcano is in normal, non-eruptive state. *or, after a change from a higher level:* Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.
YELLOW	Volcano is experiencing signs of elevated unrest above known background levels. *or, after a change from higher level:* Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
ORANGE	Volcano is exhibiting heightened unrest with increased likelihood of eruption. *or,* Volcanic eruption is underway with no or minor ash emission. *[specify ash-plume height if possible]*
RED	Eruption is forecast to be imminent with significant emission of ash into the atmosphere likely. *or,* Eruption is underway with significant emission of ash into the atmosphere. *[specify ash-plume height if possible]*

Previous Occurrences

Only two volcanoes (Pagan and Anatahan) have erupted since 2000. However, volcanoes that have not erupted historically may still reawaken. For example, the 2003 Anatahan eruption was the first in at least several hundred years. Summaries of USGS named volcanoes in the Commonwealth are provided below.

Farallon De Pajaros (Uracas)

Approximately 315 nautical miles north of Saipan, the island has a land area of 1 square mile with an active volcano, which keeps its steep slopes smooth by frequent lava flows and ash. The summit is crowned with white Sulphur and at times dense clouds of yellow smoke and fire emit from the crater. The north, south, and west shores are precipitous and bare. The highest point on the island stands at 1,047 ft.

Ahyi & Supply Reef

These two submarine volcanoes sit at the northern extent of the Marianas chain. Ahyi seamount is a large conical submarine volcano that rises to within 450 ft of the sea surface about 11 miles southeast of the island of Farallon de Pajaros (Uracas), with the most recent eruption recorded in 2014. Supply Reef is a conical submarine volcano that rises to within 26 ft of the sea surface and lies about 6 miles northwest of the Maug Islands, the emergent summit of a submarine volcano that is joined to Supply Reef by a low saddle at a depth of about 5,900 ft. The last recorded eruption at Supply Reef was 1989.

Maug

Located approximately 280 nautical miles north of Saipan, the area is comprised of three islands (North, West, and East Islands), which are the remains of a partly submerged volcano that surrounds a deep and spacious harbor. Steep cliffs border the islands. On the north and west islands there are columns resembling tombstones, which crown the ridges, are outcrops of basaltic veins. The island is uninhabited. The highest peak stands at 746 ft on North Island.

Asuncion

This island is comprised of 2.8 square miles and located about 260 nautical miles north of Saipan. Last active in 1906, this volcano rises steeply as an almost perfect cone. White smoke occasionally emerges from the top and slopes. Lava has streamed down the mountainsides giving it a black surface. Shrubs and a few trees can be found on the island. The highest point on the island is at 2,923 ft.

Agrihan

Situated 206 nautical miles north of Saipan, the volcanic island has an area of 11.4 square miles and was last active in 1917. There are areas of gentle slopes near the shore on the southeast and southwest sides, and the crater entrance is on the north side. The remaining island area consists of steep slopes and deep gorges. The coast is rocky and steep with a landing beach on the southwest coast. The highest point on the island is 3,166 ft.

Pagan

Located 173 nautical miles north of Saipan and one of the largest and most active volcanoes of the Marianas Islands, Pagan consists of two stratovolcanoes connected by a narrow isthmus. Both north and south Pagan stratovolcanoes were constructed with calderas, 4 and 2.5 miles in diameter, respectively. Mount Pagan at the northeast end of the island rises above the flat floor of the caldera, which probably formed during the early Holocene. South Pagan is a stratovolcano with an elongated summit containing four distinct craters. The highest point on the island stands at 1,870 ft. Most of the historical eruptions of Pagan originated from the North Pagan volcano. The 1981 eruption, which sent a Plinian column to the elevation of 42,650 ft, was the largest eruption in Pagan's historical record. Since the May 1981 eruption, several small to moderate ash eruptions have been observed, and plumes have occasionally been visible on satellite imagery. Seismic monitoring of Pagan ended in 1984. The pre-1981 Pagan record includes 11 eruptions dating back to the early 1800s, and a possible eruption in 1669. The most recent volcanic activity was in 2012, with gas and light ash observed in January, April, July, and December. The CNMI Emergency Management Center reported local observations of ashfall on the island on July 9, 2012. Pagan is currently inhabited as part of an ongoing homestead project under the guidance of the Northern Islands Mayor's Office.

Alamagan

Situated 146 nautical miles north of Saipan, this island has an extinct volcano with a large crater at the summit. The island has a land area of 4.4 square miles. The west side is cut by deep gorges covered with high savanna grass. The southeast side is a steep slope of bare lava. There are deep valleys with caves. Coconut palms grow on gradual slopes. Warm freshwater springs are located on the northern part of the west coast. The highest point on the island is 2,441 ft Although the last eruption is believed to have occurred in approximately 870 CE, seismic activity, including what was reported to be thick black smoke and a sulfuric haze, prompted the immediate evacuation of residents from the island in December 1998. In July 1999, a state of emergency was declared for Alamagan Island due to high levels of tectonic seismicity within the Mariana subduction zone. On March 15, 2000, Governor Pedro P. Tenorio extended a declaration of disaster emergency in the CNMI in the wake of the continued threat of a major volcanic eruption on Alamagan. During this period, Governor Tenorio stated that the area was to remain off-limits to human habitation and restricted travel to the island. Volcanic activity and seismic phenomena continued for almost eight months and then abated. On September 22, 2000, the State of Emergency declaration was cancelled. To date, the potential for future eruption activity on Alamagan is still uncertain. Alamagan is currently being repopulated as part of the ongoing homestead project under the guidance of the Northern Islands Mayor's Office.

Guguan

Located 130 nautical miles north of Saipan, this island has a land area of 1.5 square miles. The northwest wall of the active volcano has collapsed, and a new cone has been built up above the wall of the old one. There are deep ravines between the two peaks. USGS reports that the only known historical eruption of Guguan took place between 1882 and 1884 and produced the northern volcano and lava flows that reached the coast. The coast is bordered by steep basaltic rock with gables of high ridges and deep rain-eroded gorges. At times, a lake forms within the crater. The island is uninhabited and has a peak of 988 ft.

Sarigan

The island is 95 nautical miles north of Saipan and is considered an extinct volcano. The summit crater reaches a height of 1,765 ft and contains a small ash cone. The youngest eruptions produced two lava domes from vents above and near the south crater rim. Lava flows from each dome reached the coast and extended out to sea, forming irregular shorelines. The island has numerous ravines and valleys with dense tropical vegetation. It is surrounded by perpendicular cliffs, which make coastal landing difficult.

Anatahan

The island of Anatahan is located 65 nautical miles north of Saipan Island and 174 nautical miles north of Guam. The island has an area of 12.5 square miles with a high point of 2,585 ft. Anatahan is a stratovolcano that contains the largest known caldera in the Northern Mariana Islands. The island's steep slopes are furrowed by deep gorges covered by high grass. The coastline is precipitous with several landing beaches on the northern part and western shore and a small sandy beach on the southwest shore. The first historic eruption in recent times began on the evening of May 10, 2003. The explosive eruption created a large plume of volcanic ash that rose to an altitude of 49,000 ft, whereupon aircraft and ships were warned to avoid the area. The eruption consisted of a nearly continuous small eruption column (less than 3 miles) punctuated by stronger explosive activity. In early June 2003, a small lava flow erupted in the volcano's east crater, which was mostly destroyed by subsequent explosive activity. The most recent eruption was recorded in 2008, with activity lasting through 2009.

Esmeralda Bank

Esmeralda Bank is a massive submarine volcano with three summit cones oriented along a North-South line. Their summits are from 140 ft to 450 ft beneath the sea surface and their depths range from 177 ft to 6,732 ft. The highest, middle peak contains a 1.9 mile-wide caldera open to the west and several parasitic cones. Frequent sulfur boils and water discoloration have been observed, which have variously been attributed to eruptive events or solfataric activity. Located 21 nautical miles west of Tinian, this is the southern-most active volcano in the Mariana Arc and is one of the most active vents in the Western Pacific. The middle peak rises to within 100 ft of sea level and is an area of potential eruption. In the early part of the 20th century the banks were reported to be above sea level but subsided below water as a result of an earthquake.

Ruby

A submarine volcano that rises to within 665 ft of the sea surface northwest of Saipan was detected in an eruption in 1966 by sonar signals. In 1995 submarine explosions were detected, accompanied by a fish kill, sulfurous odors, disturbed water, and the detection of volcanic tremor.

Probability of Future Occurrence

Commonwealth volcanoes erupt on average once every three to five years but also occasionally produce noneruptive volcanic activity, such as earthquakes and minor releases of gas. Historical rates of eruption are expected to continue for the indeterminable future.

Climate Change Considerations

Climate change is not expected to increase the probability of volcanic events, but changing future conditions may influence the dispersion and areas of impact of the volcanic hazard. As discussed in other hazard sections in this plan, climate change projections indicate potential changes in wind and rainfall activity in the Western Pacific. Any changes in wind and rainfall frequency and intensity may alter the dispersion of volcanic gas emissions, with potential for adverse human health impacts.

The types of volcanic activity that results in massive outpouring of gases and ash can influence climate patterns for near-term years (1–5), following a volcanic eruption. The conversion of sulfur dioxide to sulfuric acid is the most significant climate impact from a volcanic eruption and can have a measurable cooling effect on the Earth's surface as with the Pinatubo eruption in the Philippines in 1991. However, other eruptions release carbon dioxide and contribute to greenhouse gas emissions.

4.10.2 Vulnerability Assessment

Volcanic activity hazards are primarily confined to uninhabited or sparsely inhabited islands with very little infrastructure currently. Therefore, a qualitative approach is used to assess vulnerability and losses. However, where Commonwealth owned and operated assets exist on an active volcanic island, the estimate loss values were calculated.

Commonwealth Asset Vulnerability Assessment and Potential Losses

This section discusses the Commonwealth asset exposure and potential losses due to volcanic activity hazards. Commonwealth assets include Commonwealth owned and operated buildings, Commonwealth primary roads and critical facilities.

Commonwealth Buildings

Since 2018, water tanks on Agrihan, Alamagan, and Pagan have been renovated (Table 4.10-3). Water tank capacity is 10,000 gallons on Agrihan and Alamagan and 20,000 gallons on Pagan. Also, public facilities and typhoon shelters were rebuilt on Agrihan, Alamagan, and Pagan after being damaged by Super Typhoon *Yutu.*

Table 4.10-3. Commonwealth buildings vulnerable to volcanic activity and potential losses.

Northern Islands	Total No. of Buildings	% of Total Buildings	Total Replacement Costs Value	% of Total RCV
Agrihan	9	39%	$774,222	44%
Alamagan	5	22%	$288,394	16%
Pagan	9	39%	$702,307	40%
Total	**23**		**$1,764,923**	

Although ash fall has been documented on Rota, Saipan, and Tinian, this hazard is not expected to have significant impacts to Commonwealth owned and operated buildings. This is based on the historical record that indicates ash fall is a benign concern.

Commonwealth Roads

There are no Commonwealth roads located in the Northern Islands. No impacts to Commonwealth roads on Rota, Saipan, or Tinian are expected.

Community Lifelines and Critical Facilities

All Commonwealth owned and operated buildings on Agrihan, Alamagan, Anatahan and Pagan are considered critical facilities that provide essential community lifelines for island residents. In addition, volcanic activity could damage these critical facilities and disrupt their essential lifeline functions to provide communications via radio towers and equipment, healthcare dispensaries, shelter, and drinking water supply. The total estimated value of the critical facilities and community lifelines in the Northern Islands is estimated to be $1.8 million.

General Assets Vulnerability Assessment and Potential Losses

This section provides a summary of Commonwealth-wide exposure and potential losses to general building stock, population, natural and cultural resources.

General Building Stock

There is no information about general building stock on the sparsely inhabited Northern Islands. This data gap will be addressed over the next 5 year plan performance period and information about general building stock, if any, will be included in the 2029 SHMP Update.

For the southern islands, ash fall has been documented but this hazard is not expected to have significant impacts to the general building stock. However, prolonged exposure to high concentrations of volcanic gases could negatively affect the economy. Although little data exists for the effects from volcanic gases in the Commonwealth, research has documented negative effects to grazing livestock after consuming grass coated with fluoride salts deposited by volcanic gases (Koli et al., 2017). Farmers in Hawaiʻi also have experienced severe losses due to damage arising from exposure to high concentrations of sulfur dioxide and sulfuric acid aerosols emitted from Kīlaeua volcano (State of Hawaiʻi Emergency Management Agency, 2023). In addition, poor air quality could negatively affect the tourism and recreation industries for the duration of an eruption.

Socially Vulnerable and Total Population

The residents of the Northern Islands will be exposed to most localized eruption-related hazards such as lava flows, volcanic gases, and earthquakes. The entire Commonwealth population can be exposed to volcanic gases and ash fall, with the Northern Island residents likely being potentially exposed at higher concentration levels due to their proximity to the eruption sites.

The current permanent resident population of the Northern Islands is five people; however, hundreds of people consider themselves displaced residents of the Northern Islands and are waiting for the opportunity to return. Although a social vulnerability assessment has not officially been developed for the population of the Northern Islands, for this assessment all residents are assumed to be socially vulnerable. Socially vulnerable populations are most susceptible based on many factors including their physical and financial ability to react or respond during a hazard event. Residents of the Northern Islands are in a remote and austere environment with aid days to weeks away following a hazard event. The circumstances alone render the population vulnerable.

Toxic gases emitted from a volcano can travel great distances and cause respiratory distress. Sulfur dioxide (SO_2) is irritating to the eyes, nose, throat, and respiratory tract. The most vulnerable populations to these gases include children and individuals with pre-existing respiratory conditions such as asthma, emphysema, bronchitis, and chronic lung or heart disease. Vulnerable populations may respond to very low levels of sulfur dioxide in the air. Prolonged or repeated exposure to higher levels of sulfur dioxide may increase the danger of illness. Future threats from volcanic gases will also be dependent on the location of future eruptions and prevailing meteorological conditions.

Natural Resources

Natural resources on the active volcanic islands will have the greatest exposure to volcanic hazards. Animals and vegetation can be displaced or killed by lava flows and volcanic gases. Animals can experience similar respiratory irritations as humans. In Hawaiʻi, wildlife and livestock died after eating grass or drinking water that was heavily contaminated by falling ash or other volcanic particles (State of Hawaiʻi Emergency Management Agency, 2023). Elevated volcanic gas emissions are expected to negatively affect native vegetation, which could lead to die-off and other cascading effects such as reduced capacity for groundwater recharge, increased erosion and run-off into nearshore waters, and reduction in wildlife habitat.

If there is a large eruption and winds carry the volcanic gases and ash to Rota, Tinian, and Saipan similar effects to natural vegetation, wildlife, and livestock may occur.

Cultural Resources

To date, the Historic Preservation Office does not manage any cultural resource sites on the volcanically active islands. Volcanic ash and gases such as vog may threaten artifacts housed in repositories as well as accelerate corrosion of metal objects. If this occurs, repositories will need to support special air filtration (Rockman et al., 2016).

Future Changes that May Impact Commonwealth Vulnerability

Understanding future changes that impact vulnerability in the Commonwealth can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The following factors were considered to examine potential conditions that may affect hazard vulnerability:

- Climate change and other identified conditions as relevant and appropriate
- Potential or projected development
- Projected changes in population

Climate Change

Climate change is not expected to influence future volcanic activity, but changes in prevailing meteorological conditions due to climate change could influence hazard effects.

Potential or Projected Development

The Mayor of the Northern Islands is actively working to establish safe, reliable, and consistent transportation and communication systems between Saipan and the Northern Islands. The Mayor is also working toward developing basic facilities and infrastructure including water, power, sewer, roads, ports, etc., on Agrihan, Alamagan, Anatahan, and Pagan. Other potential development includes expanding the tourism/eco-tourism industry in the Northern Islands as well as to establish local revenue-generating activities through taxing or licensing to use or harvest natural resources (e.g., commercial fisheries and volcanic mineral mining) related activities utilizing and/or harvesting the of the Northern Islands.

Source: Northern Islands Mayor’s Office Citizen-Centric Report FY 2023.

The *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (DPL, 2019), identifies potential locations for proposed future land use including sites for agricultural homestead on each island and a Mayor’s Office facility that is proposed to include an emergency shelter and lodging (see Section 2.7.7 for maps). There are no lava hazard maps for Agrihan, Alamagan, Anatahan, or Pagan. For this assessment, all proposed development is considered at risk from volcanic activity hazards.

Projected Changes in Population

The Northern Islands Mayor's Office is actively working to assist residents to return to homesteads on Agrihan, Alamagan, Anatahan, and Pagan. As stated above, a social vulnerability index for the population of the Northern Islands is available; however, for this assessment the entire population of the Northern Islands is considered socially vulnerable because most of the population is of Northern Mariana descent, the isolated, remote nature of the island homesteads, the lack of facilities and infrastructure, and limited economic opportunity. Because volcanic activity hazards are likely to have a greater impact on the Northern Islands, the population of these islands is exposed and at-risk from these hazards. Increased numbers of residents unequally increases the impacts, effects, and response effort for volcanic activity hazards of the Northern Islands.

4.10.3 Mitigation Success

Currently, volcanic activity in the CNMI is monitored through the Northern Mariana Islands Volcano Observatory located in Alaska using satellite imagery, distant seismic stations, and hydroacoustic signals. Following the report by Ewart et al. (2018), Congress passed the John D. Dingell, Jr. Conservation, Management, and Recreation Act (Public Law 116-9; 133 Stat. 580), in which Title V (43 U.S.C 31k) authorized the establishment of the National Volcano Early Warning System (NVEWS) within the USGS. The first 5-year Management Plan was published in 2020 and Pagan volcano was listed as a high threat (Cervelli et al., 2021). As such, Pagan will be prioritized for additional monitoring infrastructure during the first five years of implementation on the NVEWS. More robust monitoring of this active volcano will help alert North Island residents and the Commonwealth in general of pending volcanic activity and potential eruptions.

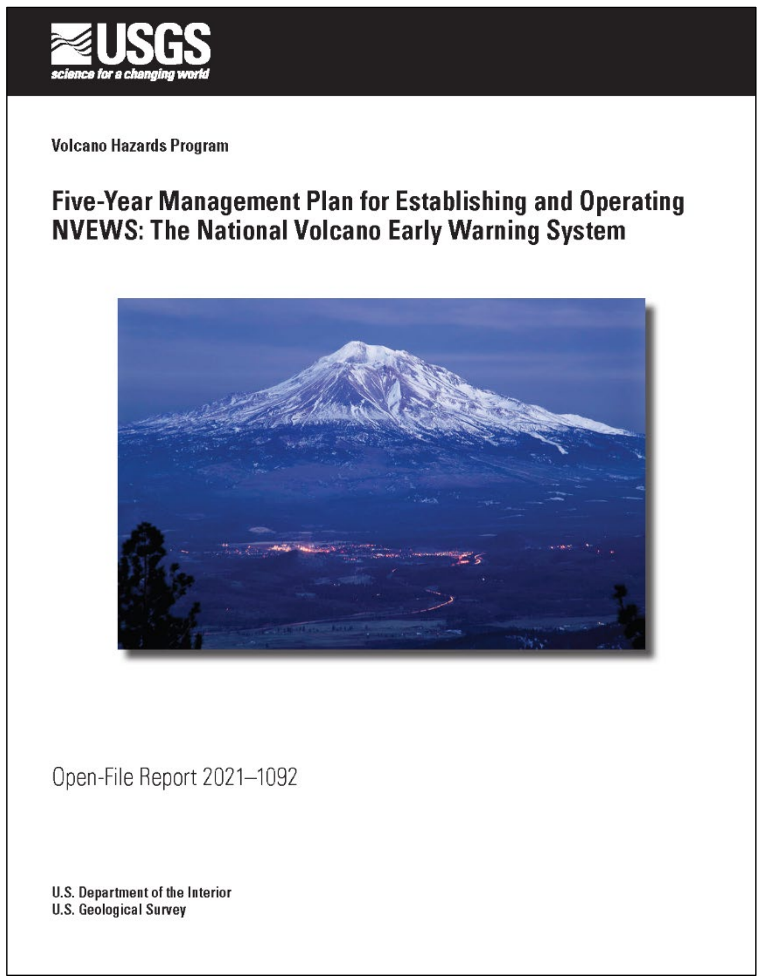


Figure 4.10-4. Cover of the *Five-Year Management Plan for Establishing and Operating NVEWS: The National Volcano Early Warning System*

References

Cervelli, P. F., Mandeville, C. W., Avery, V. F., & Wilkins, A. M. (2021). *Five-Year Management Plan for Establishing and Operating NVEWS: The National Volcano Early Warning System* (US Geological Survey Open File Report 2021-Open-File Report 1092; Open-File Report, p. 11). US Geological Survey. ttps://doi.org/10.3133/ofr20211092.

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

Ewert, J. W., Diefenbach, A. K., & Ramsey, D. W. (2018). *2018 Update to the US Geological Survey National Volcanic Threat Assessment.* (US Geological Survey Scientific Investigations Report 2018–5140; Scientific Investigations Report, p. 40). https://doi.org/10.3133/ sir20185140.

Koli, P., Yadav, D. K., Yadav, S., & Devi, S. (2017). Fluoride Toxicity in Livestock. *Popular Kheti*, *5*(2), 1.

Rockman, M., Morgan, M., Ziaja, Sonya, Hambrecht, George, & Meadow, Alison. (2016). *Cultural Resources Climate Change Strategy* (p. 50). Cultural Resources, Partnerships, and Science Climate Change Response Program, National Park Service. https://www.nps.gov/subjects/climatechange/culturalresourcesstrategy.htm

State of Hawaiʻi Emergency Management Agency. (2023). *State of Hawaiʻi 2023 State Hazard Mitigation Plan* (p. 1034). State of Hawaiʻi.

[USGS] US Geological Survey. (2019). *Volcanic Hazards in the Pacific and U.S. Territories* (p. 6). US Department of Interior, US Geological Survey. https://doi.org/10.3133/fs20193036

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 4.0 Risk Assessment
Section 4.11 Risk Assessment Summary

28 July 2024

Table of Contents

List of Tables

4.0 Risk Assessment

4.11 Vulnerability Assessment Summary

2024 SHMP Update Changes

- The 2024 State Hazard Mitigation Plan (SHMP) Update changes are given in Sections 4.1 through 4.10.

Element S6 and 44 CFR § 201 4(c)(2)(ii) and § 201.4(c)(iii): The risk assessment shall include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses, including jurisdictions most threatened by the identified hazards and most vulnerable to damage and loss from hazard events with respect to populations, structures, infrastructure, and community lifelines. Additionally, potential losses to the identified vulnerable structures based on estimates in the local risk assessment as well as the state risk assessment should be included.

The purpose of ranking the hazards is to summarize the Commonwealth vulnerabilities and to guide updates to the hazard mitigation strategy. The hazard ranking is provisional, and it will likely change over time as new data, information, analytical tools, and models become available; the Commonwealth develops new capabilities; and climate change becomes realized or more predictable. The hazard ranking presented in this chapter represents a snapshot in time. This section concludes the Risk Assessment and ranks the hazards of concern to summarize Commonwealth-wide vulnerability.

Regardless of rank, all hazards addressed in the 2024 SHMP Update are of concern. Medium or low ranking hazards require mitigation against future losses. Due to inherent biases in risk assessment methodologies, rare but potentially catastrophic events like a tsunami are sometimes ranked low in priority (Mamuji & Etkin, 2019). However, these rare events require adequate planning and mitigation efforts to reduce the potential catastrophic consequences should the event occur. The Mitigation Strategy is included in Chapter 6.0.

4.11.1 2024 SHMP Update Hazard Ranking

For the 2024 SHMP Update, the Risk Index planning tool used in the 2018 Standard State Mitigation Plan (SSMP) was updated and expanded. Numerical values allowed hazards to be ranked against one another; the higher the relative risk score, the hazard risk is assumed to be greater.

Methodology

For the 2024 SHMP Update, the 2018 SSMP Risk Index was updated and expanded to include additional categories to describe overall risk including spatial extent, warning time, hazard duration, adaptive capacity, and potential future changes due to climate change. Adding these categories aligns the risk index more closely with recommendations in the *State Mitigation Planning Key Topic Bulletin on Risk Assessments* from the Federal Emergency Management Agency (FEMA). Also, weights were assigned to the risk categories to emphasize certain risks in the relative risk scores. Definitions for new risk categories and weights were adapted for the Commonwealth from the *State of Hawai‘i 2023 State Hazard Mitigation Plan* (State of Hawai‘i Emergency Management Agency, 2023).

There are considerations and limitations to the methods used to rank the hazards. The levels and types of analysis for each hazard differed based on available information. Some hazards have more detailed, spatially-based analyses while others are qualitatively assessed. In addition, tools to model hazards were largely unavailable for use in the 2024 SHMP Update. Therefore, professional judgement and qualitative analyses were used to assign numerical values for some hazards.

As described in Section 4.1 (Risk Assessment Overview), three levels of analysis were used to estimate potential impacts: 1) historic occurrences/qualitative analysis, 2) exposure analysis, and 3) loss estimation. These analyses are suitable for planning purposes; however, as with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts. Impacts from any hazard event within the Commonwealth will vary from the analysis presented here based on the factors described for each hazard of concern, namely location, extent, warning time, and mitigation measures in place at the time of an event. The hazard ranking methodology for some hazards of concern is based on an event (e.g., 1% annual chance flood), while others are based on the potential vulnerability to the Commonwealth as a whole (e.g., extreme heat). To account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgment and subject matter expert input and assumptions are included, as appropriate, in the following sections. The limitations of this analysis are recognized given that all scenarios do not have the same likelihood of occurrence; nonetheless, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk. Below are the definitions of the categories included in the relative risk evaluation.

- **Probability of Occurrence—**The probability of occurrence of the scenario evaluated was estimated by examining the historic record and/or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historic record and judgment was used to estimate the probability of occurrence of an event that will impact the Commonwealth.
- **Impact**—Impact is comprised of impact to people (described as severity in the 2018 SSMP) and impact to assets and the economy (described as magnitude in the 2018 SSMP). The results of the updated risk assessment and/or professional judgment were used to assign the numeric values for these impact subcategories. The impact to Commonwealth assets and the overall economy and resilience were considered. The impact to general building stock, community lifelines that affect Commonwealth resilience and economy were also considered.
- **Spatial Extent—**The area of impact was calculated in a Geographic Information System (GIS) for the hazards with a delineated spatial extent. For hazards that do not have a geographic extent, it was determined whether the hazard event would have local, regional, island-wide, or Commonwealth-wide impacts. Refer to Section 4.1 (Risk Assessment Overview), which describes the spatial data sets used.
- **Warning Time**—The lead time associated with the hazard event was researched, and the warning measures/systems in place to alert the Commonwealth in advance of the event occurring were considered. Warning time is discussed in each hazard profile (refer to Sections 4.2 through 4.10).
- **Duration—**The duration was estimated by determining the approximate length a hazard event may last and does not include time until full recovery. An examination of the historic record was used as a point of reference.
- **Adaptive Capacity**—Adaptive capacity describes the current ability of the Commonwealth to protect from or withstand a hazard event. The Commonwealth develops an annual Stakeholder Preparedness Review (SPR) that rates core capabilities across five elements: planning, organization, equipment, training, and exercises. The three step self-assessment of capability levels is based on capability targets in the Threat and Hazard Identification and Risk Assessment (THIRA). These ratings, conducted by the CNMI Homeland Security and Emergency Management (HSEM) and supporting stakeholders, form the basis for the adaptive capacity assessment for each hazard of concern for the 2024 SHMP Update.
- **Changing Future Conditions**—Current climate change projections were considered as part of the hazard ranking to ensure the potential for an increase in severity/frequency of the hazard was factored into the hazard ranking. Consideration of future climate conditions is important because the hazard ranking helps guide and prioritize the mitigation strategy development, which should have a long-term future vision to mitigate the hazards of concern. The potential impacts climate change may have on each hazard of concern is discussed in Sections 4.2 through 4.10.

For the 2024 SHMP Update a new schema was adopted to develop the relative risk scores. Research suggests that risk is better characterized by multiplying frequency of occurrence with impact, which is the sum of magnitude and severity scores (Mamuji & Etkin, 2019). The following relative risk schema was used, and the benchmark values and weights used for each risk factor are listed in Table 4.11-1.

Relative Risk Schema

Relative Risk = [(Frequency x Impact x 0.5) + (Spatial Extent x 0.15) + (Warning Time x 0.05) + (duration x 0.1) + (Adaptive Capacity x 0.1) + (Future Conditions x 0.1)]

Table 4.11-1. Risk criteria definitions used in the relative risk schema to rank hazards.

Category		Level	Degree of Risk	Numeric Value	Weight
Frequency of Occurrence		Unlikely	Less than 1% probability in the next 100 years.	0	25%
		Occasional	Between 1% and 10% probability in the next year or at least one chance in 100 years.	1	
		Likely	Between 10% and 100% probability in the next year or at least one chance in 10 years.	2	
		Highly likely	Near 100% probability in the next year.	3	
Impact (Sum Pop and Assets)	Population (Severity)	Negligible	No anticipated displacement or injuries; minimal quality-of-life impact.	0	25%
		Significant	Potential for measurable life safety impacts (displacement, injury, fatalities) in less than 10% of the total population.	1	
		Critical	Potential for measurable life safety impacts (displacement, injury, fatalities) in more than 10-25% of the total population.	2	
		Catastrophic	Potential for measurable life safety impacts (displacement, injury, fatalities) in more than 25% of the total population.	3	
	Assets (Magnitude)	Negligible	Shutdown of critical facilities and services for 24 hours or less, less than 10% of property is severely damaged.	0	
		Significant	Complete shutdown of facilities for more than one week, more than 10–25% of property is severely damaged.	1	
		Critical	Complete shutdown of facilities for at least 2 weeks, more than 25–50% of property is severely damaged.	2	
		Catastrophic	Complete shutdown of facilities for 30 days or more, more than 50% of property is severely damaged.	3	

Table 4.11-1. Risk criteria definitions used in the relative risk schema to rank hazards (*cont'd*).

Category	Level	Degree of Risk	Numeric Value	Weight
Spatial Extent	Limited	Less than 10% of the planning area.	1	15%
	Significant	10-50% of the planning area.	2	
	Extensive	50-100% of the planning area.	3	
Warning Time	High	More than 24 hours.	0	5%
	Medium	12-24 hours.	1	
	Low	6 to 12 hours.	2	
	Minimal	0 to 6 hours.	3	
Duration of Event	Minimal	Less than 6 hours.	0	10%
	Low	Less than 24 hours.	1	
	Medium	Less than 1 week.	2	
	High	Greater than 1 week.	3	
Adaptive Capacity	Complete	The Commonwealth has mitigated all hazard risks through mitigation measure and in-house capabilities.	0	10%
	High	Plans, policies, codes/ordinances in place and exceeded minimum requirements; mitigation/protective measures in place, Commonwealth has ability to recover quickly because resources are readily available, and capabilities are high.	1	
	Medium	Plans, policies, codes/ordinances in place and met minimum requirements; mitigation strategies identified but not widely implemented; Commonwealth can recovery but needs outside resources; moderate commonwealth capabilities.	2	
	Low	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	3	
Changing Future Conditions	No Change	Studies and modeling projections indicated there is no evidence at this time to indicated that conditions may change in the future.	0	10%
	Uncertain	No local data is available; modeling projections are uncertain if risk will increase in the future; confidence level is low (inconclusive evidence).	1	
	Likely	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive evidence).	2	
	Highly Likely	Studies and modeling projections indicate exacerbated conditions due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).	3	

The method to summarize the confidence level regarding the input used to populate the hazard ranking was adopted for the Commonwealth from the *State of Hawai'i 2023 State Hazard Mitigation Plan* (State of Hawai'i Emergency Management Agency, 2023). A gradient of certainty was developed for CNMI and a high, medium, or low certainty factor was selected and assigned to each hazard to provide a level of transparency and increased understanding of the data used to support the resulting ranking. The following scale was used to assign a certainty factor to each hazard:

- **High**—Defined scenario/event to evaluate; probability calculated; evidenced-based/quantitative assessment to estimate potential impacts through hazard modeling.
- **Moderate**—Defined scenario/event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis, no hazard modeling) and qualitative data to estimate potential impacts.
- **Low**—Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; majority of potential impacts are qualitative.

Table 4.11-2 summarizes the hazard scenario or hazard area evaluated; highlights key impacts to population, Commonwealth assets, and natural and cultural resources; and lists the associated certainty factor assigned for each hazard to convey the level of confidence in the data used. This table is not intended to be a complete and comprehensive list of all hazard impacts determined in the risk assessment and considered for the hazard ranking exercise. Refer to Sections 4.2 to 4.10 for a complete summary of all estimated Commonwealth-wide impacts for each hazard.

Table 4.11-2. Overview of the hazard scenarios and the associated estimated impacts considered in the hazard ranking.

Hazard	Hazard Scenario/ Area Evaluated	Population	Commonwealth Assets	General Building Stock / Economy	NR / CR	Certainty Factor
Typhoon, Wind	Commonwealth wide; 1% annual chance extreme wind (154 mph)	Entire population exposed; ~1,000 people require emergency shelter for Category 5 Typhoon	Extensive structural damage expected to buildings constructed with wood walls and non-concrete roof; past damages estimated at hundreds of millions	Extensive structural damage expected to buildings constructed with wood walls and non-concrete roof; past damages estimated at hundreds of millions	NR: Damage to watersheds; debris management; hazardous material release; water supply contamination CR: damage to structures and landscapes	Moderate
Typhoon, Storm Surge	FIRM V-Zones + storm surge	2,744 people exposed including 2,461 people of moderate to high social vulnerability	$42M building damages; $16M damage to community lifelines and critical facilities	$340M building damages	NR: 10.9 sq. miles species habitat exposed CR: 2.8 sq. miles of designated area exposed	High
Tsunami	Commonwealth-wide; 9.0 Mw earthquake event	12,126 people exposed including 10,643 people of moderate to high social vulnerability	$405M building damages; $236M damages to community lifelines and critical facilities	$2.3B building damages	NR: 41.2 sq. miles of species habitat exposed CR: 8.3 sq. miles of designated area exposed	High
Drought	Commonwealth-wide	Entire population exposed	Impacts to structures low; increased water demand may impact to community lifelines	Impact to structures low; agricultural losses ($1.6M market value exposed)	NR: Environmental damage; increased wildfire potential; watershed damage CR: Increased wildfire potential; impacts to cultural practices	Moderate

Table 4.11-2. Overview of the hazard scenarios and the associated estimated impacts considered in the hazard ranking (*cont'd*).

Hazard	Hazard Scenario/ Area Evaluated	Population	Commonwealth Assets	General Building Stock / Economy	NR / CR	Certainty Factor
Flood, Event-based	1% Annual chance flood	4,041 people exposed, including 3,134 people of moderate to high social vulnerability	$102M building damages; $66M damages to community lifelines and critical facilities	$520M building damages	NR: 12.28 sq. miles species habitat exposed CR: 2.8 sq. miles of designated area exposed	High
Flood, Coastal Erosion	High risk for coastal erosion	491 people exposed including 321 people of moderate social vulnerability	$20M building damages; $2M damages to community lifelines and critical facilities	$130M building damages	NR: 3.4 sq. miles species habitat exposed CR: 2.2 sq. miles of designated area exposed	Low
Health Risks	Commonwealth-wide	Entire population exposed	Low impact to structures; loss of services	Reduced visitors impacting economy; temporary closure of ports of entry impacted import/ export of goods and resources	NR: Impacts to food supply CR: Exposure to this hazard is low.	Moderate
Extreme Heat & Heatwave	Commonwealth-wide	Entire population exposed	Impact to structures low; electrical power and water service demands may disrupt community lifelines	Impact to structures low	NR: Increased wildfire and drought potential CR: Degradation of cultural resources	Low
Wildfire	High probability wildfire areas	253 people exposed including 73 people of moderate to high social vulnerability	$8.3M building damages; $1M damages to community lifelines and critical facilities	$48M building damages	NR:17.9 sq. miles of habitat exp. CR: 4.7 sq. miles of designated area exp.	Moderate

Table 4.11-2. Overview of the hazard scenarios and the associated estimated impacts considered in the hazard ranking (*cont'd*).

Hazard	Hazard Scenario/ Area Evaluated	Population	Commonwealth Assets	General Building Stock / Economy	NR / CR	Certainty Factor
Earthquake	475-yr probabilistic earthquake event with peak round acceleration of 0.398	Entire population exposed: sheltering needs not developed	$947M building damages; $623M damages to community lifelines and critical facilities	$1.7B building damages	NR: Induced landslides; poor water quality; hazardous material release. CR: Structure damage.	Moderate
Volcanic Activity	Northern Islands	Entire population exposed to ash and volcanic gases	$1.8M building/critical facility and community lifeline damages	No exposure to structures. Poor air quality; reduced visitor arrivals	NR: Negative effects to plants and animals near volcanic eruptions or exposed to volcanic gases/ash CR: Low exposure to volcanic gas/ash	Low
Flood, Chronic Coastal	High tide flood risk	1 residence	No Commonwealth buildings or critical facilities/ community lifelines exposed	$67M building damages	NR: 0.53 sq. miles species habitat exposed CR: 0.9 sq. miles of designated area exposed	High

Note: Building damage includes damage to the structure and contents, but does not include land values.
Population estimates do not include visitors. NR = Natural Resources; CR = Cultural Resources.
Exposed = the number of assets located in the hazard area, all of which may not incur losses as the result of an event.
Certainty factors:
High = defined scenario/event to evaluate; probability calculated; evidence-based/quantitative assessment to estimate potential impacts through hazard modeling.
Moderate = Defined scenario/event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis, no hazard modeling) and qualitative data to estimate potential impacts.
Low = Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; most potential impacts are qualitative.

Table 4.11-3 summarizes the projected changes in hazard event occurrences in terms of location, extent or intensity, and frequency and/or duration. In addition, it lists the associated value assigned to each hazard in the risk factor calculation (i.e., confidence in changing future conditions). Refer to Sections 4.2 through 4.10 for a more detailed discussion of all factors of change for each hazard of concern.

Table 4.11-3. Overview of the projected future changes for each hazard of concern.

Hazard	Location	Extent/Intensity	Frequency Duration	Confidence in Changing Future Conditions
Typhoon, Wind	—	↑	↓	Highly Likely (Extent/intensity) Likely (Frequency)
Typhoon, Storm surge	↑	↑	↑	Highly Likely
Tsunami	—	↑	—	Likely
Drought	—	↑	↑	Highly Likely
Earthquake	—	—	—	No change
Flood, Event-based	↑	↑	↑	Highly Likely
Flood, Coastal Erosion	↑	↑	↑	Likely
Health Risks	—	↑	↑	Highly Likely
Extreme Heat & Heatwave	—	↑	↑	Likely
Wildfire	↑	↑	↑	Highly Likely
Volcanic Activity	—	—	—	No Change
Flood, Chronic Coastal	↑	↑	↑	Highly Likely

Note: Arrow direction indicates a projected increase or decrease based on literature review described in Section 4.1 (Risk Assessment Overview). A horizontal line indicates no change. Change in future conditions is based on the confidence of climate change projections from the Fifth National Climate Assessment (USGCRP, 2023).

- Highly likely = Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).
- Likely = Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).
- Uncertain = No local data is available; modeling projections are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).
- No Change = Studies and modeling projections indicate there is no evidence at this time to indicate conditions may change in the future.

4.11.2 Hazard Ranking Results

Table 4.11-4 provides the Commonwealth-wide hazard ranking for the 2024 SHMP Update.

Table 4.11-4. 2024 SHMP Update relative risk ranked results for the hazards of concern.

Hazard Rank	Hazard	Frequency	Population	Assets	Spatial Extent	Warning	Duration	Adaptive Capacity	Future Conditions	Relative Risk Factor
High	Typhoon, Wind	2	3	3	3	0	2	2	3	7.2
High	Typhoon, Storm surge	2	2	3	2	0	2	2	3	6.0
Medium	Tsunami	1	2	3	2	3	1	0	2	3.3
Medium	Drought	2	1	1	3	0	3	2	3	3.3
Medium	Flood, Event-based	1	2	2	2	0	1	2	3	2.9
Medium	Flood, Coastal Erosion	2	1	1	1	0	2	2	3	2.9
Medium	Health Risks	1	3	0	3	0	3	1	3	2.7
Low	Extreme Heat & Heatwave	1	2	0	3	0	2	1	3	2.1
Low	Wildfire	1	1	1	1	3	2	2	3	2.0
Low	Earthquake	1	1	1	3	3	0	2	0	1.8
Low	Volcanic Activity	1	1	1	1	3	2	2	0	1.7
Low	Flood, Chronic Coastal	3	0	0	1	0	1	2	3	0.8

Table 4.11-5 compares the high-ranked hazards from the 2018 SSMP with the high-ranked hazards for the 2024 SHMP Update using the numeric rank from both years. Typhoon hazards continue to be top-ranked in the Commonwealth. Drought gained in prominence in the 2024 evaluation due to its potential widespread effects and likely increased future probability of occurrence. Although there is no recent history of a devastating tsunami in the Commonwealth, this threat increased in relative risk due to recent efforts to model the impacts of a significant tsunami event. Hazards from flooding continue to be a hazard of concern and significance in the Commonwealth.

Table 4.11-5. Comparison between the 2018 and the 2024 hazards of concern rankings.

Numeric Rank	2018 Hazards of Concern	2024 Hazards of Concern
1	Typhoons &Tropical Storms	Typhoon, Wind
2	Flood	Typhoon, Storm Surge
3	Earthquake	Tsunami
4	Volcanic Eruptions	Drought
5	Tsunami	Flood, Event-based
6	Drought	Flood, Coastal Erosion
7	Wildfire	Health Risks
8		Extreme Heat and Heatwave
9		Wildfire
10		Earthquake
11		Volcanic Activity
12		Flood, Chronic Coastal

Saipan tended to have the most assets vulnerable to most hazards compared to the other municipalities. However, this is largely due to the fact that Saipan is the most populated and most developed municipality. Additionally, much of the development on Saipan is on the western low-lying coastal plain increasing the vulnerability of these structures to several hazards.

On Rota and Tinian, development in low-lying areas is also exposed and vulnerable to several hazards. Assets in the Northern Islands were discussed separately for most hazards in Sections 4.2 through 4.10. The assets in the Northern Islands are most vulnerable to typhoon, earthquake, and volcanic activity. These facilities double as critical facilities and their importance and value to the Northern Islands communities is obscured when considered along with the Commonwealth building stock on Saipan, Tinian, and Rota.

4.12 Opportunities to Improve the Hazard Identification and Risk Assessment

FEMA provided recommendations for improvements to the SHMP (see Appendix G). Many of these recommendations were incorporated in the 2024 SHMP Update. Hazard Identification and Risk Assessment recommendations to be incorporated in the 2029 SHMP Update include:

- Consider analyzing general trends for each hazard by calculating historical frequency by 5- to 10-year increments for the hazard. This will result in a currently accurate historical frequency probability for the action. It will also show how the number of events has increased, decreased, or remained constant over time.

- For the hazards that have fewer or no direct impacts on structural assets of the CNMI, analyze potential impacts to the economy, residents, and other applicable assets. It may be harder to quantify potential losses associated with hazards such as drought and extreme heat. However, it is still important to understand the risk each hazard presents to the territory.
- Consider taking the recent and potential development and population changes one step further to fully relate the shifts back to how they will impact vulnerability of the CNMI. Clearly linking the changes to the physical environment of the planning area as well as the makeup of its people will help territory officials understand how to best minimize increased vulnerability.

A task to annually review the opportunities for improvement provided by FEMA was added to the Annual Maintenance Schedule for the SHMP (Table 7-1).

References

Mamuji, A. A., & Etkin, D. (2019). Disaster Risk Analysis Part 2: The Systemic Underestimation of Risk. *Journal of Homeland Security and Emergency Management*, *16*(1), 20170006. https://doi.org/10.1515/jhsem-2017-0006

State of Hawaiʻi Emergency Management Agency. (2023). *State of Hawaiʻi 2023 State Hazard Mitigation Plan* (p. 1034). State of Hawaiʻi.

[USGCRP] US Global Change Research Program. (2023). *Fifth National Climate Assessment*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Chapter 5.0 Mitigation Capabilities

28 July 2024

Table of Contents

List of Tables

List of Figures

5.0 Capability Assessment

2024 State Hazard Mitigation Plan (SHMP) Update Changes

- For the 2024 State Hazard Mitigation Plan (SHMP), a summary of land use laws and plans with particular emphasis on development in hazard-prone areas was developed.
- Building codes, buildings standards, and permitting process were reviewed and summarized.
- Commonwealth participation in national mitigation programs is described in detail.
- Obstacles in reducing hazard mitigation were identified and solutions to overcoming the obstacles proposed.

5.1 Introduction

This Capability Assessment is key to identifying resources the Commonwealth can apply to mitigate natural hazard risk and support community resiliency. An assessment of mitigation capabilities includes a review and evaluation of existing laws, regulations, programs, plans, policies, administrative and technical structure, financial viability, and people-powered capabilities that support risk reduction. Capabilities that support mitigation actions are essential for risk reduction. This capability assessment helps to identify resource gaps, thereby allowing the Commonwealth to focus efforts where there are challenges and to strengthen capabilities for hazard mitigation.

This section provides a comprehensive review and evaluation of Commonwealth capabilities used to support and facilitate mitigation activities and describes the process used by the Commonwealth of the Northern Mariana Islands (CNMI) to support, promote, and coordinate mitigation planning and actions.

5.2 Administration of Hazard Mitigation Programs

5.2.1 Office of the Governor

The Governor has the overall responsibility for emergency management activities in the CNMI. Since the 2018 Standard State Mitigation Plan (SSMP), the Office of the Governor established the CNMI Recovery Administrator to coordinate recovery and mitigation efforts following Super Typhoon *Yutu* and the coronavirus disease 2019 (COVID-19) pandemic. The Office of the Governor administers several programs to facilitate hazard mitigation planning and actions as well as to administer post-disaster recovery projects. A brief description of programs under the Office of the Governor follows.

Office of Grants Management & State Clearinghouse and the Department of Finance

The Office of Grants Management & State Clearinghouse and the Department of Finance manage a website for CNMI Disaster Recovery (https://www.cnmidr.gov.mp) to streamline financial management and reporting efforts for disaster recovery processes. The website supports the mission of capturing and processing documents of all disaster-related grants the CNMI has received and serves as a conduit for information, financial management, and progress.

State Hazard Mitigation Officer

The State Hazard Mitigation Officer (SHMO) implements hazard mitigation activities throughout the Commonwealth, and provides expertise, guidance, and assistance to various sectors of the community, which include government agencies and representatives of the public sector. The SHMO also coordinates with other agencies in implementing mitigation measures. The SHMO also supports implementation activities by helping lead agencies identify, coordinate, and obtain technical and financial resources. The SHMO prepares progress reports and manages the Hazard Mitigation Grant Program. The SHMO serves as the lead point-of-contact for the Federal Emergency Management Agency (FEMA).

Hazard Mitigation Grant Program

The CNMI Hazard Mitigation Grant Program (HMGP) was adopted under US Public Law 93-288, Section 404 to provide funding to rebuild in a way that reduces or mitigates future disaster losses. The CNMI HMGP works with FEMA to develop mitigation plans such as the SHMP that identify policies and actions to reduce risk and future loss of life and property, and implement Hazard Mitigation Assistance projects. The HMGP administers federal mitigation grants such as the Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA), HMGP, and HMGP Post Fire programs. The HMGP is not empowered with regulatory authority.

5.2.2 Homeland Security and Emergency Management

Pursuant to Public Law 18-4 (Homeland Security and Emergency Management Act of 2013), emergency management functions are coordinated between the federal, Commonwealth, and local levels by the CNMI Office of Homeland Security and Emergency Management (HSEM). HSEM is the lead coordinating agency for all disasters. HSEM is responsible for preparing and updating the *CNMI All-Hazards Emergency Operation Plan* (EOP) (HSEM, 2021a) and associated annexes, the Threat Hazard Identification and Risk Assessment (THIRA), and the Stakeholder Preparedness Review (SPR). The THIRA lays the foundation for determining the community's capabilities gap. The SPR determines the jurisdiction's current capability levels against the threats and hazards indicated in the THIRA. The EOP directs and assigns functional responsibilities to all CNMI departments, agencies volunteer and private groups with emergency operations responsibilities, roles, and functions to promptly respond and efficiently support the protection of life and property, and assist in recovery from a disaster.

5.2.3 Mayoral Offices

The duties and responsibilities of the Offices of the Mayor are established in Article VI of the Northern Mariana Islands Constitution and 1 CMC §§5101–5110. Chief among these constitutional and statutory duties and responsibilities include but are not limited to, the mobilization of resources and meeting emergency conditions in a declared disaster. The overall welfare and improvement of the community includes educating residents about natural hazards and promoting mitigation planning and actions.

5.3 Identification and Evaluation of Commonwealth Mitigation Capabilities

Element S8 and [44 CFR § 201.4(c)(3)(ii)]: Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified?

Element S8-a. Does the plan include an evaluation of the state's laws, regulations, policies, and programs related to hazards that improve or impede resilience to future natural hazard events and other future conditions, including the effects of climate change, capabilities, and funding sources to mitigate the hazards identified?

Mitigation Capabilities provide the means to accomplish desired mitigation outcomes. Capabilities include laws, regulations, policies, programs, administrative and technical staffing and resources, funding, and people-powered capabilities, such as volunteer groups.

This Section discusses Commonwealth capabilities for mitigation of hazards identified in the risk assessment. Capabilities can also be described as pre- and post-disaster capabilities. Pre-disaster capabilities are programs, agencies , and offices that have authority to plan and regulate development and infrastructure and provide services. Post-disaster capabilities are response and recovery organizations that operate in near-term (days to weeks), mid-term (months), and long-term (years) following a disaster declaration. An evaluation is provided for each mitigation capability. Evaluations discuss how capabilities improve or impede resilience to future natural hazard events and the potential effects of climate change.

5.3.1 Legal, Regulatory, Policy and Program Capabilities

A review of Commonwealth laws, rules, existing plans, and programs related to hazard mitigation was conducted to identify and evaluate mitigation capabilities, including those related to development in hazard prone areas. Each capability is described, significant changes that occurred since the 2018 SSMP were noted, and opportunities or challenges in enhancing capability effectiveness or minimizing conflicts with mitigation goals are discussed. Detailed information for the evaluation of mitigation capabilities is in Appendix E (Mitigation Capabilities Supplement). Table 5-1 summarizes the information from the detailed evaluation and identifies the range of mitigation capabilities and the hazards they mitigate. Detailed information in the appendix includes the areas of strengths or deficiencies of the capabilities.

Table 5-1. Summary of the Commonwealth mitigation capabilities by hazard of concern.

Capability	Typhoon	Tsunami	Drought	Flood	Health Risk	Extreme Heat and Heatwave	Wildfire	Earthquake	Volcanic Activity
Office of the Governor (OG)									
Capital Improvements Program (CIP)	❖	❖	❖	❖			❖	❖	
CNMI Disaster Recovery Program (OG)	❖			❖					
Community Development Block Grant Infrastructure Program (CDBG)	❖			❖					
Infrastructure and Recovery program (OG)	❖			❖					
Planning and Development Advisory Committee (PDAC)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Commonwealth Planning Act (Office of Planning and Development [OPD])	❖	❖	❖	❖	❖	❖	❖	❖	❖
Comprehensive Sustainable Development Plan (OPD)	❖	❖	❖	❖	❖	❖	❖	❖	
Energy Task Force	❖								
Mariana Mappers Working Group	❖	❖	❖	❖	❖	❖	❖	❖	❖

Table 5-1. Summary of the commonwealth mitigation capabilities by hazard of concern (*cont'd*).

Capability	Typhoon	Tsunami	Drought	Flood	Health Risk	Extreme Heat and Heatwave	Wildfire	Earthquake	Volcanic Activity
Bureau of Environmental and Coastal Quality (BECQ)									
Areas of Particular Concern (BECQ)	❖	❖		❖			❖		
Clean Water Act Section 401 Water Quality Program (BECQ)	❖	❖		❖			❖		
Coastal Management Zone (BECQ)	❖	❖		❖					
Commonwealth Environmental Protection Act (BECQ)	❖		❖	❖		❖	❖		❖
CNMI Environmental Laws Policy Act (BECQ)				❖					
The Environmental Council of States (BECQ Member)				❖	❖				
Flood Hazard Assessment (BECQ)	❖	❖		❖					
Hazardous Waste Program (BECQ)	❖	❖		❖			❖		
Hazardous Waste Regulations (BECQ)	❖	❖		❖			❖		
NPDES Wastewater Discharge Permits (BECQ)	❖	❖		❖			❖	❖	
Coastal Resource Management Regulation (Title 15-10)	❖	❖	❖	❖			❖		
One-Start Permit Process	❖	❖	❖	❖		❖	❖	❖	
Permitting Application and Hazard Assessment Tool (BECQ)	❖	❖		❖		❖	❖	❖	
Safe Drinking Water Program (BECQ)	❖	❖		❖			❖	❖	
Shoreline Monitoring Program (BECQ)	❖	❖		❖					
Water Quality Surveillance and Non-Point Source Monitoring Program (BECQ)	❖	❖	❖	❖			❖		
Watershed Management	❖		❖	❖			❖		
Department of Public Works									
Building Code Council (DPW)	❖	❖		❖			❖	❖	

Table 5-1. Summary of the commonwealth mitigation capabilities by hazard of concern (*cont'd*).

Capability	Typhoon	Tsunami	Drought	Flood	Health Risk	Extreme Heat and Heatwave	Wildfire	Earthquake	Volcanic Activity
Comprehensive Highway Master Plan (COTA)	❖	❖		❖					
Damage Assessments (DPW)	❖	❖		❖			❖	❖	
National Flood Insurance Program (DPW)	❖	❖		❖					
Risk MAP (DPW)	❖			❖					
Territorial Transportation Improvement Plan (DPW)	❖	❖		❖			❖	❖	
Homeland Security and Emergency Management									
Homeland Security and Emergency Management Operations Plan (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
All-Hazards Training and Exercise Program (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
CNMI Catastrophic Typhoon Plan (HSEM)	❖			❖					
Emergency Operations Center (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Emergency Management Warning Point Social Media Outlets (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Multi-Agency Coordination (MAC) Group (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Stakeholder Preparedness Report (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Threat Identification and Risk Assessment (HSEM)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Department of Fire and Emergency Services									
Fire Program (DFEMS)							❖		
Emergency Response	❖	❖	❖	❖	❖	❖	❖	❖	❖
Department of Forestry and Wildlife									
CNMI State Wildfire Plan (DLNR)							❖		
Forestry Program (DLNR)	❖	❖	❖	❖			❖		
State Wildlife Action Plan	❖		❖	❖			❖		

Table 5-1. Summary of the commonwealth mitigation capabilities by hazard of concern (*cont'd*).

Capability	Typhoon	Tsunami	Drought	Flood	Health Risk	Extreme Heat and Heatwave	Wildfire	Earthquake	Volcanic Activity
Native Ecosystems Protection and Management (DLNR)	❖	❖		❖					
Department of Public Lands									
Public Land Use Plan Update (DPL)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Department of Community and Cultural Affairs									
Emergency and Preparedness, response, and Recovery Plan for Childcare (DCCA)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Protection of Cultural Resources (DCCA)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Commonwealth Utilities Corporation									
Strategic Energy Plan (CUC)	❖	❖		❖			❖	❖	
Typhoon Preparedness and Safety Tips (CUC)	❖			❖					
Underground storage tank regulations	❖	❖	❖	❖					
Sustainable Water Infrastructure Management Strategy (SWIMS) Program	❖	❖	❖	❖	❖	❖	❖	❖	
Commonwealth Healthcare Corporation									
Commonwealth Healthcare Corporation Preparedness Program (CHCC)					❖				
Immunization programs (DOH)					❖				
Northern Marianas College									
Community Development Institute (NMC)	❖				❖				
Northern Marianas Trade Institute	❖				❖				
Other Programs and Partnerships									
Infrastructure Investment and Jobs Act	❖	❖	❖	❖	❖	❖	❖	❖	❖
Economic Resiliency Center	❖	❖	❖	❖	❖	❖	❖	❖	❖

Table 5-1. Summary of the commonwealth mitigation capabilities by hazard of concern (*cont'd*).

Capability	Typhoon	Tsunami	Drought	Flood	Health Risk	Extreme Heat and Heatwave	Wildfire	Earthquake	Volcanic Activity
Fiscal Response Team									
Pacific Mosquito Surveillance Strengthening for Impact (PacMOSSI)					❖				
Pacific RISA	❖		❖	❖	❖	❖	❖		
Pacific Risk Management 'Ohana (PRiMO)	❖	❖	❖	❖	❖	❖	❖	❖	❖
Rebuilding American Infrastructure with Sustainability and Equity (RAISE) program.	❖	❖		❖				❖	
Resilient Food Infrastructure Program (USDA)			❖						
Silver Jackets	❖	❖	❖	❖	❖	❖	❖	❖	❖

Land Use and Development

In 2006, the Commonwealth legislature passed Public Law 15-2 to enact the Public Lands Act of 2006, which created the Department of Public Lands (DPL). DPL is mandated to administer the Commonwealth's public lands according to the provisions of Article XI of the Commonwealth Constitution and public Law 15-2 for the benefit of all persons of Northern Marians Descent to support the policies outlined in Section 5 of the Constitution. Public Law 15-02 requires that DPL maintain a Comprehensive Public Land Use Plan (PLUP) for all islands and that the plan be updated every 5 years. The current plan was produced in 2019 and is currently being updated to cover the next 5-year period (2024–2029). More information regarding the PLUP is provided in Appendix E (Mitigation Capabilities Supplement).

In 2020, Public Law 20-20 established the Office of Planning and Development (OPD) to coordinate among different agencies and levels of government to guide future development and to develop a Comprehensive Sustainable Development Plan (CSDP). OPD also served as a clearing house for all information related to development, planning, and resources use in the Commonwealth. The CSDP establishes planning themes, goals, and objectives for the commonwealth. More information regarding the CSDP is provided in Appendix E (Mitigation Capabilities Supplement).

Guidance Manual for *Smart, Safe Growth*

Smart, Safe Growth (*SSG*) is a comprehensive planning approach with three critical areas of practice—hazard mitigation, climate impact adaptation, and smart growth—each associated with voluminous policy guidance and best practices. Since the 2018 SSMP, a *Guidance Manual for Smart, Safe Growth of the Northern Mariana Islands* (NES, 2018) was developed concurrently with the establishment of the OPD in November 2018. The document introduces *SSG* and discusses adaptation measures, recommendations for government action, planning resources, regulatory instruments, and tools to work toward *SSG* in the communities of the CNMI. The *Guidance Manual* also presents key issues and tools to facilitate leadership actions towards *SSG* and aims to help the Commonwealth evaluate planning and development initiatives for conformance with *SSG Principles* in a consistent and uniform manner. OPD continues to work with development and redevelopment planning partners to mainstream the *Guidance Manual* for planning and project scoping using the best available data to build smarter and safer in the face of changing environmental conditions.

Land Use Recommendations

Ensure the 2025 PLUP update incorporates hazard mitigation data, climate change, and *Smart, Safe Growth Principles* so that future projects and investments are not in risk prone areas. Align public land use maps with regulatory restrictions, constraints, and existing infrastructure availability to assess the suitability of areas for future development (OPD, in prep.). Improve coordination between DPL, OPD, the Office of Homeland Security and Emergency Management, and other key Commonwealth agencies (e.g., built infrastructure and development regulation) to ensure projects are sited and designed to withstand future impacts expected under conditions of a changing climate (OPD, 2021). The DPL would benefit from adjusting regulations and land use planning for shorelines and coastal properties to help develop *Smart, Safe Growth Principles* in the tourism and coastal recreation sectors (NES, 2018).

Recommendations outlined in the CSDP include continued communication and alignment between the Capital Improvements Program and priority implementation projects to achieve shared visions, goals, and objectives to achieve infrastructure, health, and education investments that ensure strategic and resilient outcomes. Limited integration of hazard mitigation consideration in development planning increases environmental and socio-economic vulnerabilities and frustrates long-term risk reduction planning efforts. Use of hazard mitigation data and data updates would prevent development of projects and private investment in risk prone areas (OPD, in prep.).

Land Use Obstacles

Planning for wide variations in population and economic growth presents challenges for long range implementation of land management objectives. The COVID-19 pandemic interrupted and delayed expected growth in the tourism market while the population of the Commonwealth decreased by 12.2% between 2010 and 2020. Projecting population growth continues to be challenging. Flexible goal setting and iterative reassessment of development trends and trajectories in the Commonwealth may be a more effect method for management of public lands.

Key principles of *SSG* are undermined by regular variances granted by the Office of Zoning on Saipan and permit conditions for large developments. The Department of Public Works (DPW), DPL, and the Commonwealth Utilities Corporation (CUC) could realize short- and long-term benefits to critical resources from the integration and implementation of *SSG Principles*. DPW can improve resiliency and recovery of critical CNMI infrastructure as well as meet mandates to address resiliency for some federal funding opportunities. DPL can adjust regulations and land use planning for shorelines and coastal properties to help develop *SSG Principles* in the tourism and coastal recreation sectors. CUC can consider opportunities to build system resilience and reduce dependency on fossil fuels (NES, 2018).

Zoning Regulations and Updates

Public Law 6-32, the CNMI Zoning Code of 1989, established the Commonwealth Zoning Board to administer a land use and zoning system and to promulgate regulations. The Zoning Board has seven members of which four are officers. The Zoning Office staff administer mandates of the Zoning Board by providing services to commercial and residential developers, property owners, and the business community to understand and comply with land use regulations to preserve natural and cultural resources while promoting economic growth. Zoning Office staff provide essential outreach and education to CNMI communities about the zoning laws. The Zoning Office processes and issues permits for new development, non-conforming structures and uses, rezones or changes in district boundaries, subdivision plans, fences, and signs. In 2023, the Zoning Office processed a total of 4,034 zoning permits and clearances, of which 98% were completed by the end of the fiscal year with only 2% pending submittal of further requirements. The Zoning Office also provides enforcement of the zoning law. In 2023, the Zoning Office conducted 142 inspections for compliance with zoning requirements (Commonwealth Zoning Board, 2023). These inspections included 44 on single family homes, 39 on public nuisances, 20 on zoning permits, and 18 on Conditional Use permits. Of the total inspections, 39 notices of violations were issued, of which 35 were found in compliance while 4 were ongoing and being monitored under enforcement.

An important mandate of the Zoning Office is to work collaboratively with other government agencies, such as the Resiliency Working Group (formerly the Climate Change Working Group) and the Bureau of Environmental and Coastal Quality (BECQ), Division of Environmental Quality (DEQ). The Zoning Board also maintains a Zoning Database system to manage permit application and issuance. A Geographic Information System (GIS) helps Zoning Office staff link information in the GIS with as-built survey plans and the Zoning Database to readily visualize the locations of proposed and existing development.

Enacted into law on June 14, 2018, the Nuisance Abatement & Blighted Property Maintenance Act of 2018 requires all property owners that hold blighted properties within the island of Saipan to be held accountable for securing and maintaining abandoned, vacant, and blighted properties. Since 2019, the Zoning Office continues to work on updates to zoning regulations including the text and map amendments to the Saipan Zoning Law of 2013 and the Nuisance Abatement & Blighted Property Maintenance Act of 2018, to name a few. The proposed changes within the text amendments include increasing height restrictions and regulations for setback requirements across zoning districts based on sea level rise (SLR) and sea level change (SLC).

Obstacles

The Zoning Office has experienced several challenges, including the implementation of government-wide cost cutting measures from budget reductions and austerity measures to reduce government work hours and staff shortages. With the discontinuance of the American Recovery Plan Act grant, the Zoning Office released 3 staff who were hired and funded through this grant. The Zoning Office anticipates the need to hire additional enforcement staff to support upcoming projects, and they are actively searching for funding opportunities to assist with hiring.

There is limited funding and staffing for Blighted Buildings reclamation efforts from the Office of Zoning despite the Legislative mandate. Blighted buildings continue to pose environmental and human health hazards, which further deter investment and redevelopment. Many developers would rather clear vegetated properties than rehabilitate or demolish existing structures, contributing to land management pressures (OPD, in prep.). The Zoning Office needs additional enforcement vehicles and continues to search for funding sources. In 2023, three vehicles were operable, with only two serving enforcement while one was used for administrative services. The Zoning Office's aim to activate the full implementation of the Nuisance Abatement & Blighted Properties Maintenance Act in 2024 adds pressure to prioritize searching for funding to secure enforcement vehicles.

Regular variances granted by the Office of Zoning on Saipan and permit conditions for large developments result in sprawling development. Zoning maps are not aligned with regulatory restrictions, constraints, and existing infrastructure availability. This results in development that does not meet the pace of infrastructure upgrades or considers environmental or other regulatory constrains upon an area (e.g., flood zones, ground water protection, < 24/7 water service areas, etc.) (OPD, in prep.).

Building Code Updates

A positive step toward long-term resilience was the adoption and enforcement of the latest hazard-resistant building codes and referenced standards. On December 19, 2019, Governor Torres signed into law Public Law No. 21-14 adopting the 2018 International Building Codes (IBC) as the standard Building Safety Code for the CNMI. Soon after, the DPW updated the Building Safety Code Rules and Regulations (Sec. 155-10.1-601) to use the 2018 IBC and 2018 International Residential Code (IRC) with the public notice published in the Commonwealth Register (DPW, 2020) on July 28, 2020. This is a significant upgrade from the previously adopted 2009 IBC and

2009 IRC. The 2018 IBC specifically address hazards associated with natural hazard events, such as high winds, storm surge, flooding, and sea-level rise.

The DPW Building Safety Code Division (BSCD) is dedicated to upholding Public Law 21-14 to ensure buildings meet the minimum safety standards of the IBC and IRC. The 2018 IBC and 2018 IRC govern the design and construction of buildings, which include requirements to address earthquakes, flooding, and high winds that help resist damage. New buildings and building repairs must meet or exceed these requirements as certified by DPW pursuant to Public Law 6-45. The BSCD also enforces floodplain management regulations to minimize flood damage in accordance with Public Law 8-7. For all new construction, elevation standards are applied so the lowest floor is at least 2 feet above the 1% annual floodplain elevation. Currently, the CNMI is implementing training efforts, oversight, and enforcement of building codes to ensure cost-effective compliance that reduces risk to people, the economy, and the environment. The BSCD serves a vital role in helping the public understand and adhere to the building codes. The BSCD issued 1,189 Certificates of Compliance in 2022 and 1,128 in 2023. No publicly accessible BSCD website exists with information about building code adoption with amendments, permit applications, fee requirements, and links to useful publications for property owners and contractors (FEMA, 2021a).

In November 2020, the FEMA Mitigation Assessment Team (MAT) assigned to the CNMI conducted an extensive and comprehensive structural performance evaluation for buildings in the CNMI impacted by Super Typhoon *Yutu*. This FEMA-led initiative resulted in the publication of *Codes, Standards, and Permitting* (FEMA, 2021a) summary report for the CNMI that provides a retrospective of the structural performance of buildings during extreme wind and design-level flood events, in order to develop recommendations for building repairs and new construction to mitigate damage during future extreme wind events. The following section was adopted from the *Codes, Standards, and Permitting* (FEMA, 2021a) summary report.

<u>Obstacles</u>

The Commonwealth does not regularly adopt the most recent edition of the International Building Codes (I-Codes), which leaves the infrastructure of the CNMI lagging behind national standards. The hazard-resistant provisions of the latest I-Codes and standards referenced by the I-Codes enable new and existing buildings to better resist the impacts of typhoons, floods, and seismic events. *Building Codes Save: A Nationwide Study of Loss Prevention* (FEMA, 2020a) concluded that state, local, tribal, and territorial governments that have adopted the I-Codes and continue to adopt the latest updated editions can avoid billions of dollars in annual losses. Without a formal adoption cycle, many years may pass between adoptions without the latest hazard-resistant building code provisions being in effect. This is particularly acute when considering low-income households. Poorly built and inadequately maintained housing is typically occupied by low-income residents, making them more susceptible to damage in typhoons, tropical storms, and flooding. According to the 2020 US Census, 38% of households in the CNMI had incomes below the national poverty level (US Census Bureau, 2024). Residents living below the national poverty level have a great deal to lose during an event and may be the least prepared to deal with potential losses. FEMA's Building Code Adoption Tracking (BCAT) system and the publication titled *Building Codes Adoption Playbook for Authorities Having Jurisdiction* (FEMA P-2196) are resources that help promote, adopt, and enforce up-to-date building codes and are available at Building Code Adoption Tracking | FEMA.gov.

The CNMI appropriately updated Section 155-10.1-601 of the Building and Safety Code Rules and Regulations to specify the adoption of the 2018 IBC and 2018 IRC. Currently, the public is not provided with sufficient detail to determine from this section the other International Codes® (I-Codes) and their editions being adopted. Section 601 of the Building and Safety Code Rules and Regulations provides two examples of the other I-Codes being adopted along with the IBC, but it does not list each of the I-Codes adopted as part of the Commonwealth Building Safety Code. "The International Building Code of 2018, which includes its ICC [International Code Council] Family of codes such as the International Residential Code and energy codes, as adopted by the International Code Council, is hereby adapted [sic] as the Commonwealth Building Safety Code." There is an opportunity for the BSCD to have a document that summarizes for the public the full extent of amendments made to the 2018 I-Codes. The summary will be especially useful for design professionals and contractors in clarifying which provisions of the I-Codes are not appropriate for local conditions, and how some local requirements exceed the 2018 IBC and 2018 IRC because of historical knowledge and past disaster experience. The *Codes, Standards and Permitting* (FEMA, 2021a) summary report goes on to outline areas for clarifying legislative language as it pertains to the CNMI Legislature's implementation of the 2018 IBC and 2018 IRC.

The BSCD serves a vital role in helping the public understand and adhere to the building codes. The Division holds responsibility for reviewing permit applications and conducting inspections before issuing occupancy permits. The BSCD does not have a publicly accessible website that shares building code adoption with amendments, permit applications, fee requirements, links to publications useful for contractors and property owners, and answers to frequently asked questions.

The Commonwealth Building and Safety Code Rules and Regulations (Sec. 155-10.1-615) has earthquake and typhoon amendments that conflict with the adopted IBC and referenced standards. The initial portion of this section recognizes that proper earthquake and typhoon standards are a matter of life and death for the citizens of and visitors to the CNMI. Emphasis on these particular hazards is an opportunity for the CNMI to clarify the language within this section to agree with the most recent adoption of the I-Codes. Adoption of the 2018 IBC and 2018 IRC creates a conflict between a seismic provision in the Commonwealth Building Safety Code amendments and the seismic requirements in the adopted I-Codes. The existing amendments found in Section 155-10.1-615 specify: "All structures which are required to meet earthquake construction requirements shall be designed and constructed to Seismic Zone 4 standards." The 2018 IBC and 2018 IRC no longer use the term *Seismic Zone* which is a legacy term used in the Uniform Building Code. This term is not consistent with the I-Codes and should be replaced with the corresponding term *Seismic Design Category.*

In Section 155.10.1-615, the code amendments go on to specify that “the minimum design strength of every building and structure and every portion thereof to which the Building Safety Code applies shall be designed and constructed to withstand the minimum horizontal and uplift pressure of wind velocity of at least 175 miles per hour.” In that section, the code amendments should specify a “minimum design strength.” The code amendment was in place when the CNMI adopted the 2009 IBC and 2009 IRC. Since that time, the I-Codes have transitioned to an updated wind design methodology. For example, a basic (design) wind speed of 175 miles per hour (mph) in the 2009 IBC is now equivalent to a basic wind speed of 225 mph in the 2018 IBC.

In support of applying the appropriate wind speed for the CNMI, FEMA developed the 2020 CNMI Special Wind Region (SWR) maps to assist design professional, planners, citizens, and other stakeholders to determine structural design wind speeds for various types of buildings to meet requirements in the 2018 IBC adopted by the CNMI (FEMA, 2020b). Four sets of SWR maps were produced for each of the islands Saipan, Tinian, and Rota. The SWR maps include the effects of island topography and provide an alternative method to the guidance in *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (American Society of Civil Engineers[ASCE]/Structural Engineering Institute [SEI] 7-16), which is referenced in the 2018 IBC and 2018 IRC. These SWR maps and the associated design wind speeds enable design professionals to simply select a design wind speed for a building at a site from the SWR maps. This will provide results similar to those of ASCE/SEI 7-16’s methodology, yet without performing the additional, complex calculations it requires. Using the SWR maps for the design of buildings and structures helps optimize designs and avoids unnecessary costs. There is an opportunity to adopt the SWR maps into the Commonwealth Building Safety Code as an alternative method for calculating design wind pressures on buildings and structures.

The CNMI Flood Damage Prevention Regulations are not consistent with the flood provisions in the 2018 IBC and 2018 IRC. By enactment of Public Law No. 8-7 in 1992, the CNMI Legislature vested the Director of Public Works with the authority to bring the CNMI into full compliance with the provisions of the NFIP and to make the CNMI a participating NFIP community. On October 15, 1993, DPW adopted Subchapter 155-10.2, Flood Damage Prevention Regulations, within the Northern Mariana Islands Administrative Code (NMIAC). The regulations have not changed for many years. FEMA provides a model code-coordinated ordinance that can be used with the adoption of the I-Codes and IBC Appendix G Flood-Resistant Construction.

Building code councils are used to help make amendments that are necessary to address local conditions, reflect local laws, and make recommendations that strengthen the resiliency of buildings. The CNMI currently does not have a professional oversight council designated with the responsibility of proposing amendments to the I-Codes that are appropriate for the CNMI. DPW has been given the authority to employ staff and designate a Building Code Council with the responsibility of studying, evaluating, and making recommendations for building code amendments.

Permitting Framework for Land Use Management

Development influences land availability, environmental quality, infrastructure needs, and socio-economic conditions. Permitting and inspection are the enforcement tools to implement building code and flood plain management regulations. Adherence to permitting, inspection, and enforcement processes helps to produce sustainable and resilient buildings (FEMA, 2021a).

Established in 1983 as the Office of Coastal Resources Management and merged with Bureau of Environmental and Coastal Quality (BECQ) in 2013, the Division of Coastal Resources Management (DCRM) administers the federal Coastal Zone Management Act to promote efficient resources management through coordination across Commonwealth departments to achieve twenty-three legislative policies, including to “plan for and manage any use or activity with the potential for causing a direct and significant impact on coastal resources” (Public Law 3-47, 2 CMC § 1500 et. seq.). The BECQ Division of Environmental Quality (DEQ) ensures compliance with environmental regulations to protect water and air quality as well as coast resources as outlined in the Commonwealth Environmental Protection Act of 1982 (Public Law 3-23, 2 CMC § 3101 et. seq.).

The DCRM Permitting Section is responsible for permitting minor and major developments and/or projects that are situated within and around the DCRM designated Areas of Particular Concern (APC), including developments that have the potential to cause significant adverse impacts to coast resources. For projects that exceed a certain size, utility demand, or operational thresholds, a Major Siting permit is required. This requires a more extensive application and review process with the Coastal Resources Management Agency Board (CRM Board). The CRM Board is composed of appointed representatives from DCRM, DEQ, Department of Public Work (DPW), Department of Land and Natural Resources (DLNR), Historic Preservation Office (HPO), and the Commonwealth Utilities Corporation (CUC). The Major Siting permit is issued to ensure the project avoids, minimizes, or mitigates all agency and public concerns regarding significant impacts (see Public Law 3-47, 2 CMC §§ 1500 et seq.). For minor permits such as construction of temporary or permanent pala palas or picnic shelters or public landscaping within APC, conditions or restrictions may be added.

DCRM receives and reviews One-Start permit applications from BECQ-DEQ. All earthmoving activities that exceed six cubic yards of soil disturbance must apply for a One-Start permit with the BECQ-DEQ. DEQ reviews the application to confirm that infrastructure is properly sized to comply with wastewater and stormwater management standards and that the development complies with related air, water, and land regulations. The review process also helps determine whether a project needs other permits. As established by a Memorandum of Understanding, DEQ also manages the One-Start process by routing the application to partner regulatory agencies for review. The DLNR Division of Fish and Wildlife reviews the proposal to ensure there is no significant negative impact to wildlife or important habitat. The HPO reviews the proposal for compliance with cultural resource management standards. The DCRM reviews the proposal to ensure no significant negative impacts to coastal resources. Project(s) located in an APC, require an APC permit issued by DCRM with additional conditions to protect important coastal resources such as corals, seagrass, and wetlands, and to ensure early coordination with the DPW Floodplain Administrator and Building Safety Code Division (BSCD) if the project is located in a high hazard flood zone. To uphold Public Law 6-45, the BSCD issues final Certificates of Occupancy to completed developments and ensures that all buildings are held to minimum safety standards of the 2018 International Building Code. Through enforcement and inspection, the DPW-BSCD works to promote the health, safety, and general welfare of the people of the Commonwealth in the built environment. In 2023, the DCRM Permitting Section received and reviewed 521 applications and approved/cleared 501 applications (BECQ-DCRM, 2023).

In 2019, a new single strategy for better buildings practices was adopted to address coastal hazards. The DCRM published the guidebook *Better Buildings Practices in the CNMI: Addressing Coastal Hazards Through Responsible Development and Resiliency* (BECQ-DCRM, 2022) and promotes Better Building and Development Practices through permit incentives. By addressing cumulative and secondary impacts, the strategy sought to reduce the impacts of stormwater runoff and non-point source pollution on the CNMI's shoreline and coastal waters through the development of an incentives program that would prioritize low-impact develop (LID) building practices, deployment of green infrastructure, and maintenance of living shorelines. Permit fees are reduced for major siting projects that are Leadership in Energy and Environmental Design (LEED) Certifiable or that incorporate best practices for site redevelopment (15-10-205(h)(5)(1)&(2)). To support best management practices, a *Low-Impact Development Best Management Practices Manual* was published in April 2018. The *Guidance Manual for Smart, Safe Growth in Commonwealth of the Northern Mariana Islands* (NES, 2018) is being applied to support project scoping in the CNMI.

<u>Obstacles</u>

The CRM Board approves permits for all major development in the CNMI. Although the Board has interagency representation, the current permit review and approval processes are essentially done independently by each agency with little coordination (i.e., stove pipes) (NES, 2018). For example, the capacity or sequencing ability of CUC to provide essential services for all approved development permits is not considered by all CRM Board members. The sheer volume of development project proposals and pressure for action make the situation more challenging.

The permitting and inspection of construction for homeowner repairs presents some challenges. The following section was adopted from the *Codes, Standards, and Permitting* (FEMA, 2021a) summary report.

Poor construction practices of the past resulted in building failures during Super Typhoon *Yutu*. Many homeowners take the initiative to repair their homes without complying with the CNMI building permitting and construction requirements in violation of Building Safety Code Section 155-10.1-501. The Commonwealth faces the challenge of breaking the cycle of improper repair and construction practices by homeowners. These improper practices occur when building permit applications are not submitted. It would benefit the communities of the CNMI for the BSCD to increase public awareness and have mechanisms in place that provide instruction about how to adhere to the building permit and construction requirements found in the Building Safety Code Section 155-10.1-501 (FEMA, 2021a).

Contractors who assist homeowners and building owners with new construction and repairs are not required to be licensed in the CNMI. Licensure provides a method of oversight to determine whether building contractors have the knowledge to properly serve the CNMI community. Contractors who are knowledgeable about proper construction practices and current building codes and good practices promote code-compliant construction (FEMA, 2021a).

In some cases, the construction of resilient buildings is limited by the availability of hazard-resistant materials and products that are tested and approved to meet the IBC and IRC hazard requirements. Approved materials and products such as shutters, structural connectors, windows, and doors are critical elements that help protect buildings from wind loads and wind-borne debris. Without the use of properly approved materials and products, these building elements are more likely to fail when exposed to hazardous conditions.

The current building permit applications do not require identification of load path connectors on the construction design documents, leaving contractors to select the number and type of connectors. The *load path* is the route by which building loads are transferred through the members and connections. The loads may be dead loads such as the building's own weight; live loads such as the weight of occupants or furniture; or environmental loads such as those caused by wind, floods, and earthquakes. The load path begins where a load is applied, moves through the building, and ends where the load is transferred to the ground. A design professional will evaluate and specify load path connectors of the appropriate type, number, size, and corrosion protection to resist all the imposed building loads that occur during extreme weather. Lightly constructed buildings with weak points or incomplete load paths performed poorly under high winds (FEMA, 2021a).

Building permit applications submitted to the BSCD sometimes lack documentation of design criteria for hazards such as high winds, earthquakes, and floods. The building code requires this information to be supplied in permit applications and construction documents. Some building permit files lack plan review and inspection reports. Accessing ICC training on building codes and code administration is one way to educate BSCD staff as new building code editions are adopted. Regular audits of building permit files promote accountability and a consistent approach (FEMA, 2021a).

BSCD’s Requirements for Plan Review Checklist, which lists the minimum building plan and specification submittal requirements associated with permit applications, does not match the submittal and construction document requirements specified in the 2018 IBC and 2018 IRC. See 2018 IBC Section 107 and Section 1603; and 2018 IRC Section 105.3 and Section 106 for more information.

Temporary facilities were still in existence more than two years after Super Typhoon *Yutu*. The IBC and IRC require permits for temporary structures, which are allowed for no more than 180 days of service. It is critical that temporary buildings be tracked during the permitted time of service. Temporary buildings are not required to adhere to all the typical building requirements, which puts these structures more at risk than permanent structures during hazard events (FEMA, 2021a).

5.3.2 Other Regulatory Updates

Public Law 3-47, the Coastal Resources Management Act of 1983, established the CRM Agency Board to support the DCRM mission to administer Coastal Resource Management permit decisions, to provide feedback to DCRM, and to work with DCRM to update and adopt regulations and policies. The DCRM guiding policies include land use master planning, floodplain management, and the development of zoning and building code legislation with a focus on reducing risks of coastal hazards to people and the environment. Many DCRM regulations and policies are consistent with *Smart, Safe Growth Principles*. The *2021–2025 Section 309 Assessment and Strategy Report* (BECQ-DCRM, 2020) discusses program changes and updates. The following is taken from this report.

DCRM adopted regulations and policies to define jurisdiction over all wetlands and more adequately define what constitutes a wetland area. Amended regulations and the adoption of the mitigation hierarchy give DCRM the authority to enforce a no net loss policy, buffer zone, and mitigation requirements. In April 2019, the *2018 Guidance on Using the Mitigation Hierarchy to Avoid Impacts of Projects and Activities* was adopted. The mitigation hierarchy is a decision-making process that can help reduce negative impacts to the CNMI's coastal resources and sensitive habitats including shorelines, wetlands, seagrass, and coral reefs (BECQ, 2018). The guidance serves as mitigation framework to address adverse impacts for projects within all designated APC and Major Siting permitting jurisdictions. Project planners are first asked to identify and consider the potential environmental impacts of their proposed actions and then seek alternatives that would avoid some or most of the negative effects. The Mitigation Hierarchy policy provides guidelines to offset projects, should impacts to wetland systems or other high value ecosystems be unavoidable. The Mitigation Hierarchy policy makes clear that avoidance and minimization should be implemented before mitigation is proposed.

In February 2018, the DCRM updated its regulations to increase shoreline setbacks. The objective for this update is to prevent or significantly reduce threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential SLR and SLC. The strategy sought to create DCRM-specific coastal hazard mitigation and adaptation guidelines that incorporate the unique demographics of the CNMI and expanded upon the *Climate Change Vulnerability Assessment for the Island of Saipan* (Greene & Skeele, 2014) to include a broader range of hazards, including storm surge, localized flooding, and drought. SLR scenarios and coastal flooding scenarios for Saipan were completed in 2017, and six revised sea level extremes and flooding thresholds were created based on the 2017 updates to National Oceanic and Atmospheric Administration (NOAA) sea level trend analysis and the global and regional Sea Level Rise Scenarios for the United States. The spatial data is available on the BECQ Open Data Portal, CNMI Climate Impact Viewer (CNMI Climate Impact Viewer v2022 | CNMI Bureau of Environmental and Coastal Quality Open Data Portal (arcgis.com), and Public Permitting Application. The spatial data was incorporated into the *Smart, Safe Growth Guidance Manual* (NES, 2018) and *SSG* matrix for project scoping and prioritization purposes. This update includes coordination and scoping requirements to support early action and assessment of *green infrastructure elements* for development within a coastal APC or a FEMA designated Special Flood Hazard Area (A-zones on the Flood Insurance Rate Maps for the CNMI) as noted in NMIAC §15-10-101(c).

5.3.3 Participation in National Mitigation-Related Programs

Several national programs support mitigation activities including the Rehabilitation of High Hazard Potential Dams Program (HHPD), National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk Mapping Assessment and Planning (Risk MAP), and the National Incident Management System (NIMS). These programs are a key component of Commonwealth hazard mitigation capabilities. The following section discusses participation and administration of these programs in the Commonwealth.

National Flood Insurance Program

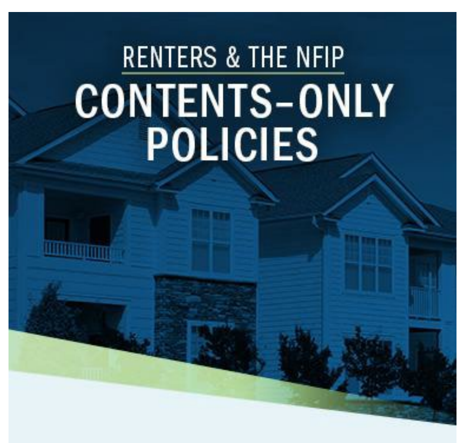
The National Flood Insurance Act of 1968 and its implementing regulations provides flood insurance to individual property owners, businesses, and government agencies in flood-prone areas where insurance is either not available or prohibitively expensive. The law requires communities to adopt and enforce floodplain management regulations that contribute to protecting lives and reducing the risk of new construction and substantial improvements from future flooding. The Department of Public Works (DPW), Building Safety Code Division (BSCD) is responsible for floodplain management and administering the National Flood Insurance Program (NFIP; Public Law 8-7). Within the BSCD, a flood plain manager is responsible for implementing the Flood Damage and Prevention Regulations (Subchapter 155-10.2) on Saipan, Tinian, and Rota (flood hazards have not been modeled for the Northern Islands).

Although the Flood Damage and Prevention Regulations (Subchapter 155-10.2) have not been updated since 1993, the Commonwealth building code has been updated to the 2009 International Building Codes (I-Codes) and more recently, to the 2018 I-Codes. The Commonwealth I-Codes apply to new construction and to alteration, movement, enlargement, replacement, and repair of existing buildings, and include Substantial Improvement/Substantial Damage (SI/SD) provisions that are consistent with the requirements of the NFIP (FEMA, 2010). The SI/SD provision of the NFIP says that when the cost to repair or improve a structure equals or exceeds 50% of the structure's pre-damage market value, the structure must be brought into compliance with current NFIP standards, building codes, and other standards. Through implementing the building permit process, the Commonwealth can evaluate if structures must comply with the SI/SD provision and continue to work toward bringing existing structures in the special flood hazard zones into compliance with current NFIP standards. Currently, no Commonwealth-owned or operated structures meet the FEMA definition of a repetitive or severe repetitive loss structure (FEMA, 2024). Commonwealth owned or operated structures vulnerable to flooding are discussed in Section 4.5.

Currently, the flood plain manager is the only person administering the NFIP due to the low level of participation in the CNMI (see below) and the relatively low number of building permit applications for structures within Special Flood Hazard Areas (SHFA) identified on CNMI Flood Insurance Rate Maps (FIRMs). Through various permit processes—such as the building permit, zoning permit, Bureau of Environmental and Coastal Quality minor and major siting permits—the BSCD flood plain manager works with other CNMI agencies to administer the NFIP. The flood plain manager also inspects buildings within the flood plain to ensure compliance with regulations before building permits are finalized.

The CNMI participates in the NFIP at the state-level versus the community level; therefore, the level of participation in the NFIP has remained the same over the last 5 years. As of February 2024, only four NFIP policies were in force in the Commonwealth with total coverage in the amount of $356,000 (FEMA NFIP PIVOT, 2024). Commonwealth participation in the NFIP has historically been low. Although the number of NFIP policies in force between 2018 and 2024 was not included in the 2018 SSMP, there has not likely been a substantial change in insurance coverage. The Commonwealth has not participated in other NFIP related programs such as the Community Assistance Visits (CAVs) or Community Assistance Contacts (CACs) administered by FEMA.

Opportunities



Of the 14,282 occupied housing units in the CNMI, 71% or 10,145 are occupied by renters (US Census Bureau, 2024). Renters may purchase a contents-only flood insurance policy from the NFIP to cover contents up to $100,000. The NFIP policy covers personal property and contents during a flood event. Renters flood insurance premiums are calculated based on year of building construction, building occupancy, number of floors, location of contents, flood risk (i.e., flood zone), location of lowest floor in relation to elevation requirement on the flood map, and the deductible chosen and the amount of coverage. The number of contents-only flood insurance policies in force in the CNMI is presently unknown.

The NFIP Community Rating System (CRS) is a voluntary incentive program that encourages community floodplain management activities that exceed the minimum NFIP requirements. The CNMI does not currently participate in in the CRS program, though some officials have expressed interest in joining (FEMA, 2021a).

Challenges

According to the 2020 Census and 1991 FIRMs, approximately 3.55% of CNMI's population lives in a high hazard flood zone. Commonwealth property owners, businesses, and government agencies minimally participate in the NFIP managed by FEMA and delivered to the public by a network of insurance companies. The low participation rate is due in part to several factors: low percentage of households with mortgages, high rate of residents that rent rather than own, prohibitive premiums, and no licensed flood insurance agents in the CNMI. According to the National Flood Insurance Act, lenders must require borrowers whose property is with the SFHA to purchase flood insurance as a condition of a federally-backed loan. Article XII of the CNMI Constitution (Restrictions on Alienation of Land) restricts land ownership to persons of Northern Marianas descent such as Chamorro or Northern Marianas Carolinian or a combination of both. This restriction results in 80% or 3,325 homes in the CNMI being owned free and clear with only 20% or 812 homes being mortgaged (US Census Bureau, 2024). The low rate of home mortgages may explain, in part, why so few homeowners purchase flood insurance.

Flood insurance on homes and businesses located in SFHA costs substantially more than those properties located above or outside a floodplain. The dearth of licensed flood insurance agents in the Commonwealth requires anyone interested in flood insurance to consult with a broker elsewhere. To date, there are only two flood insurance providers for the Commonwealth (see | Flood Insurance Providers | FloodSmart) and neither have agents located in the CNMI. An increase in flood insurance options and policies have been identified as a community mitigation need. To help reduce the financial risks of flood damage, there is a desire to insure structures in the SFHA (FEMA, 2021a).

Risk MAP Program

The Risk Mapping, Assessment, and Planning (MAP) program, administered by FEMA in partnership with federal, state, territory, tribal, and local partners across the nation, is used to identify flood risk using the best available data and tools to promote informed planning and development practices. The Risk MAP program specializes in high-quality flood hazard modeling, which includes FIRMs for communities.

In January 2021, FEMA published the findings from the discovery phase of the Risk MAP program. During this phase FEMA listened to CNMI planning experts, public safety officials, water resource managers and engineers, as well as other community decision-makers, federal agencies, and FEMA's mitigation specialists to identify top hazards and needs (FEMA, 2021a). The Discovery Report is a snapshot of the CNMI's currently identified risks and hazards, and a collection of potential mitigation actions to address those issues (FEMA, 2021a). The findings include map update requests for new FIRMs based on projected future conditions and/or 100 year sea level extremes and an updated flood study to re-delineate flood zone boundaries and re-establish base flood elevations (BFEs) for the CNMI. Light Detection and Ranging (LiDAR) data used for formal flood analysis and additional natural resources and hazards planning is available for this update. The findings from the discovery phase are discussed in greater detail in Chapter 6.0 (Mitigation Strategy).

National Incident Management System

The National Incident Management System (NIMS) guides all levels of government, nongovernmental organizations, and the private sector to work together to prevent, protect against, mitigate, respond to, and recover from incidents. NIMS defines operational systems that guide how personnel work together during incidents. CNMI strives to maintain NIMS compliance with the Commonwealth's Emergency Operations Plan administered by HSEM.

High Hazard Potential Dams Program

The Commonwealth does not participate in the High Hazard Potential Dams Program because there are no dams in the territory.

5.4 Other Mitigation Programs and Partnerships

5.4.1 Climate adaption

The Commonwealth has experienced numerous consecutive super typhoon events that caused loss of vegetation cover and left communities exposed to severe and devastating effects of coastal flooding. The National Fish and Wildlife Foundation (NFWF), in partnership with the NOAA, is committed to supporting programs and projects that improve resilience by reducing communities' vulnerability to coastal storms, SLR, and flooding events through strengthening natural ecosystems and the habitat they provide.

As communities in the CNMI rebuild, community planners, conservation specialists, and others are using the *CNMI Coastal Resilience Assessment* (Dobson et al., 2020a) to help make informed decisions about restoration, conservation, or resilience projects that achieve dual benefits for both human and fish and wildlife communities that maximizes available funding opportunities. The assessment supports effective decision-making to help build resilience for communities facing flood-related threats. The GIS-based *CNMI Coastal Resilience Assessment* combines spatial data related to land use, protected areas, human community assets, flooding threats, and natural resources (specifically fish and wildlife resources) to identify and prioritize resilience hubs.

Resilience hubs are large areas of natural, open space or habitat where, if investments are made in conservation or restoration, there is potential for improved human community resilience and benefits to fish and wildlife habitats and species.

The *CNMI Coastal Resilience Assessment* (Dobson et al., 2020b) reveals abundant opportunities to use nature-based solutions to help build human community resilience while supporting important species and habitats. Nature-based solutions include actions that sustainably manage and utilize natural systems to address societal challenges such stormwater management, urban flooding, and heat islands while benefiting biodiversity and human well-being. Implementing nature-based solutions, such as coral reef or wetland restoration, provides tremendous co-benefits to people and wildlife.

5.4.2 Watershed Management

Water quality is closely connected with overall ecosystem health and resiliency of aquatic systems from the uplands to the marine environments. To improve water quality across all aquatic systems, the Commonwealth implements several watershed protection plans aimed at reducing non-point source pollution by improving upland habitats to attenuate effects to downstream and shoreline water quality. Through the Watershed Working Group, the BECQ partners with local and federal government agencies, environmental non-profits, and other stakeholders to provide technical expertise and project support on watershed initiatives.

In response to Super Typhoon *Yutu*, the US Army Corps of Engineers (USACE), under the authority of Section 729 of the Water Resources Development Act of 1986 (Public Law 99-662) as amended, completed a watershed assessment. The USACE provided recommendations both within and outside of the agency authorities to help rehabilitate and improve the resiliency of damaged infrastructure and natural resources, reducing risks to human life and property from future natural hazards. The *CNMI Post-Disaster Watershed Plan* (USACE, 2022) concluded that although developed area totals are relatively low for Saipan, Tinian, and Rota compared with total land mass, the degree by which human impacts may adversely affect ecosystems remains high because island infrastructure is typically located along the shoreline due to the terrain and need for harbor access. Human stressors that adversely affect marine ecosystems and infrastructure in coastal areas include land use practices that alter vegetative cover, increase the risk of fire and heat stress, impact drainage patterns and water quality, and result in overall environmental degradation. Human activities inland such as land clearing for agriculture or other purposes pose threats to terrestrial habitats and upland wildlife species (USACE, 2022, p. 22). Land use management is critical to balancing the needs of development with preservation of critical ecosystem services. Because the islands of Saipan, Tinian, and Rota are small, land use practices need to maintain a delicate balance with the conservation and management of natural resources. Public education and informational campaigns on hazardous mitigation raise community awareness and buy-in. Promoting sustainable development practices through partnerships and strengthening power infrastructure while promoting energy independence are some of the key areas for improvement. The recommendations proposed in the plan include management measures, implementation strategies as well as funding sources and partners.

A guiding standard of the *2021–2030 Comprehensive Sustainable Development Plan* (OPD, 2021) is Integrated Watershed Management Planning. In 2020, the Office of Planning and Development's Natural Resources Taskforce, which includes the BECQ and DLNR, collaborated to secure close to $1.7 million in funding from the NFWF to implement watershed management priority projects aimed at building resilience through restoring select wetlands and coral reefs in the Garapan Watershed. The NFWF Coastal Resilience project builds interagency planning and project implementation capacity with a focus on flood risk reduction and habitat restoration. Interagency collaboration and engagement, water quality and habitat monitoring, invasive species removal, and enhancement of coral and wetland plant nurseries are supporting ongoing restoration efforts in the Commonwealth.

The project is projected to outplant and monitor coral and wetland plants in Garapan, one of Saipan's priority watershed management areas, and is on track to continue through December 2024. Additional watershed planning coordination and priority project implementation continues—for example, in 2023, OPD was awarded funding through the FEMA BRIC program and the CNMI HMGP for projects that provide planning support for blighted building remediation on Saipan, Tinian, and Rota, and to assess shoreline management options at Micro Beach on Saipan.

5.4.3 Hazardous Waste

The DEQ administers hazardous waste management program for the Commonwealth. Facility compliance with the Hazardous Waste Management Regulations (Chapter 65-50) is determined by the DEQ. A multi-agency Emergency Response team, which includes DEQ, HSEM, DFEMS, the Department of Public Safety, and DPW, DCRM, Office of the Mayor, and Commonwealth Ports Authority-Aircraft Rescue and Fire Fighting, is equipped to response to natural and human-caused disasters such as typhoons, earthquakes, and chemical and oil spills. The importance of such emergency response capabilities was highlighted by Typhoon *Soudelor*, which ruptured a fuel tank at the Mobil Oil facility at the Saipan Port on August 5, 2015. The release of 500 gallons of diesel into the water closed the port for 5 days for clean-up operations and limited the service stations operations.

During the Threats and Hazards Identification Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR) processes, the HSEM examines capabilities to respond to hazardous materials following severe weather, earthquake, or other disaster. The Commonwealth aims to build capabilities to deploy HazMat teams to conduct assessments and execute response operations to control the release and effects of contaminants at bulk fuel facilities, utility facilities, inundated sites, and other sources of contaminant release within 24-hours. Gaps and needs were identified across all functional areas—planning, organization, equipment, training, and exercises—in the 2023 SPR report (HSEM, 2024a).

Comprehensive Economic Development Strategy

The *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (referred to hereafter as 2019 CEDS) (OPD, 2019) was published following Super Typhoon *Yutu*. In the 2019 CEDS, a strengths, weaknesses, opportunities, and threats (SWOT) analysis for the CNMI is presented. Through extensive public and agency stakeholder engagement, the OPD developed a list of projects to support economic activity. Projects were prioritized by 1) public benefit, 2) industry growth, 3) support of new or emergent industries, 4) SWOT impact, 5) employment sourcing 6) economic circulation, 7) environmental impact, and 8) infrastructure impact. Some of the projects listed in the CEDS align with risk reduction actions for natural hazards. The OPD and the Department of Commerce are currently working with members of the CEDS Commission and socio-economic Taskforce partners to support the 2025–2030 Comprehensive Economic Development Strategy update.

Highway Master Plan

The *CNMI 20-Year Highway Master Plan* (GHD, 2023) focuses on transportation issues related to mobility, safety, and congestion on the islands of Saipan, Tinian, and Rota. The plan identifies goals, policies, and improvement needs over the next 20 years for the CNMI transportation system with the aim to accommodate the need of each island while integrating their common needs into a unified transportation plan. The plan establishes a roadway classification scheme to assist the DPW in prioritizing transportation improvements and identifying deficiencies and constraints in the existing and expected future transportation networks. Stormwater management and flood risk reduction planning efforts are ongoing and require coordination across jurisdictions and sections to support road development and maintenance objectives. The Master Plan emphasizes complete streets planning. To support complete streets planning, the Commonwealth Healthcare Corporation completed Walkability Assessments for Saipan in 2021, and Tinian and Rota in 2022 as part of the effort to reduce non-communicable diseases through increased walkability.

5.4.4 Education and Outreach

Plan to Action

An effective hazard mitigation plan starts with educating government agencies and community stakeholders about the hazards that may affect the community and ways to implement mitigation strategies that reduce or minimize the impact of natural hazards. From August 8–11, 2023, HMGP and FEMA, with the support of the Office of Planning and Development, hosted a *Plan to Action* (P2A) Workshop and Consultation to support improved hazard mitigation planning and project implementation. Fifty representatives from all of the Mayor's Offices, agencies such as the Commonwealth Utilities Corporation and the Northern Marianas Housing Corporation, and non-governmental organizations such as the Marianas Alliance of Non-Governmental Organizations (MANGO) and the Mariana Islands Nature Alliance participated in the inaugural event that focused on application and eligibility of Hazard Mitigation Assistance grants in advance of the CNMI/FEMA Annual Consultation on August 11, 2023. The annual consultation meeting with FEMA aims to address challenges and opportunities specific to the CNMI's Hazard Mitigation Grant Program with local officials. "This Plan to Action workshop provided opportunities to learn together and discuss how to bridge the gap between hazard mitigation planning and developing applications to improve sustainability outcomes" (Elizabeth Balajadia, State Hazard Mitigation Officer).

Figure 5-1. Plan to Action Workshop stakeholders.
Source: Saipan Tribune, August 14, 2023

Tabletop Exercises

Tabletop exercises (TTX) allow emergency managers and first responders to test and validate emergency operating procedures and plans. To test the *2017 CNMI Typhoon Catastrophic Plan* (HSEM, 2018), the HSEM conducted a *Typhoon Pakyo TTX* as part of a workshop series. The *2022 Disaster Financial Management Plan TTX*, designed to test the Nation's first-ever Disaster Financial Management Plan, is used to establish and implement sound disaster financial management practices (HSEM, 2021b).

PRiMO Conference

The Office of Planning and Development with the support of the Governor's Office and Planning and Development Advisory Council highlighted how the Comprehensive Sustainable Development Plan is achieving *Smart, Safe Growth* including climate-smart adaptation and mitigation planning efforts in the Commonwealth at the International Union for Conservation of Nature (IUCN) World Conservation Congress in September 2021. In February 2024, the representatives from the HMGP, Northern Marianas College, HSEM, and the National Weather Service Guam participated in a multi-hazard disaster planning session at the Pacific Risk Management 'Ohana (PRiMO) Conference. The conference brought together experts in the field of emergency management to discuss strategies on the development and implementation of multi-hazard

Figure 5-2. PRiMO Conference stakeholders.

disaster plans. The session covered topics such as the 2024 SHMP Update, improvements to communication tools regarding disasters, on-the-ground typhoon preparedness and response, and existing tsunami and earthquake plans.

Voluntary Mitigation Programs

The Commonwealth voluntarily participates in other mitigation programs that help strengthen the safety of the community through advanced planning, education, and awareness. The TsunamiReady® and StormReady® programs, sponsored by the US National Weather Service (NWS), are federal programs that encourage governments to prepare for severe weather events. TsunamiReady® and StormReady® (TR-SR) Committee members include representatives from the HSEM, Office of the Mayor of Saipan, Bureau Coastal Environmental Quality, Northern Marianas College, Public School System, and Department of Public Works.

<u>TsunamiReady®</u>

Figure 5-3. TsunamiReady® program.

The Commonwealth is a recognized community participant of the TsunamiReady® program. In order for the NWS to recognize a community as TsunamiReady®, the community must have implemented the activities established in the TsunamiReady Guidelines to promotes tsunami hazard preparedness by collaborating with federal and local emergency management agencies, community leaders and the public. The TsunamiReady® program was established by the NWS and the National Tsunami Hazard Mitigation Program, in partnership with NOAA, FEMA, and the US Geological Survey in 2001. The TsunamiZone website provides the community with information for individuals, schools, and other organizations to support ongoing participation in tsunami preparedness activities and to promote awareness and preparedness. There is an opportunity to further increase awareness of the program and the benefits of being prepared for a tsunami. Thirty-eight (38%) percent of community stakeholders who responded to the 2024 SHMP planning process survey reported being somewhat familiar and unfamiliar with the TsunamiReady® program. There is an opportunity to increase public awareness campaigns that target tsunami hazard preparedness.

The TR-SR Committee members partner with the Guam Weather Forecast Office and the National Disaster Preparedness Training Center at the University of Hawai‘i to participate in tsunami workshops. The HSEM developed Tsunami Evacuation Maps with a whole community approach for Saipan, Tinian, and Rota in 2023. Evacuation routes were assessed and refined through input and data gathered from CNMI stakeholders and residents during town hall meetings. This effort was completed in tandem with the replacement of Tsunami Evacuation Signs around the Island of Saipan. Initiated in 2021, the Tsunami Siren Project will involve the installation of four early warning sirens on Saipan. Currently, the HSEM is coordinating with federal counterparts to enhance the Tsunami Evacuation Maps by adding a pedestrian evacuation map layer to the existing evacuation map products.

Figure 5-4. Rota tsunami evacuation sign.
Source: National Weather Service

Children under the age of 18 years are particularly vulnerable to natural hazards. Tsunami hazard educational activities are an important opportunity to improve child resiliency and information sharing in their homes. The HSEM collaborated with other partner agencies to conduct a tsunami drill with the Oleai Elementary School on June 3, 2021. The event involved over 200 participants (HSEM, 2021b). Education materials have also been updated and children’s activity booklets were created to educate the youth on tsunami-related terms and concepts (HSEM, 2023). These types of activities make it easier for children to understand and think about natural disaster issues, resiliency, and risk reduction.

StormReady®

The Commonwealth is also a recognized StormReady® community. The program encourages communities to take new, proactive approaches to improving local hazardous weather operations by providing emergency managers with guidelines on how to improve hazardous weather operations. In 2023, an updated weather station engineered to measure, monitor, and manage weather data at the CNMI Emergency Operation Center (EOC) was installed. The *CNMI All-Hazards Emergency Operations Plan (EOP)* (HSEM, 2021a)

Figure 5-5. StormReady® program
Source: National Weather Service

covers a full range of requirements prior to, during, and following an emergency or disaster. The HSEM also completed the development of a crisis-management solution that enables monitoring and management of daily and crisis operations from planning, mitigation, response, and recovery phases of an emergency. There is an opportunity to increase public awareness of the program. Fifty-four (54%) of community stakeholders who responded to the 2024 SHMP planning process survey reported being unfamiliar with the StormReady® program.

The Great ShakeOut

The Great ShakeOut, sponsored by FEMA, US Geological Survey, and the National Science Foundation in partnership with the National Earthquake Hazards Reduction Program, is an annual drill used to promote earthquake awareness and preparedness by practicing what to do before, during and after an earthquake (Drop, Cover and Hold On). It also encourages individuals and communities to update their emergency plans and supplies, and prepare their space to prevent damage and injuries from an earthquake. The Commonwealth has participated in The Great ShakeOut every year since the 2018 SSMP. Forty-eight (48%) of community stakeholders who responded to the 2024 SHMP planning process survey reported being somewhat familiar with The Great ShakeOut program.

The CNMI Public School System and other schools play a critical role in disaster risk reduction by integrating natural disaster education into the curricula and conducting practice drills. On October 19, 2023, over 11,000 people participated in *The Great CNMI ShakeOut* with K-12 grade children comprising the largest group of participants. Commonwealth and local government agencies, childcare and preschools, non-profit organizations such as the American Red Cross, Northern Mariana Islands Chapter, businesses, and families participate in this annual event. Educating children about natural hazards such earthquakes is a vital step in building resilience and preparedness.

Figure 5-6. The Great ShakeOut.
Source: Shakeout.org

Social Media

Figure 5-7. Outreach through social media.

Social media plays an integral role in how people communicate, share information, and connect. Emergency management and public safety officials in the Commonwealth are availing themselves of social outlets such as Facebook, Instagram, YouTube, X (formerly Twitter) or through mobile device apps to reach larger audiences of all ages and spread information more rapidly. The HSEM, CNMI Emergency Operations Center (EOC) State Warning Point Facebook page has over 7,000 followers. The platform is used as a supplemental channel to disseminate information and promote awareness of disaster preparedness. The HSEM is also using @cnmi_hsem on Instagram to broadcast updates on tropical disturbances, earthquakes, and tsunami watches. Launched in December 2017, the HSEM's CPM Committee & MDTV directed and produced a commercial to push emergency preparedness and encourage the CNMI #liveprepared. The commercial is available at https://youtu.be/xU8U4oajG_Q?feature=shared. The public can find more information on the on the CNMI Office of Homeland Security and Emergency Management Official YouTube Channel (2023) at www.youtube.com/@CNMIHomelandSecurity. The Ready CNMI mobile app, available for Android and iPhone devices, features real time alerts and notifications from the CNMI EOC–State Warning Point, and includes preparedness information, maps of emergency shelters in the CNMI and links to preparedness partners. Several government agencies stakeholders support the exchange of hazard awareness and emergency preparedness. The External Affairs Division of the Office of the Mayor of Tinian and Aguiguan frequently uses @tinianmayor_aldan on Instagram to broadcast HSEM and DFEMS public service announcements. For example, on March 19, 2024, the general public on Tinian was alerted to a fire in the north part of the island. Similarly, the Office of the Mayor for Saipan and Rota also use social media to reach their constituents and relay hazard warnings. Thirty-one (31%) of community stakeholders who participated in the 2024 SHMP survey reported social media as the best way for them to receive information about how to protect themselves and their families and prepare their homes and businesses against natural hazards. Leveraging social media as a broadcasting tool to enhance natural hazard awareness and preparedness presents an opportunity to further public engagement.

Virtual Training

The COVID-19 pandemic demonstrated that people could efficiently work together in a virtual meeting setting. Emergency preparedness training offered in virtual meeting setting increases attendance and improves equity and accessibility by allowing people to participate in ways that worked for them. For example, in March 2023, the Child Care and Development Fund providers completed Emergency Preparedness and Recovery Planning training that was funded by the Department of Human Health Services, Office of Child Care program under the Department of Community and Cultural Affairs. There is an opportunity to offer community-wide virtual training events directed at natural hazard awareness and preparedness.

5.5 Administrative and Technical Capabilities

The Commonwealth leverages the administrative and technical skills of government agencies and private sector staff and tools to implement hazard mitigation planning. Technical assistance is provided by emergency managers, floodplain managers, engineers, planners, historic preservation specialists and cultural resources officials, GIS analysts, building inspectors, economic development officers, and grant writers.

5.5.1 Office of Planning and Development

The growth of the Commonwealth relies on effective government and private actions and coordination among different agencies and levels of government. Public Law 20-20 § 20185 mandates that planning efforts are provided the appropriate financial, human, technical, and support resources necessary to accomplish the requirements of law relative to development planning.

The OPD and the Planning and Development Advisory Council (PDAC) members and other partners provide administrative and technical capabilities for sustainable planning and development that supports hazard mitigation. The PDAC and partners support gathering and centralizing data to support more efficient planning and project implementation as mandated in Public Law 20-20 § 20174(g). The state of the resources report is an invaluable source of information for disaster risk reduction planning. As mandated by Public Law 20-20 § 20174(b), (e), (g), (h), the OPD established an information system and data bank for the continual collection and storage of publicly available information needed or used in the development planning process (see https://opd.gov.mp./cnmi-data-library.html).

The *2021–2030 Comprehensive Sustainable Development Plan* (OPD, 2021) contains a schedule of programs and projects to be implemented annually. Funding for such projects and programs are identified in the plan by the principal or administering government agency or instrumentalities. The plan reviews US Economic Development Administration's Comprehensive Economic Development Strategy (CEDS) projects, Housing and Urban Development Community Development Block Grant (CDBG) projects, Capital Improvement Program (CIP) projects funded by the Office of Insular Affairs, Department of Interior through Section 702 of the CNMI Covenant, and other grant and local funding allocations for consistency with cross-cutting principles, goals, and objectives to ensure high priority management needs are effectively satisfied.

To promote administrative and technical understanding and implementation of *Smart, Safe Growth Principles*, over 90 individuals from various government agencies and organizations participated in a one-week training centered around *Smart, Safe Growth* (*SSG*) in July 2022.

The training included an in-depth look into what *SSG* is and the benefits of implementing it in the CNMI. It teaches communication techniques that support advocating for and training colleagues in *SSG*. A tutorial for the web-based *SSG* Evaluation Tool, available on the ArcGIS Survey 123 platform, allows users to assess a project's conformance with *SSG*. The *SSG* Evaluation Tool was updated in 2023. The *Smart, Safe Growth* training materials are publicly available on OPD's website (https://opd.gov.mp/ssg-trainig-materials.html).

5.5.2 Infrastructure and Recovery Program

Under Directive 21-005, the Office of the Governor's Infrastructure and Recovery Program, created on May 1, 2021, streamlines the process to expedite federally funded projects for various government agencies. The Infrastructure and Recovery Program (IRP) provides resources and subject matter experts to agencies to ensure timely completion of federally funded projects within the performance period. The IRP provides technical assistance to local government stakeholders to ensure their federally funded projects meet local and federal permitting requirements. It also works closely with local and federal permitting agencies to follow each technical assistance request to completion. Technical assistance includes archaeological assessments, Section 106 of the Historic Preservation Act review and monitoring, biological assessments and reports, engineering consultation and review, engineering inspection and monitoring, stakeholder coordination and liaising, planning and logistics for training, and technical writing assistance. The Commonwealth's ability to conduct local and federal compliance inspections *in-house* through IRP has saved the government and estimated $13.6 million in costs. Directive 21-005 for the IRP expired on May 2023.

The IRP helps to build capacity in the CNMI by offering training to local agencies in coordination with the Interagency Recovery Coordination, under the FEMA Joint Recovery Office. Training sessions included Public Assistance, Category A (Debris Removal), Category B (Emergency Protective Measures), and Category Z (Management Cost), Environmental Planning and Historic Preservation (EHP) and mitigation. In 2022, 270 participants availed themselves of the training, with the majority of participants participating in Environmental Planning and Historic Preservation (CNMI Office of the Governor, 2022).

5.5.3 Threat and Hazard Identification and Risk Assessment (THIRA)

The Threat and Hazard Identification and Risk Assessment (THIRA)/Stakeholder Preparedness Review (SPR) are critical tools for improving resilience by putting the National Preparedness System into action. Using the hazard mitigation together with the THIRA/SPR allows for a more holistic approach to achieving strategic mitigation goals. Both processes require the involvement of multiple stakeholders, identify potential threats and hazards, assess the risks, vulnerabilities, and capabilities for managing risks and potential impacts. A unified approach to hazard mitigation planning and THIRA/SPR processes provide opportunities for leveraging information and results from each in a complementary fashion. The HSEM is responsible for preparation and updates to the THIRA on a 3-year cycle, and the SPR annually. The HSEM completed the THIRA review process for the entire Commonwealth in 2023 and the SPR (HSEM, 2024b).

5.5.4 Geographic Information System (GIS)

The BECQ manages and updates a publicly available portal for geographic spatial data related to coastal management and environmental projects. The Open Data Portal is an invaluable tool for accessing data related to climate change (e.g., inundation and social vulnerability), natural resources (e.g., soils, vegetation, geology, etc.), regulated areas (e.g., floodplains, protected areas, wetlands, etc.), and general purpose (e.g., recreation, buildings, parcels, etc.). The Open Data Portal integrates data available at the national level from climate change projection databases such as NOAA, US Department of Agriculture-Natural Resources Conservation Sciences, and US Geological Survey with Commonwealth data sets. The CNMI Climate Impact Viewer v2022 is a map collating all available spatial data related to potential and existing climate impacts or hazards in the Commonwealth. The map is an active project that will continue to be updated as new data becomes available. Regulators, land use planners, and emergency services use the data when updating policies and procedures, comprehensive land use and economic development plans, and funding of projects that incorporate future climate conditions.

5.5.5 CREST

The Regional Coastal Resilience Assessments were developed by the NFWF, in partnership with NOAA, and University of North Carolina, Asheville-National Environmental Modeling and Analysis Center in consultation with the USACE and the Nature Conservancy-NatureServe. The Coastal Resilience Evaluation and Siting Tool (CREST) provides an interactive platform to view, download, and interact with the results of the *CNMI Coastal Resilience Assessment* (Dobson et al., 2020a). This assessment identifies areas on the landscape where the implementation of nature-based solutions have potential to maximize benefits for human community resilience to flooding threats and fish and wildlife habitat. The information is used in making informed decisions about the siting of coastal restoration and resilience projects.

5.5.6 WebEOC

The Commonwealth uses WebEOC, an emergency management software used before, during, and after disasters. The software allows government authorities, corporations, educational institutions, health systems, and non-profit groups to have complex emergency management to maintain a common operating picture during emergency response. WebEOC enables agencies and organizations to break down geographic, jurisdictional, and communication barriers.

5.5.7 Federal Technical Assistance and Funding

Federal agencies play a crucial role in providing training and technical assistance for hazard mitigation. Federal agencies actively engage in providing technical assistance as well as funding to enhance hazard mitigation efforts and build resilient communities.

Federal Emergency Management Agency

FEMA collaborates with Commonwealth and local government staff and community decision-makers to assist in hazard mitigation actions. As part of the FEMA Risk MAP process, FEMA provides technical and administrative support as the path to resilience is refined, data and decision-making tools are developed, and projects and plans are implemented. As the flood mapping update project unfolds, FEMA and its partners prepare data and maps, collaborate with stakeholders to obtain the necessary data. FEMA collaborates with Commonwealth stakeholders to review data, floodplain mapping and methodologies, and deliverables. Throughout the process, FEMA provides technical assistance related to program areas, including flood management, mitigation planning, and grants support (FEMA, 2021b).

Various federal agencies provide training for mitigation efforts and hazard mitigation planning. During the FEMA Risk MAP discovery phase, many communities express interest in staff training. The Emergency Management Institute develops and delivers training to enhance capabilities to minimize the impact of disasters and emergencies on the public with particular emphasis on the National Response Framework, National Incident Management System, and National Preparedness Guidelines. The Association of State Floodplain Managers provides training, both in-person and online, to support floodplain management and floodplain managers.

The BRIC program from FEMA provides mitigation planning and project grants and technical assistance to support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC grant sims to shift federal focus away from reactive disaster spending and toward research-supported proactive investment in community resilience by providing funding for greater investments in resiliency and mitigation efforts in preparation for natural hazard events, including mitigation planning and project grants. Funding is also available for management costs. Building Resilient Infrastructure and Communities | FEMA.gov

US Army Corps of Engineers

The USACE provides technical assistance, planning, feasibility studies, and/or construction efforts. Most USACE authorities require a non-Federal cost share, however cost share waivers may be available, per Section 156 of Water Resources Development Act of 1986, as amended.

Floodplain Management Services (FPMS), authorized under Section 206 of the Flood Control Act, as amended, provide communities with technical and planning services to support effective floodplain management. Under the FPMS program, USACE supports both riverine and coastal flood risk reduction efforts and empowers communities to better understand their risks of flooding and develop plans to communicate and manage that risk. Activities provided under this authority include hydrologic and hydraulic technical services, general planning guidance, education and outreach material, and National Flood Insurance Program support. Flood Plain Management Services, U.S. Army Corps of Engineers, New England District

The Emergency Operations: Flood Control and Coastal Emergencies authorizes the USACE to undertake activities including disaster preparedness, advance measures, emergency operations (Flood Response and Post Flood Response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source. Public Law 84-99 (army.mil)

Planning Assistance to States (PAS) offers technical assistance, pursuant to Section 22 of Water Resources Development Act of 1974, as amended, that supports planning efforts related to the management of water resources. This includes the provision and integration of hydrologic, economic, or environmental data and analysis in support of water resources management and related land resources development plans. The technical assistance may not include preparation of site-specific designs or construction. Technical assistance activities through the PAS program are cost shared (50%) with the non-Federal sponsor and voluntarily contributed funds in excess of cost share may be provided by the non-Federal partner. The cost-share for technical assistance must be provided by funds (not in-kind). Planning Assistance to States (army.mil)

US Department of Energy

The Department of Energy State Energy Program offers technical assistance and grant funding to implement energy security, resiliency, and emergency preparedness plans and develop Commonwealth-led strategic energy initiatives. State Energy Program | Department of Energy

US Department of Housing and Urban Development

The US Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) offers technical assistance and funding to helps states ensure affordable housing, to provide services to low and moderate income communities, and to create jobs. The CDBG Program awards grants to smaller units of local government. Community Development Block Grant Program | HUD.gov / U.S. Department of Housing and Urban Development (HUD)

The Community Development Block Grant-Disaster Recovery Program (CDBG-DR) offers funding to address disaster-related recovery activities, meet a national objective of CDBG, or be CDBG eligible. Funds can be used for disaster relief, long-term recovery, restoration of infrastructure, housing, or economic revitalization. Community Development Block Grant Disaster Recovery Grant Funds | HUD.gov / U.S. Department of Housing and Urban Development (HUD)

The Community Development Block Grant-Mitigation (CDBG-Mit) provides funding to mitigate against disaster risks, while allowing the opportunity to transform local planning. The program requires reference to applicable FEMA Hazard Mitigation Plans (HMP) in proposed action plans and describes how the HMP informs the CDBG-MIT action plan. Funding may also use for planning activities, including but not limited to regional mitigation planning, the integration of mitigation plans with other planning initiatives, and activities related to FEMA's Pre-Disaster Mitigation. CDBG-MIT: Community Development Block Grant Mitigation Funds - HUD Exchange

US Department of Interior

The US Department of Interior National Coastal Wetlands Conservation Grants Program provides annual grants of up to $1 million to protect, restore, and enhance coastal ecosystems and associated uplands. The grants are funded through the Sport Fishing Restoration and Boating Trust Fund, which is supported by excise taxes on fishing equipment and motorboat fuel. National Coastal Wetlands Conservation Grants | U.S. Fish & Wildlife Service (fws.gov)

US Department of Transportation

The US Department of Transportation Federal Transit Administration's Emergency Relief Program offers technical assistance and grants to reimburse for disaster damage related to public transportation systems. This funding helps pay for capital projects to protect, repair, and replace equipment and facilities that have been seriously damaged from a major disaster. Emergency Relief Program | FTA (dot.gov)

US Economic Development Administration

The US Economic Development Administration Economic Adjustment Assistance Program offers technical assistance and funding to support distressed communities experiencing adverse economic changes that may result from industrial or corporate restructuring, new Federal laws or requirements, reduction in defense expenditures, depletion of natural resources, or natural disaster. Economic Adjustment Assistance grants are intended to enhance a distressed community's ability to compete economically by stimulating private investment in targeted areas. Economic Adjustment Assistance | U.S. Economic Development Administration (eda.gov)

The Economic Development Disaster Supplemental Funding provides grants to help regions recover from the economic harm and distress resulting from natural disasters to rebuild stronger, more resilient economies. Fiscal Year 2023 Disaster Supplemental | U.S. Economic Development Administration (eda.gov)

National Oceanic and Atmospheric Administration

The NOAA National Coastal Resilience Fund (NCRF) provides funding that benefits coastal communities by reducing the impact of coastal flooding and associated threats to property and key assets, such as hospitals and emergency routes; improving water quality and recreational opportunities; and enhancing the ecological integrity and functionality of coastal and inland ecosystems. National Coastal Resilience Fund (noaa.gov)

The National Coastal Zone Enhancement Program provides technical assistance and funding to help improve Coastal Management Plans. The program focuses on 9 enhancement areas: wetlands, coastal hazards, public access, marine debris, cumulative and secondary impacts, special area management plans, ocean and Great Lakes resources, energy and government facility siting, and aquaculture. Every five years, states and territories review their programs to identify priority needs and opportunities for improvement. The programs work with NOAA to develop multi-year improvement strategies. NOAA Office for Coastal Management | The National Coastal Zone Management Program

The NOAA Coral Reef Conservation Funding Opportunities support projects through several financial assistance programs. NOAA's Coral Reef Conservation Program (CRCP) - Grant Program Funding Opportunities

US Small Business Administration

The US Small Business Administration Disaster Loan Assistance provides long-term, low interest loans to rebuild damaged facilities, with additional loans for mitigation assistance to prevent future loss of the same type. Disaster assistance | U.S. Small Business Administration (sba.gov)

Silver Jackets

The Silver Jackets is an innovative interagency program that brings together multiple state, federal, and sometimes tribal and local agencies to learn from one another and jointly apply resources to reduce flood risk. The Silver Jackets teams are state-led interagency teams. This authority provides technical assistance to communities to support throughout all phases of the flood risk management cycle (preparation and training, response, recovery, and mitigation). These interagency teams utilize nonstructural measures to reduce flood risk, including projects such as education and outreach events, emergency planning and training, non-structural education, and data gathering and dissemination. Silver Jackets projects are federally funded with matching in-kind contributions from other Federal and local agencies. There is an ongoing effort to develop a team in the Commonwealth.

5.6 Financial Capabilities

Element S8-b. Does the plan include a general discussion of state funding capabilities for hazard mitigation actions and projects?

The economic difficulties experienced during the development of the 2010 SSMP, the 2014 and 2018 SSMP cycles coupled with the economic fallout from COVID-19 pandemic exacerbated the challenges for local funding for mitigation and other preparedness activities in the Commonwealth. Hazard mitigation funding continues to be heavily reliant on federal resources in the form of grants. Mitigation projects within the Commonwealth are primarily funded through FEMA Pre-Disaster grants and HMGP for long-term, immediate recovery mitigation measures. Other funding sources include the Capital Improvement Program (CIP), which receives annual funding from the Office of Insular Affairs through Section 702 of the CNMI Covenant.

Table 5-2 summarizes FEMA hazard mitigation grant funding programs, their purpose, and applicability of pre- or post-disaster requirements.

Table 5-2. Summary of FEMA Mitigation Funding.

Hazard Mitigation Grant Program
Purpose: To provide funds to states, territories, Indian tribal governments, and local communities to significantly reduce or permanently eliminate future risk to lives and property from natural hazards. HMGP funds projects in accordance with priorities identified in state or local hazard mitigation plans and enables mitigation measures to be implemented during the recovery from a disaster. **Availability:** Post-Disaster. When authorized under a Presidential major disaster declaration in areas of the state requested by the Governor.
Building Resilient Infrastructure and Communities
Purpose: To provide funds to states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program guiding principles are supporting communities through capability and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. **Availability:** Pre-Disaster
Pre-Disaster Mitigation
Purpose: Makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures. These mitigation efforts are designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters. This funding is offered in addition to funds provided through other FEMA grant programs for projects that will support growing mitigation needs nationwide. **Availability:** Pre-Disaster

Table 5-2. Summary of FEMA Mitigation Funding (*cont'd).*

Flood Mitigation Assistance
Purpose: To implement cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other structures insured under the National Flood Insurance Program (NFIP). As noted, the FMA combines the previous Repetitive Flood Claims and Severe Repetitive Loss grants into one grant program. **Availability:** Pre-Disaster
HMGP Post-Disaster Fire Assistance and Fire Management Assistance Grant
Purpose: Provides assistance to help communities implement hazard mitigation measures after wildfire disasters. **Availability:** Post-Disaster
High Hazard Potential Dam Grant Program
Purpose: Provides technical, planning, design and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. **Availability:** Pre- and Post-Disaster
Public Assistance
Purpose: Provides federal assistance to government organizations and certain private non-profit organizations following a Presidential Disaster Declaration so that communities can quickly respond to and recover from major disasters or emergencies. Provides assistance to supplement federal disaster grants for debris removal, life-saving emergency protective measures, and the repair, replacement, or restoration of disaster-damaged publicly owned facilities and the facilities of certain private non-profit organizations. Supports local communities with opportunities to strengthen infrastructure that has been proven to fail under disaster conditions. **Availability:** Post-Disaster

Source: FEMA

5.6.1 Past Hazard Mitigation Projects

Past hazard mitigation project funding came from a variety of sources including:

- Hardening of Commonwealth Utilities Corporation Waterwells—Pre-Disaster Mitigation (PDM)
- Backup Generator at the CNMI Emergency Operations Center—Homeland Security Grant Program
- Tsunami Evacuation Route Signage—National Tsunami Hazard Mitigation Program
- Renovation of Rota High School Gym as a Disaster Shelter, including structural repairs and storm shutters—Capital Improvement Projects
- Hardening of Mt. Tapochau Communication Tower—Commonwealth General Funds

Since the 2018 SSMP, significant disaster recovery funding and hazard mitigation prioritization followed the devastation of Typhoon *Mangkhut*, Super Typhoon *Yutu*, COVID-19, and Typhoon *Mawar.* Tables 5-3 to 5-5 summarize FEMA funds received by the Commonwealth for these disasters. Also, Public Assistance Program Worksheets for Typhoon *Yutu* (DR-4404-MP) and Typhoon *Mangkhut* (DR-4396-MP) can found in Appendix E (Mitigation Capabilities Supplement).

Table 5-3. FEMA awards by disaster declarations and grant programs 2018–2024.

Grant	Total
DR-4404 Super Typhoon *Yutu*	$61,568,870.72
DR-4396 Typhoon *Mangkhut*	$326,762.71
DR-4235 Super Typhoon *Soudelor*	$6,720,163.69
PDM FY 2017–2019	$591,615.25
BRIC 2020	$659,970.20
DR-4511 COVID	$2,000,000.00
Total	**$71,867,382.57**

Table 5-4. Status of requests for FEMA funding for DR-4404, DR-4396, DR-4511, BRIC and PDM (FY2017–2019) 2018–2024.

FEMA Grant Status	Amount
Projects—Awarded	$11,409,737.87
Projects—Phase 2 Estimate	$31,715,183.00
Projects—Pending FEMA Review	$21,805,164.00
Projects—Completed	$7,069,892.70
Projects——Withdrawn	$12,444,733.00
Sub-recipient Management	$200,963.14

Table 5-5. Post-disaster project requests for FEMA funding by agency 2018–2024.

Agency	No. of Projects by Agency	Total
Commonwealth Healthcare Corporation	3	$871,358.00
Commonwealth Port Authority	4	$346,040.25
Commonwealth Utilities Corporation	8	$25,545,311.66
Department of Community and Cultural Affairs	5	$238,255.89
Department of Fire and Emergency Medical Services	2	$4,064,865.00
Department of Public Works	4	$12,154,706.28
Department of Public Safety	1	$37,223.59
Office of the Governor	4	$9,367,938.60
Office of the Mayor of Tinian and Aguiguan	1	$272,595.75
Office of the Mayor of Rota	1	$901,024.00
Northern Marianas Housing Corporation	2	$1,083,221.56
Office of the Governor, Office of Planning and Development	1	$345,000.00
Public School System	1	$1,458,665.00
Total		**$56,686,205.58**

In accordance with HUD regulations and requirements, the CNMI Northern Marianas Housing Corporation released the *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan* related to the 2018 Disasters Typhoon *Mangkhut* and Super Typhoon *Yutu* in 2023 (NMHC, 2023).

Additional typhoons and tropical storms have impacted the CNMI. In 2023, Typhoon *Mawar* (DR-4716-MP) and Typhoon *Bolaven* (EM-3602-MP) impacted the Commonwealth. In each instance, the CNMI HSEM was the lead coordinating agency that responded to and led recovery efforts alongside local and federal partners to restore water and power to the impacted residents of the Commonwealth.

Investment in Infrastructure and Jobs Act (i.e., Bipartisan Infrastructure Law)

The Investment in Infrastructure and Jobs Act, as known as the Bipartisan Infrastructure Law, makes a historic investment to bolster resilience against pressing challenges like impacts from climate change, extreme weather events, and other hazards. To date, approximately $21.5 million has been allocated to the CNMI for infrastructure resilience in 2022 and 2023.

5.6.2 FEMA Funding

Adopted under US Public Law 93-288, Section 404, the Commonwealth uses two of the three Hazard Mitigation Assistant grant programs under FEMA—HMGP and PDM. The BRIC program was created by Section 3041 of the Disaster Recovery Reform Act of 2018 which amends Section 203 of the Stafford Act and replaces the PDM program. The first BRIC cycle started in fiscal year 2020.

Following a major disaster declaration, HMGP continues to provide services based on a 36-month period of performance. In contrast, PDM grants are funded annually by US Congressional appropriations. The HMGP and PDM are currently funding approved mitigation projects for typhoon disasters from Typhoon *Soudelor* (FEMA DR-4235-MP), Typhoon *Mangkhut* (FEMA DR-4396-MP), and *Super* Typhoon *Yutu* (FEMA DR 4404-MP). Appendix E (Mitigation Capabilities Supplement) includes HMGP and PDM funded projects. Currently, no HMGP Fire Management Assistance Grants are available. In the past, the Commonwealth used Hazard Mitigation Grant Program (HMGP) Post-fire, BRIC, or Flood Mitigation Assistance (FMA) funds.

The CNMI Office of the Governor HMGP works with FEMA to develop hazard mitigation plans and implement Hazard Mitigation Assistance (HMA) projects to help the CNMI rebuild and to reduce or mitigate future disaster losses. Individuals, business owners, and private nonprofits cannot directly apply for HMA funding from FEMA, but HMGP encourages collaboration with eligible sub applicants such as local government agencies, emergency management offices, or in specific cases, eligible nonprofit organizations, to develop mitigation activities that align with the local hazard mitigation plan to reduce damage from future natural disasters. These local subapplicants then submit their project sub-applications to HMGP for possible inclusion in the CNMI's FEMA HMA application.

Building Resilient Infrastructure & Communities

Since 2010, most of the CNMI mitigation projects have received FEMA mitigation grant funding for storm mitigation for the Northern Marianas Housing Corporation, Hazard Mitigation Plan updates, flood control and drainage projects, and infrastructure updates for key government buildings (FEMA, 2021a).

Funding is critical for the objective implementation and to support short- and long-term adaptive management planning efforts. As detailed in Public Law 20-20 § 20182, the CSDP includes many mitigation and climate adaptation projects and a schedule of programs and projects implemented annually. Funding for the programs and projects outlined in the CSDP in large part is already allocated through the budget requests and grant funds of identified lead agencies. Where data gaps are identified, OPD works with planning and resource management partners and financial management partners within the CNMI Office of the Governor, federal grantors, and private or non-governmental organization representatives as appropriate to identify and support cross-cutting priorities.

Funding to pay for *Smart, Safe Growth* initiatives such as retrofitting vulnerable infrastructure, buy-out programs for vulnerable development, and land acquisitions is a challenge (OPD, 2021). Many *Smart, Safe Growth* projects address hazards potentials that are likely over the long-term. In the near term, it is often difficult to justify the added expense for long-term projects, especially when governments are fiscally constrained and have difficulty funding short-term priorities. However, several tools are available to assist governments and communities in developing multiple approaches to fund *Smart, Safe Growth* projects. Many Federal agencies provide funding opportunities to help governments fund long-term projects that will foster *Smart, Safe Growth*. For example, due to FEMA's match waiver for *Smart, Safe Growth* compliant projects, implementation of *Smart, Safe Growth* practices and principles saved the Commonwealth government approximately $20 million in costs for DR-4404 mitigation projects.

5.6.3 National Fish and Wildlife Foundation

In 2020, the OPD secured close to $1.7 million in funding from the NFWF to implement projects aimed at building resiliency through restoration of select wetlands and coral reefs. With this funding, the OPD was able to support BECQ and DLNR with filling five staffing positions needed to execute this flood risk reduction and habitation restoration project.

5.6.4 Environmental Protection Agency

Following Super Typhoon *Yutu*, OPD secured $56 million in Additional Supplemental Appropriates for Disaster Relief Act funding through the Environmental Protection Agency (EPA) to support critical solid was disaster recovery projects. OPD oversees several of these major infrastructure development projects.

5.6.5 Department of Homeland Security, Federal Emergency Management Agency, and National Oceanic and Atmospheric Administration

In 2023, the HSEM received preparedness grant funding from the Department of Homeland Security-FEMA in the amount of $2,076,096. Additionally, they secured $264,795 in tsunami mitigation funding from NOAA.

The development of the SHMP through the mitigation planning process assists HMGP and other agencies within the Commonwealth to plan for grant funding opportunities provided by FEMA, Department of the Interior, HUD, NOAA, and other grantors with hazard-specific grant awards. With an approved SHMP, the Commonwealth may avail itself of various hazard mitigation assistance programs, including the HMGP, BRIC, and the Flood Mitigation Assistance (FMA) program.

5.6.6 Coronavirus Pandemic

The Federal Government enacted the Coronavirus Aid, Relief, and Economic Security (CARES) Act to provide support to Americans affected by the economic fallout. HUD awarded $275,414 in CARES Act funding to the Northern Marianas Housing Corporation to prepare and prevent the spread of COVID-19. They were also awarded $275,414 in Emergency Solutions Grant funds to assist families that are homeless or at risk of homelessness.

The US Department of Interior allocated $4,409,485 through the Office of Insular Affairs for several COVID-19 related projects including $366,900 for personal protective equipment and hygienic supplies to government workers and the CNMI public.

Upon the enactment of the CARES Act, US Department of Human and Health Services allocated $3,903,447 for multiple programs in the CNMI. To date, most of the funds received have been awarded to the Office of the Aging to continue the Home Meal Program and the Child Care Licensing Program under the Department of Community and Cultural Affairs.

5.7 Opportunities to Improve Capabilities

Element S8-c. Does the plan include a summary of obstacles, challenges, and proposed solutions related to any state capabilities, including a brief discussion of potential strategies for overcoming any challenges related to implementing and enforcing hazard-resistant building codes statewide, as applicable, and changes since the previous plan approval?

Throughout the stakeholder engagement process for the 2024 SHMP Update, stakeholders noted gaps and challenges in existing Commonwealth capabilities to implement hazard mitigation actions and build resilience. Opportunities for improvement on capabilities include the following:

- There is a need to coordinate economic development planning and hazard mitigation planning. New mitigation actions that tie priorities established by the economic sector should more closely align with emergency management.

5.7.1 Land Use and Development

Land use and development is a critical part of mitigation planning. Through proactive planning, CNMI can evaluate the intersection of development and hazards to reduce vulnerabilities and increase resiliency of land use and development and the economy.

Under Public Law 20-20 § 2013(a), OPD published the CSDP (OPD, 2021) to serve as a guide for future long-range development using and improving on existing plans, maps, and other resources. The categories assessed in the plan include land use, community design, transportation, public facilities, public lands, public buildings, housing redevelopment, conservation, recreation, safety, tourism, development policy, capital improvements, labor work force, specific policies, and other elements related to the physical development of the CNMI.

Article XI of the Commonwealth Constitution (Public Laws 12-33, 12-71, 15-2, 2 CMC § 2800 et seq.) mandates the Department of Public Lands (DPL) to administer the Commonwealth's public lands for the benefit of all persons of Northern Marians Descent. In 2019, the DPL updated the *CNMI Comprehensive Public Land Use Plan for Rota, Tinian, Saipan, and the Northern Islands* (PLUP) (DPL, 2019)—the first update since 1989. In this plan, the DPL established five public land uses—Grant of Public Domain Public Land, Designated/In Use Public Land, Undesignated/Not In Use Public Land, Leased Public Land, and Covenant/Military Leased Public Land along with maintaining public land data in a GIS that is regularly updated.

The *Guidance Manual for Smart, Safe Growth of the Northern Mariana Islands* (NES, 2018) outlines a number of recommendations for improving capabilities include updating regulations and the permitting process, hazard mitigation supported by long-term mitigation planning, and continued efforts to identify and incorporate *better building* principles and practices in planning and development (NES, 2018). *Smart, Safe Growth* (*SSG*) is a comprehensive planning approach with three critical areas of practice—hazard mitigation, climate impact adaptation, and smart growth—each associated with voluminous policy guidance and best practices.

5.7.2 Building Code Updates

The Commonwealth adopted and implemented the 2018 International Building Code (IBC). The 2018 IBC establishes improved standards for construction that will enhance resiliency of the built environment to extreme weather events and other natural hazards.

- Recommended building codes be regularly updated, and training provided to CNMI building code officials and the CNMI contractor community.

5.7.3 Permitting and Land Use

- Increase interagency coordination and communication to help ensure permit reviews and approvals consider and find solutions to second and third order effects of multiple, major development activities occurring simultaneously (e.g., disrupted or increased traffic, inadequate power or water, inadequate inspection support, etc.).
- Increase cooperation within the CRM Board will help to ensure development proceeds at a pace that protects CNMI's natural resources and limits stress on facilities and infrastructure.

5.8 Opportunities to Improve the Mitigation Capabilities Assessment

FEMA provided recommendations for improvements to the SHMP (see Appendix G). Many of these recommendations were incorporated into the 2024 SHMP Update. The Mitigation Capabilities Assessment recommendation to be incorporated in the 2029 SHMP Update is:

- Consider including a brief narrative for each of the projects and activities that have received FEMA funding and expand on how PA Mitigation, FMA and HMGP Post Fire grant dollars have been used to complete a number of efforts within the CNMI.

A task to annually review the opportunities for improvement provided by FEMA was added to the Annual Maintenance Schedule for the SHMP (Table 7-1).

References

[BECQ] Bureau of Environmental and Coastal Quality. (2018). *2018 Guidance on Using the Mitigation Hierarchy to Avoid Impacts of Projects and Activities*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/Mitigation-Hierarchy-Rule-2018.pdf

[BECQ-DCRM] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2020). *2021-2025 Section 309 Assessment & Strategy Report Commonwealth of the Northern Mariana Islands*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/CNMI_2021-2025_309-AS-Report_Final.pdf

[BECQ-DCRM] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2022). *Better Building Practices in the CNMI: Addressing Coastal Hazards Through Responsible Development and Resiliency*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/DCRM-Better-Buildings-Guidebook-v.1_July252022-2.pdf

[BECQ-DCRM] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2023). *Citizen Centric Report Fiscal Year 2023*. CNMI Office of the Governor. https://www.opacnmi.com/oockuvoa/2023/10/BECQ-DCRM-FY-2023-CCR.pdf

[HSEM] CNMI Homeland Security and Emergency Management. (2018). *2017 CNMI Catastrophic- Typhoon Plan, Annex to the FEMA Region IX All-Hazards Plan* (p. 417). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2021a). *Commonwealth of the Northern Mariana Islands Emergency Operations Plan* (p. 132). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2021b). *FY 2021 Citizen Centric Report*. CNMI Office of the Governor.

[HSEM] CNMI Homeland Security and Emergency Management. (2023). *FY 2023 Citizen Centric Report*. CNMI Office of the Governor.

[HSEM] CNMI Homeland Security and Emergency Management. (2024a). *2023 CNMI Stakeholder Preparedness Review (SPR)* (p. 228). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024b). *2023 CNMI Threats and Hazards Identification Risk Assessment (THIRA)*. CNMI Homeland Security and Emergency Management.

CNMI Office of the Governor. (2022). *Infrastructure and Recovery Program*. CNMI Office of the Governor. https://www.opacnmi.com/oockuvoa/2022/11/Infrastructure-Recovery-Program-FY-2022-CCR.pdf

Commonwealth Zoning Board. (2023). *FY2023 Citizen Centric Report*. CNMI Office of the Governor. https://www.opacnmi.com/oockuvoa/2024/01/Commonwealth-Zoning-Board-FY-2023-CCR.pdf

[DPL] Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

[DPL] Department of Public Works. (2020). *Building Safety Code Rules and Regulations* (Number 7 42). Commonwealth Register. https://cnmilaw.org/pdf/cnmiregister/2020_Volume_42/2020_Number_07.pdf

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020a). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020b). *Regional Coastal Resilience Assessments: Methodology and Data Report* (p. 74). UNC Ashville National Environmental Center.

[FEMA] Federal Emergency Management Agency. (2010). *Substantial Improvement/Substantial Damage Desk Reference* (FEMA P-758; p. 174). US Homeland Security, Federal Emergency Management Agency.

[FEMA] Federal Emergency Management Agency. (2020a). *Building Codes Save: A Nationwide Study Losses Avoided as a Result of Adopting Hazard-Resistant Building Codes* (p. 189). Federal Emergency Management Agency. https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf

[FEMA] Federal Emergency Management Agency. (2020b). *Special Wind Region (SWR) Maps for the Commonwealth of the Northern Mariana Islands (CNMI)* (p. 11). US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2021a). *Codes, Standards, and Permitting: Mitigation Assessment Team Summary Report and Recommendations, Commonwealth of the Northern Mariana Islands, Super Typhoon Yutu* (p. 23). US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2021b). *Region 9, the Commonwealth of the Northern Mariana Islands Discovery and Engagement Report. Risk Mapping, Assessment, and Planning Program: A Snapshot of Community Identified Risks and Risk Reduction Actions.* (p. 32). US Homeland Security, Federal Emergency Management Agency.

[FEMA] Federal Emergency Management Agency. (2024). *National Flood Insurance Program (NFIP)*. PIVOT System. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fnfipservices.floodsmart.gov%2Fsites%2Fdefault%2Ffiles%2Fnfip_policy-information-by-state_20240229_0.xlsx&wdOrigin=BROWSELINK

GHD. (2023). *CNMI 20-Year Highway Master Plan, Final Report* (p. 200). CNMI Department of Public Works.

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

[NES] Nimbus Environmental Services. (2018). *Guidance Manual for Smart, Safe Growth Commonwealth of the Northern Mariana Islands* (p. 295). Federal Emergency Management Agency.

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

[OPD] Office of Planning and Development. (2019). *2019 Commonwealth of the Northern Mariana Islands Comprehensive Economic Development Strategy Update* (p. 204). CNMI Office of the Governor.

[OPD] Office of Planning and Development. (2021). *2021-2030 CNMI Comprehensive Sustainable Development Plan (CSDP) for the CNMI*. CNMI Office of the Governor. https://opd.gov.mp/assets/2021-2030_cnmi_csdp.pdf

[OPD] Office of Planning and Development. (in prep.). *Draft—2023 Resources Report* (p. 687) [Planning for Sustainability in the Commonwealth of the Northern Mariana Islands]. CNMI Office of the Governor.

[USACE] US Army Corps of Engineers. (2022). *The Commonwealth of the Northern Mariana Islands Final Post Disaster Watershed Plan* (p. 166). US Army Corps of Engineers, Honolulu District.

US Census Bureau. (2024). *2020 Island Areas Censuses: Commonwealth of the Northern Mariana Islands (CNMI)* [dataset]. https://www.census.gov/data/tables/2020/dec/2020-commonwealth-northern-mariana-islands.html

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Chapter 6.0 Mitigation Strategy

28 July 2024

Table of Contents

List of Tables

6.0 Mitigation Strategy

6.1 2024 SHMP Update Changes

The 2024 State Hazard Mitigation Plan (SHMP) Update changes include:

- Hazard mitigation goals were reviewed and validated. All 2018 Standard State Mitigation Plan (SSMP) goals were maintained with enhancements to strengthen the wording.
- Mitigation objectives were added to support the goals and measure mitigation success.
- A comprehensive review and evaluation of the 2018 SSMP mitigation action plan was conducted, and a synopsis of notable achievements was developed.
- The 2018 SSMP mitigation actions, updated risk assessment, updated capability assessment, local Hazard Mitigation Plan actions, and stakeholder input were used to identify mitigation actions for the 2024 SHMP Update.
- The updated action plan only includes projects that Commonwealth agencies have the authority to implement.

6.2 Overview

The mitigation strategy sets the mitigation program priorities and helps guide the Commonwealth agencies as they update their plans. The mitigation strategy is composed of goals, objectives, and actions that directly address the risks and vulnerabilities identified in the risk assessment as well as the findings of the capability assessment. The following sections outline the mitigation goals and objectives; reviews, evaluates, and updates the mitigation actions identified in the 2018 SSMP; identifies new actions; and prioritizes all actions for implementation over the performance period of the 2024 SHMP Update.

6.3 Mitigation Goals and Objectives

Element S9 and 44 CFR § 201.4(c)(3)(i). Does the mitigation strategy include goals to reduce long-term vulnerabilities from the identified hazards? The goals represent what the territory seeks to accomplish through mitigation plan implementation using a wide range of funding, including non-FEMA funding. The goals must be consistent with the hazards and vulnerabilities identified in the risk assessment.

As part of the 2024 SHMP Update process, the 2018 SSMP goals, objectives, and mitigation actinons were reviewed, updated, and validated (see Appendix F [Mitigation Strategy Supplement] for a list of the 2018 mitigation goals, objectives, and actions). Additional mitigation actions were developed for the 2024 SHMP Update to meet multiple goals and align with objectives already established in the Commonwealth; objectives were reviewed to verify that they could be used as measures for success for implementing actions in the 2024 SHMP Update.

During stakeholder meetings in May 2024, the 2018 SSMP mitigation goals, objectives, and actions were reviewed and discussed by agency stakeholders to determine if the goals: 1) led to mitigation projects and changes in policy that reduced risk over the performance period of the 2018 SSMP; and 2) continue to develop the long-term vision for mitigation activities in the Commonwealth by addressing both current and future vulnerabilities. Additionally, government agency stakeholders reviewed the goals to ensure that the goals: 1) reflected the updated risk assessment; 2) supported changes in mitigation capabilities; and 3) supported other Commonwealth-level priorities.

All goals, objectives, and actions identified in the 2018 SSMP were brought forward to the 2024 SHMP Update with minor revisions to the wording for some actions. No new goals or objectives were added. Several new mitigation actions were added and prioritized to move the Commonwealth closer to achieving the goals and objectives over the performance period of the 2024 SHMP Update. Selected mitigation actions are discussed in Section 6.4 (New Mitigation Actions).

The goals for the 2024 SHMP Update are as follows:

1. Save lives and minimize injuries against all hazards but recognizing that the Commonwealth of the Northern Mariana Islands (CNMI) is most vulnerable to impacts from typhoons and tropical storms.
2. Reduce potential damage to public and private property.
3. Reduce adverse impacts on the environment and natural resources.
4. Reduce the financial burden on the community, businesses, and government.

From these goals the following 8 mitigation objectives and actions were developed. The mitigation objectives are listed below.

Objective 1: Secure, strengthen, and maintain essential government facilities, identified lifeline utility systems and access for emergency medical assistance and response, and transportation systems to ensure the delivery of necessity goods and fuel.

Objective 2: Review and improve polices and enforcement of building standards and codes, particularly the International Building Codes (IBC), the Uniform Facilities Criteria (UFC), and National Flood Insurance Program (NFIP) requirements.

Objective 3: Improve inter-agency and inter-island coordination and communication.

Objective 4: Participate in public awareness and education activities that improve implementation of the strategy and in activities promoted by the CNMI Homeland Security and Emergency Management and preparedness partners at all sectors and levels of government.

Objective 5: Address post-disaster pollution control.

Objective 6: Improve freshwater resources.

Objective 7: Ensure that adequate shelter is available to all residents and visitors.

Objective 8: Build and maintain Geographic Information System (GIS) and data to improve upon existing risk assessment data.

Because all the mitigation actions were brought forward into the 2024 SHMP Update and new mitigation actions were added, a new mitigation action numbering scheme was required to track mitigation projects added in different years. The new numbering scheme includes the year followed by the objective number and then each mitigation action is numbered sequentially. For example, the first mitigation action of objective 1 from the 2018 SSMP would be 2018-1-1. The new numbering scheme is included in Table 6-1.

6.4 Review and Evaluation of 2010 SSMP Mitigation Actions

Element S12 and [44 CFR § 201.4(d)]. Was the plan updated to reflect progress in statewide mitigation efforts and changes in priorities?

Element S12-a. Does the plan provide a narrative of the status of each mitigation action in the previous plan?

6.4.1 Comprehensive Review and Evaluation of the 2018 SSMP Mitigation Actions

The 2024 SHMP Update included a comprehensive review of the mitigation actions identified in the 2018 SSMP. Progress on each identified mitigation action was reviewed to determine the status of each action and the source of funding used to implement the completed actions. For those actions that were not completed, a review of the action to determine if it should be carried forward to the 2024 SHMP Update or discontinued was undertaken. Actions included in the updated mitigation strategy were reviewed and evaluated to determine if the action should be revised to reflect any new information obtained as part of the plan update process (e.g., risk assessment or capabilities changes).

Several major disasters occurred between 2018 and 2024, disrupting implementation of mitigation actions identified in the 2018 SSMP. Super Typhoon *Yutu* caused significant damage to buildings and infrastructure on Saipan and Tinian and efforts were redirected to pressing recovery needs. Due to limited staffing and the number of disaster declarations that occurred, HMGP did not update the 2018 SSMP mitigation project list to reflect the changes necessary to sustain and recover affected communities. Additional interruptions or delays in action implementation resulted from staffing and logistic complications due to the coronavirus disease 2019 (COVID-19) pandemic. There were 34 mitigation actions identified in the 2018 SSMP and these actions are listed in Appendix F.

The following summary of progress toward mitigation efforts is a combination of actions identified in the 2018 SSMP and actions needed to support recovery efforts following major disasters for Typhoon *Mangkhut* (DR-4396), Super Typhoon *Yutu* (DR-4404), Typhoon *Mawar* (DR-4716) and COVID-19 (DR-4511). Also, some post-disaster mitigation actions from Super Typhoon *Soudelor* (DR-4235) are also included. A total of 42 mitigation actions are being tracked for these disasters.

- 10 projects were completed
- 28 projects were awarded funding
    - 19 of these projects were not initiated
    - 4 of these projects were less than 50% completed
    - 5 of these projects were greater than 50% completed
- 4 projects were under FEMA review for funding.

These 42 post-disaster actions helped to work toward several of the mitigation goals, objectives, and actions identified in the 2018 SSMP: thus, contributing toward achieving these goals. A comprehensive review and evaluation of the 2018 SSMP actions and the contribution of the 42 post-disaster mitigation actions is provided in Appendix F.

Additional mitigation projects were also submitted for funding requests under the Post-Disaster Mitigation (PDM) program, Public Assistance, Economic Development Authority, Community Development Block Grant, CNMI Capital Improvement Program, Infrastructure Investment and Jobs Act (i.e., Bipartisan Infrastructure Law), and Office of Insular Affairs.

6.5 Identification and Prioritization of Mitigation Actions

Element S10 and [44 CFR §§ 201.4(c)(3)(i), 201.4(c)(3)(ii), and 201.4(c)(3)(iii)]. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment to reduce vulnerabilities of jurisdictions and state-owned assets? Does the plan describe the process to evaluate and prioritize actions that are cost effective, environmentally sound, and technically feasible?

6.5.1 Identification of Mitigation Actions

Mitigation actions for inclusion in the 2024 SHMP Update were identified through four primary sources:

- **2018 SSMP Mitigation Strategy**—Actions that were not completed 2018–2023 were reviewed, revised, and included as described in Section 6.3.
- **2022 Comprehensive Sustainable Development Plan**—Sustainable Development Goals and the associated objectives were reviewed. Hazard mitigation actions that were not duplicative with actions from the 2018 SSMP were included in the 2024 SHMP Update.
- **Risk Assessment**—The results of the updated risk assessment were reviewed by HMGP and agency stakeholders. Mitigation actions were identified after comparing the updated risk analysis with a focus on actions that would address high and medium ranked hazards and reduce the vulnerability of commonwealth-owned/operated assets.
- **Capability Assessment—**Obstacles and opportunities identified during the capability assessment were reviewed by HMGP and agency stakeholders. Mitigation actions were added to address obstacles, capture opportunities, and enhance ongoing progress in capability development.

Agency stakeholders were given opportunities to submit mitigation actions throughout the planning process. During the February 2024 meetings and the surveys, stakeholders had the opportunity to identify mitigation actions. In May 2024, agency stakeholders and the State Hazard Mitigation Officer (SHMO) reviewed and prioritized the mitigation actions.

6.5.2 Mitigation Action Plan

Element S10-a. Does the plan identify actions based on the current risk assessment to reduce the vulnerability of jurisdictions within the state, as well as the vulnerability of state assets as described in Elements S5 and S6?

Element S10-b. Does the plan describe the process used by the state to evaluate and prioritize actions that are cost-effective, environmentally sound, and technically feasible?

Element S10-c. Does the plan describe how each action contributes to the hazard mitigation goals?

Element S11 and [44 CFR § 201.4(c)(3)(iv)]. Does the plan identify potential sources of funding to implement mitigation actions and activities?

Element S11-a. Do mitigation activities include the identification of current and/or potential sources of federal, state, local, or private funding for implementation?

Element S11-b. Does the plan identify FEMA mitigation funding sources, including but not limited to: HMGP, BRIC, FMA, and PA mitigation, at a minimum

FMAG2 and [44 CFR § 201.4(c)(3); 44 CFR § 204.51(d)(2)]. Does the plan's mitigation strategy contain wildfire-related mitigation initiatives?

FMAG2-a. Does the mitigation strategy identify mitigation actions and activities to reduce the vulnerability of jurisdictions within the state as well as the vulnerability of state-owned assets as described in Elements S5 and S6?

Implementable mitigation actions require more than just a statement of activity as actions are led by different departments and agencies, require various levels of effort, and have varied resource needs. The Commonwealth Mitigation Action Plan includes information on implementation including:

- **Mitigation Action Title and Numbering**—A numerical identifier was assigned to each action for tracking and reporting purposes. Actions with a 2018 pre-fix are carried over from the 2018 SSMP. Actions with a 2024 pre-fix were added this planning cycle. The format of the number is the year the mitigation project was added, and the associated objective number followed by a sequential number for each action under the objective. An example is 2018-1-1 to indicate the first mitigation action for objective 1 from the 2018 SSMP.
- **Responsible Departments or Agencies**—The lead department or agency responsible for implementation is listed first, followed by any supporting departments or agencies.

- **Location—**The municipalities where the mitigation action will be implemented are listed.
- **Existing or Future Development—**This factor identifies whether each action will reduce risk to new assets as they are built, existing assets (i.e., retrofits), or both.
- **Community Lifelines Addressed—**This factor lists which of the community lifeline categories each action will protect.
- **Potential Funding Sources—**Potential options for funding the action are listed.
- **Problem Statement—**The problem statement provides context as to why the action is needed. The problem connects the risk assessment, capability assessment, or both to the mitigation action.
- **Timeline—**The action plan provides general project implementation and completion timing as follows:
  - **Short-Term—**The action can be completed within the 5-year performance period for the SHMP.
  - **Long-Term—**The action is likely to take longer than 5 years to complete.
  - **Ongoing—**The action is already funded and being implemented by the Commonwealth as an ongoing program that does not have a completion date.
- **Hazards Addressed—**A list of hazards addressed by each mitigation action.

Table 6-1. Mitigation Actions

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Objective 1 Secure, strengthen, and maintain critical government facilities, identified lifeline systems, and access for emergency medical assistance and response, and transportation systems to ensure the delivery of necessary goods and fuel.					
Title: 2018-1-01 Harden essential critical facilities					
Various	All Islands	Existing	All	BRIC, CDBG,OIA, PAM, CNMI Budget	Ongoing
Problem: 1. Storm intensity is projected to increase bringing stronger winds and increased wave energy. 2. Critical facilities that provide essential community lifelines have been severely damaged in storms, especially the power grid. 3. Some critical facilities were constructed decades ago and were not designed or constructed with future hazards considered.					
Action: 1. Implement mitigation projects identified following typhoons *Soudelor, Mangkhut, Yutu* and *Mawar.* 2. Annually evaluate mitigation projects for critical facilities and develop new funding requests to implement high priority projects.					
Hazard: Earthquake, Flood, Typhoon, Tsunami, Wildfire					

Table 6-1. Mitigation Actions (*cont'd*)

<table>
<tr><th>Department or Agency</th><th>Location</th><th>Existing or Future Development</th><th>Community Lifeline(s)</th><th>Potential Funding Source(s)</th><th>Timeline</th></tr>
<tr><td colspan="6">Title: 2018-1-02 Assess hardening and retrofit requirements for critical facilities that must remain operational.</td></tr>
<tr><td>Various</td><td>All Islands</td><td>Existing</td><td>All</td><td>BRIC, CDGB, OIA, PAM</td><td>Long-term</td></tr>
<tr><td colspan="6">Problem:
1. Storm intensity is projected to increase bringing stronger winds and increased wave energy.
2. Requirements to retrofit critical facilities that must remain operational to support life-safety functions need to be identified, assessed, and evaluated.</td></tr>
<tr><td colspan="6">Action:
1. Based on the critical facility inventory developed for the 2024 SHMP Update, identify critical facilities that must remain operational.
2. Seek funding for technical assistance to evaluate the retrofit needs of each facility and develop actions plans.
3. Seek funding to implement the recommended actions.
4. Incorporate recommendations for retrofitting buildings from the FEMA MAT Team (FEMA, 2021)</td></tr>
<tr><td colspan="6">Hazard: Earthquake, Flood, Typhoon, Tsunami, Wildfire</td></tr>
<tr><td colspan="6">Title: 2018-1-03 Develop proposals to harden and retrofit facilities and seek funding.</td></tr>
<tr><td>HMGP / All agencies</td><td>All Islands</td><td>Existing</td><td>Public Safety</td><td>HMGP, BRIC, FMA. CDBG, OIA</td><td>Long-Term</td></tr>
<tr><td colspan="6">Problem:
1. Storm intensity is projected to increase bringing stronger winds and increased wave energy.
2. Requirements to retrofit facilities to reduce risk and damage need to be identified, assessed, and evaluated.</td></tr>
<tr><td colspan="6">Action:
1. Seek funding for technical assistance to evaluate the retrofit needs of each facility and develop actions plans.
2. Seek funding to implement the recommended actions.
3. Incorporate recommendations for retrofitting buildings from the FEMA MAT Team (FEMA, 2021)</td></tr>
<tr><td colspan="6">Hazard: Earthquake, Flood, Typhoon, Tsunami, Wildfire</td></tr>
<tr><td colspan="6">Title: 2018-1-04 Convert the overhead power distribution system to an underground system. Set policy governing requirements for new line installations.</td></tr>
<tr><td>CUC</td><td>All Islands</td><td>Future</td><td>Energy</td><td>FMGP, BRIC, FMA</td><td>Ongoing</td></tr>
<tr><td colspan="6">Problem:
1. Severe storms continue to damage the overhead power grid leaving residents without power for several weeks following some recent typhoons.
2. Some progress toward installing underground power lines to critical facilities was accomplished over the last 5 years.
3. Policy to govern requirements for new line installation is still recommended.</td></tr>
<tr><td colspan="6">Action:
1. Seek funding for technical assistance to update policies governing new line installation.
2. Develop 1-2 additional projects for underground power distribution and seek funding over the next 5-year period.</td></tr>
<tr><td colspan="6">Hazard: Typhoon</td></tr>
</table>

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-1-05 Replace wood poles with concrete poles. Set policy governing requirements for new concrete pole installations.					
CUC	All Islands	Future	Energy	HMGP, BRIC	Ongoing
Problem: 1. Severe storms continue to damage the overhead power grid leaving residents without power for several weeks following some recent typhoons. 2. Substantial progress toward installing concrete utility poles was accomplished over the last 5 years. 3. Ensure supporting equipment is available to respond to downed powerlines following a severe typhoon.					
Action: 1. Complete mitigation actions to replace wooden utility poles on Saipan, Tinian, and Rota. 2. Evaluate other vulnerabilities or obstacles (e.g., supply cachet/storage challenges, equipment availability, etc.) that may delay restoration of power following severe wind events. Depending on findings, develop a response plan and seek funding to address gaps.					
Hazard: Typhoon					
Titte: 2018-1-06 Reduce threats that may damage the power distribution system. Encourage legislation to prohibit planting certain vegetation under power lines and along the rights of ways.					
CUC	All Islands	Both	Energy	CNMI	Short-term
Problem: 1. Vegetation can grow into powerlines, especially trees and vines, causing damage and requiring consistent maintenance. 2. Planting low-growing plants under powerlines can reduce risk of damage from vegetation and reduce the costs of maintenance.					
Action: 1. Evaluate the feasibility of removing and replacing existing vegetation under powerlines.					
Hazard: Typhoon					
Title: 2024-1-07 By 2030 CNMI permitting system includes a mechanism to track current and proposed future water and wastewater demand and locations.					
BECQ / OPD	Saipan	Future	Water Systems	HMGP, BRIC, FMA	Long-term
Problem: 1. The pace of development can strain existing infrastructure systems and natural resources, especially freshwater supplies. 2. A system to track proposed water and wastewater demands will help improve management of these critical lifelines. 3. Better management will help reduce strains on these systems/resources during severe weather events such as flooding or drought.					
Action: 1. Assign a taskforce to evaluate the current permitting process and develop a proposal for including water and wastewater demands. 2. If deemed feasible, seek funding to implement the changes by 2023.					
Hazard: Flood, Drought					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Titte: 2024-1-08 Improve existing roads, lighting, drainage, and amenities to support safe and accessible roads for active, and accessible transportation.					
DPW COTA	All Islands	Existing	Transportation	US DOT SS4A, HMGP, BRIC,FMA	Long-term
Problem: 1. Ingress and egress to villages in critical during disaster response and recovery. 2. Well designed and maintained streets can facilitate post-disaster debris management. 3. Reduce non-point source pollution through stormwater runoff management.					
Action: 1. Implement the CNMI Highways Master Plan (GHD, 2023). 2. Review and implement projects that support natural hazard mitigation identified in the Walkability studies for Saipan, Tinian, and Rota (Cash et al., 2021; CHC, 2022a, CHC, 2022b).					
Hazard: Typhoon, Flood, Tsunami, Wildfire, Earthquake					
Title: 2024-1-09 By 2030, the Office of Planning and Development has launched *Smart, Safe Growth* (*SSG*) toolkit on the OPD website to support integration of climate impacts and adaptation opportunities into early planning and project scoping activity with at least 2 *SSG* trainings held for CNMI agencies and stakeholders by 2028.					
OPD	All Islands	Future		CNMI Budget	Short-term
Problem: 1. To work toward sustainable development goals that incorporate *Smart, Safe Growth* principles that help reduce vulnerability of the built environment to natural hazards, agency staff require new tools and training to support developing new work practices.					
Action: 1. OPD to seek funding or dedicate staff to finalizing the online prototype tool that was developed in 2022.					
Hazard: Typhoon, Flood, Tsunami, Flood, Wildfire, Drought					
Titte: 2024-1-10 Include prioritized water and wastewater management community projects in capital improvement funding requests.					
CUC	All Islands	Future	Water Systems	HMGP, BRIC, FMA, CDBG	Long-term
Problem: 1. Not all households have access to safe, clean drinking water. 2. Management of freshwater resources can reduce impacts of drought through responsible management of aquifer resources. 3. Wastewater treatment facilities help reduce impacts to commonwealth waters.					
Action: 1. To meet CNMI sustainable development goals to ensure access to safe, clean drinking water for the whole community, develop and prioritize water and wastewater capital improvement funding requests.					
Hazard: Flood, Tsunami, Drought					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-1-11 By 2030 CUC and planning partner support wastewater treatment sustainability assessment to inform future plan updates.					
CUC	All Islands	Future	Water Systems	HMGP, BRIC, FMA, CDBG	Long-term
Problem: 1. Wastewater treatment is a critical lifeline function to sustain sanitary conditions within communities and prevent exposure to potential health risks. 2. To safeguard public health, wastewater systems must be designed and constructed to withstand current and future natural hazards and to be returned to operational capacity quickly following a natural disaster. 3. Sustainable wastewater treatment practices are essential to protecting the natural environment including marine and freshwater resources.					
Action: 1. Seek funding to develop the sustainability assessment.					
Hazard: Flood, Tsunami, Earthquake					
Titte: 2024-1-12 By 2030, CUC will endorse a Comprehensive Energy Plan detailing the steps to make progress towards renewable energy standards.					
CUC	All Islands	Future	Energy	DOE GRIP program, CNMI, BIL	Long-term
Problem: 1. The exiting power infrastructure is vulnerable to severe storms. 2. The existing power generation is heavily reliant on fossil fuels, which must be delivered via port facilities which are vulnerable to storm surge, tsunami, earthquake, and flooding. 3. Promoting sustainable energy dovetails with sustainable development goals and helps to reduce carbon emissions.					
Action: 1. Seek funding to continue progress toward developing renewable energy standards.					
Hazard: Typhoon, Tsunami, Earthquake					
Title: 2024-1-13 Collaborate with the State Hazard Mitigation Officer (SHMO), HMGP, and stakeholders to evaluate and update the State Hazard Mitigation Plan on an annual basis.					
HMGP	All	Both	All	CNMI Budget, HMGP, BRIC, FMA	Ongoing
Problem: 1. The SHMP must be reviewed at least annually and updated every 5 years. 2. Regular updates keep the plan relevant and addresses conditions as they change.					
Action: 1. Seek funding to retain contract services to implement projects to improve data and information needed to efficiently evaluate natural hazard risks and vulnerabilities. 2. Adhere to the plan maintenance and monitoring schedule proposed in Chapter 7.0 of this plan.					
Hazard: All					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Objective 2 Review and improve policies and enforcement of building standards and codes, particularly the IBC, UFC, and NFIP requirements.					
Title: 2018-2-01 Review and recommend improvements in the building codes enforcement and increase inspections.					
DPW BSCD	All Island	Both	All	CNMI, HMGP	Ongoing
Problem: 1. The Commonwealth Building and Safety Code Rules and Regulations (Sec. 155-10.1-615) have earthquake and typhoon amendments that conflict with the adopted International Building Codes (IBC or I-Codes) and referenced standards. 2. Training is needed for DPW BSCD staff to effectively implement and enforce the adopted I-Codes.					
Action: 1. Implement FEMA recommendations for updating the CNMI Building Codes (FEMA, 2021) 2. Adopt the latest IBC on a reoccurring three-year basis, with amendments that are specific to the Commonwealth. 3. Adopted Special Wind Region and design requirements into the IBC/**International** Residential Code. 4. Train new and existing staff on the requirements of the adopted building codes and standards. Work with the International Code Council (ICC) and FEMA to provide and access training on the most currently adopted I-Codes.					
Hazard: Typhoon, Earthquake					
Title: 2018-2-02 Ensure a valid CNMI land use plan is in place and enforced.					
DPL	All Islands	Both	All	CNMI, HMGP, BRIC, FMA	Short-Term
Problem: The 2019 Public Land Use Plan is due for an update in 2024.					
Action: DPL to seek funding to update the plan.					
Hazard: All					
Title: 2018-2-03 Encourage the use of concrete in residential construction.					
DPW BSCD	All	Future	FSH	HMGP, BRIC, FMA, CDBG	Short-term
Problem: 1. Poor construction practices of the past resulted in building failures during Super Typhoon *Yutu*. 2. There is no list of tested and approved hazard-resistant materials and products appropriate for high-wind-resistant construction. 3. Many types of hazard-resistant materials are not available for purchase by contractors, homeowners, and building owners.					
Action: 1. Widely disseminate to the public the fact sheet titled, *Permitting and Inspection Process for Disaster-Resilient Residential Homes* (FEMA, 2021) (FHWA Fact Sheet - CNMI MAT (gov.mp)). 2. Develop and maintain a list of known hazard-resistant building products appropriate for the CNMI, which have been tested in accordance with the IBC, such as impact-resistant systems (e.g., shutters) and wind and debris impact-rated doors and windows. 3. Work with local hardware stores and construction material suppliers to stock tested and approved materials, which should be used at all times and not just after damaging events. 4. Develop other public outreach and education materials regarding concrete and other wind resistant building materials and BMP for retrofitting/repairing homes.					
Hazard: Typhoon, Flood, Earthquake					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-2-04 Prepare and adopt public education materials regarding private sector buildings.					
OPD	All Islands	Both		CNMI	Short-Term
Problem: 1. Many private sector buildings, including residences, are poorly maintained and were damaged during Super Typhoon *Yutu.* 2. A *Mariana Islands Homeowners Handbook to Prepare for Natural Disasters* was produced in 2015 and is available online from NOAA. (https://repository.library.noaa.gov/view/noaa/36089)					
Action: 1. Seek funding to update the handbook produced in 2015 to incorporate lessons learned from typhoons *Soudelor, Mangkhut, Yutu,* and *Mawar.* 2. Incorporate recommendations from the FEMA Mitigation Assessment Team (MAT) following Super Typhoon *Yutu.*					
Hazard: Typhoon					
Title: 2018-2-05 Encourage typhoon shutters installation by homeowners and businesses.					
HMGP	All Islands	Both		HMGP, BRIC, FMA	Long-term
Problem: 1. Many private sector buildings and residences still need to install shutters to reduce impacts from typhoons.					
Action: 1. Seek funding to assist the public with installing storm shutters. 2. Develop outreach materials regarding the benefits of shutters.					
Hazard: Typhoon					
Title: 2024-2-06 Building code amendments to reduce existing and future building stock vulnerable to coastal hazards and climate impacts.					
DPW	All Islands	Both	All	HMGP, BRIC, FMA	Long-Term
Problem: 1. The Flood Damage Prevention Regulations in Subchapter 155-10.2 of the Northern Mariana Islands Administrative Code have not been updated since 1993, even as the building code has been updated to the 2018 I-Codes.					
Action: 1. Update the CNMI Flood Damage Prevention Regulations and integrate the regulations with the flood provisions of the I-Codes using the FEMA model code-coordinated ordinance. 2. Implement FEMA recommendations for updating the CNMI Building Codes (FEMA, 2021)					
Hazard: Typhoon, Flood					
Title: 2024-2-07 Develop a Flood Hazard Mitigation Plan per the CNMI Flood Damage Prevention Regulations (§155-10.2-015).					
DPW	All Islands	Future	All	HMGP, BRIC, FMA	Short-term
Problem: A Flood Hazard Mitigation Plan needs to be developed per the Flood Damage Prevention Regulations.					
Action: 1. Work with FEMA Risk MAP to develop a Flood Hazard Mitigation Plan along the same timeline as the proposed update to the Flood Insurance Rate Map.					
Hazard: Typhoon, Tsunami, Flood					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Objective 3 Improve inter-agency and inter-island coordination and communication.					
Title: 2018-3-01 Review and update existing master plans for land use designations.					
OPD	All Islands	Both	All	CNMI, HMGP, BRIC, FMA	Short-Term
Problem: 1. Several land use plans required updating over the 5-year implementation of the SHMP. 2. These plans should incorporate hazard mitigation actions, including actions that will minimize exposure and vulnerability to future hazards including climate change.					
Action: 1. Work with Departments to seek funding to update land use plans. 2. Ensure plan updates consider hazard mitigation and the potential effects of climate change.					
Hazard: All					
Title: 2018-3-02 Promote interagency communication.					
OPD	All Islands	Both	Communications	HMGP, BRIC	Long-Term
Problem: 1. Increase communication among Departments to coordinate mitigation actions. 2. Improve communication systems for emergency and post-disaster response. 3. Ensure communication systems are inter-operable between Departments and municipalities.					
Action: 1. Seek funding to improve communications infrastructure for radio communications for emergency and post-disaster response. **2.** Improve coordination between Departments and municipalities to ensure radio systems and communication equipment are inter-operable.					
Hazard: All					
Objective 4 Participate in public awareness and education activities that improve preparedness partners at all sectors and levels of government.					
Title: 2018-4-01 Include risk and vulnerability assessments and maps to improve public awareness materials for hazards.					
HSEM	All Islands	Both	All	HMGP, BRIC	Short-Term
Problem: 1. Public outreach and education are necessary components to increase community preparedness for natural hazards and disasters. 2. To keep the public engaged, materials should be updated and refreshed regularly.					
Action: 1. Seek funding to prepare and update public outreach and education materials. 2. Ensure to consider the whole community when developing new materials and ensure that materials consider historically underserved communities and the socially vulnerable.					
Hazard: All					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-4-02 For the next update, gather feedback from agencies to improve the next plan update.					
HMGP	All Islands	Both	All	HMGP, BRIC, FMA	Ongoing
Problem: 1. Agency stakeholder input is essential to developing and implementing an effective Hazard Mitigation Plan.					
Action: 1. Implement the plan maintenance schedule presented in Chapter 7.0 of this plan to engage regularly with agency stakeholders throughout the 5-year implementation period. 2. In the first year of the 2024 SHMP Update period, review and incorporate agency feedback provided in 2024 via questionnaires. Specifically review recommended mitigation actions and incorporate new relevant actions at the first-year review/update.					
Hazard: All					
Title: 2018-4-03 Develop a public awareness program for hazards in coordination with Federal, State, and local offices. The information gathered would be disseminated among the local communities, integrated into public school curriculum, and incorporated into the existing disaster awareness activities currently employed.					
HSEM	All Islands	Both	All	HMGP, BRIC	Short-Term
Problem: 1. Public outreach and education are necessary components to increase community preparedness for natural hazards and disasters. 2. To keep the public engaged, materials should be updated and refreshed regularly. 3. New hazards were addressed in the 2024 SHMP including Extreme Heat and Heatwave and Health Risks.					
Action: 1. Seek funding to prepare and update public outreach and education materials. 2. Ensure to consider the whole community when developing new materials and ensure that materials consider historically underserved communities and the socially vulnerable. 3. Develop educational materials for Extreme Heat and Heatwaves and Health Risks.					
Hazard: All					
Title: 2018-4-04 Implement the Public Awareness Program to disseminate all-hazard mitigation information for earthquakes or typhoon retrofits, hazard warning information, evacuation procedures, protective measures, and preventive techniques.					
HSEM	All Islands	Both	All	HMGP, BRIC	Short-Term
Problem: 4. Public outreach and education are necessary components to increase community preparedness for natural hazards and disasters. 5. To keep the public engaged, materials should be updated and refreshed regularly. 6. Develop educational materials for Extreme Heat and Heatwaves and Health Risks.					
Action: 1. Seek funding to prepare and update public outreach and education materials. 2. Ensure to consider the whole community when developing new materials and ensure that materials consider historically underserved communities and the socially vulnerable.					
Hazard: All					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-4-05 Develop and use multiple approaches to disseminate hazard awareness information to the public, including use radio and television announcements, social media, billboards, public outreach/meetings, etc. Ensure messages are provided in languages prevalent in communities.					
HSEM	All Islands	Both	All	HMGP, BRIC	Ongoing
Problem: 1. Public outreach and education are necessary components to increase community preparedness for natural hazards and disasters. 2. To keep the public engaged, materials should be updated and refreshed regularly.					
Action: 1. Partner with Northern Marianas College Office of Vocational Rehabilitation and the National Weather Service to reach underserved communities for outreach materials and messages during emergencies. **2.** Continue to develop social media platforms for disseminating important emergency messages and updates.					
Hazard: All					
Title: 2024-4-06 Support and/or coordinate with non-governmental organizations working to mitigation natural hazards (e.g., MANGO).					
HMGP	All Islands	Both		HMGP, BRIC	Ongoing
Problem: 1. Non-governmental agencies are important partners in hazard mitigation.					
Action: 1. Engage MANGO over the 5-year implementation period regarding hazard mitigation action implementation.					
Hazard: All					
Title: 2024-4-07 Provide drought public education awareness and outreach.					
HSEM	All Islands	Both	Water Systems	HMGP, BRIC	Short-Term
Problem: 1. Drought is expected to increase in intensity and duration as the climate continues to warm. 2. Water conservation during times of drought is critical to protect freshwater resources on each island. 3. Water conservation requires participation, and education and outreach are important components to achieve the public's participation.					
Action: 1. Seek funding to prepare and update public outreach and education materials. 2. Ensure to consider the whole community when developing new materials and ensure that materials consider historically underserved communities and the socially vulnerable.					
Hazard: Drought					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-4-08 Provide wildfire awareness, preparedness, and prevention education to the public.					
DFEMS / BECQ	All Islands	Both	Public Safety	HMGP, BRIC	Short-Term
Problem: 1. Wildfire currently mostly impacts grasslands and savannas where it does not threaten many structures. 2. Wildfire causes many ecological problems that can degrade habitats and water quality. 3. Some areas selected by DPL for future homestead development on Saipan, Tinian, and Rota are vulnerable to wildfire hazards. 4. Wildfire hazards will likely increase with increased temperatures and changes rainfall patterns due to expected climate change impacts.					
Action: 1. Seek funding to develop educational and outreach materials regarding wildfire threat and how it is expected to change as the climate continues to change. 2. Partner with the Pacific Wildfire Exchange.					
Hazard: Wildfire.					
Objective 5 Address post-disaster pollution control.					
Title: 2018-5-01 Improve hazardous material and waste storage.					
BECQ / DPW	All Islands	Both	Hazardous Materials	HMGP, BRIC	Long-Term
Problem: 1. Hazardous materials can harm the environment and the public. 2. Hazardous materials can be vulnerable to natural hazards. 3. Improving the resiliency of storage facilities is critical.					
Action: 1. Identify and evaluate hazardous materials storage locations. 2. Seek funding to improve/relocate storage areas that are exposed and vulnerable to typhoon wind and storm surge, flooding, earthquake, and tsunami.					
Hazard: Typhoon, Tsunami, Flood, Earthquake.					
Title: 2018-5-02 Develop a surface water quality control program.					
BECQ	All Islands	Both	Water Systems	BRIC	Long-Term
Problem: 1. Non-point source pollution degrades and impairs water bodies across CNMI. 2. Following a disaster, non-point source pollution from damaged buildings, cars, and equipment is a significant issue and can damage the environment and endanger public safety.					
Action: 1. Develop a post-disaster response plan to monitor surface water quality					
Hazard: Typhoon, Tsunami, Flood, Earthquake					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Objective 6 Improve freshwater resources, natural infrastructure, and cultural resources protection.					
Title: 2018-6-01 Explore and quantify water sources on all islands.					
BECQ / CUC	All Islands	Future	Water Systems	HMGP, BRIC,FMA, USGS	Long-Term
Problem: 1. Freshwater resources are finite on all islands and require strict management to ensure quality as demand increases. 2. The freshwater lens aquifers for each island can be degraded if too much water is extracted via wells. 3. Surface water and springs are also important freshwater resources, especially on Rota.					
Action: 1. Develop partnerships with USGS to develop water research needs for the Marianas. 2. Seek funding to study how changing rainfall patterns and increased temperatures are already affecting ground water / aquifer recharge. 3. Seek funding to develop models for sustainable groundwater yield based on anticipated future groundwater / aquifer recharge rates.					
Hazard: Drought					
Title 2018-6-02 Institute a system of storm water runoff management.					
DPW	All Islands	Both	Water Systems	US DOT GRIP, FMA, CNMI CIP	Ongoing
Problem: 1. Stormwater runoff is a major non-point source pollutant and can degrade marine and freshwater resources. Stormwater runoff can also pose a health risk due to potential contaminants. 2. Stormwater runoff can intensify erosion and flooding issues. 3. Increased stormwater runoff can impede groundwater / aquifer recharge. 4. Extreme rainfall events are expected to increase in frequency with climate change.					
Action: 1. Request technical assistance from HMGP to develop project proposal to enhance the existing stormwater runoff / drainage infrastructure. 2. Incorporate green infrastructure where feasible.					
Hazard: Typhoon, Flood, Drought					
Title: 2018-6-03 Develop a program to develop ponding basins to enhance aquifers.					
CUC	All Islands	Both	Water Systems	US DOT GRIP, FMA, CIP	Long-Term
Problem: 1. Stormwater runoff is a major non-point source pollutant and can degrade marine and freshwater resources. Stormwater runoff can also pose a health risk due to potential contaminants. 2. Stormwater runoff can intensify erosion and flooding issues. 3. Increased stormwater runoff can impede groundwater / aquifer recharge. 4. Extreme rainfall events are expected to increase in frequency with climate change.					
Action: 1. Partner with DPL to identify areas for ponding basins in the next Public Land Use Plan update. 2. Develop a plan to create, enhance, or construct ponding basins.					
Hazard: Typhoon, Flood, Drought					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-6-04 Develop a water conservation program including public awareness materials.					
CUC	All Islands	Both	Water Systems	HMGP, BRIC	Short-Term
Problem: 1. Public outreach and education are necessary components to increase community preparedness for natural hazards and disasters. 2. To keep the public engaged, materials should be updated and refreshed regularly. 3. New hazards were addressed in the 2024 SHMP including Extreme Heat and Heatwave and Health Risks.					
Action: 1. Seek funding to prepare and update public outreach and education materials. 2. Ensure to consider the whole community when developing new materials and ensure that materials consider historically underserved communities and the socially vulnerable. 3. Develop educational materials for water conservation.					
Hazard: Typhoon, Flood, Drought					
Title: 2018-6-05 Propose legislation to implement rainwater catchment systems in homes, businesses, and public buildings.					
CUC / BECQ	All Islands	Both	Water Systems	HMGP, BRIC, FMA, CDBG, OIA TAP	Long-Term
Problem: 1. Freshwater resources are finite on all islands and require strict management to ensure quality as demand increases. 2. The freshwater lens aquifers for each island can be degraded if too much water is extracted via wells. 3. Captured rainfall can supplement island water supplies and help reduce stormwater runoff.					
Action: 1. Seek funding for technical assistance to develop proposed legislation to implement rainwater catchment systems.					
Hazard: Flood, Drought					
Title: 2018-6-06 Improve the collection of water in existing springs.					
CUC / BECQ	All Islands	Both	Water Systems	HMGP, FMA, USFS, USFWS	Ongoing
Problem: 1. Freshwater resources are finite on all islands and require strict management to ensure quality as demand increases. 2. Rainfall infiltration and ground water recharge are linked to spring water availability. 3. Rainfall patterns are expected to change as the climate warms with more extreme rainfall events and longer dry periods.					
Action: 1. Implement existing Conservation Action Plans (CAP) for watersheds on Saipan and Rota. 2. Develop CAP for Tinian. 3. Implement wildfire awareness programs to reduce the number of fires set intentionally and link this to water quality in springs, especially for Rota.					
Hazard: Flood, Drought, Wildfire					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-6-07 Develop a water-recycling program.					
CUC / DPW	All Islands	Both	Water Systems	OIA TAP	Long-Term
Problem: 1. Freshwater resources are finite on all islands and require strict management to ensure quality as demand increases. 2. Rainfall patterns are expected to change as the climate warms with more extreme rainfall events and longer dry periods.					
Action: 1. Seek technical assistance to develop a feasibility study to evaluate water recycling programs for Saipan, Tinian, and Rota.					
Hazard: Drought					
Title: 2018-6-08 Develop and update the water master plan for Saipan, Tinian and Rota, and the Confidence Consumer Report for water quality.					
CUC	All Islands	Future	Water Systems	HMGP, BRIC, FMA	Ongoing
Problem: 1. Freshwater resources are finite on all islands and require strict management to ensure quality as demand increases. 2. The freshwater lens aquifers for each island can be degraded if too much water is extracted via wells. 3. Surface water and springs are also important freshwater resources, especially on Rota.					
Action: 1. Seek funding to update the drinking water master plans for Saipan, Tinian, and Rota.					
Hazard: Drought					
Title: 2024-6-09 DPW works with DEQ and partners to revise the 2006 Stormwater Management Manual to integrate BMPs across planning sectors and projects.					
DPW / DEQ	All Islands	Both	Water Systems	HMGP, BRIC, FAM, US DOT GRIP	Ongoing
Problem: 1. Stormwater runoff is a major non-point source pollutant and can degrade marine and freshwater resources. Stormwater runoff can also pose a health risk due to potential contaminants. 2. Stormwater runoff can intensify erosion and flooding issues. 3. Increased stormwater runoff can impede groundwater / aquifer recharge. 4. Extreme rainfall events are expected to increase in frequency with climate change.					
Action: 1. Seek funding to update the Stormwater Management Manual. 2. Seek funding to train agencies staff regarding BMP implementation.					
Hazard: Typhoon, Flood, Drought					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-6-10 Improve and maintain coral reefs as natural infrastructure.					
DLNR / BECQ	All Islands	Future		NOAA, HMGP, BRIC, FMA	Long-Term
Problem: 1. Coral reefs are natural infrastructure that provide protective functions for CNMI shorelines by attenuating wave energy. 2. Coral reefs are important economic resources for the Commonwealth. 3. Coral reefs provide habitat for many species that support commercial and subsistence fisheries. 4. As the sea temperature warms, conditions that cause coral bleaching are expected to be more frequent. 5. Changing sea chemistry due to climate change is expected to negatively affect coral.					
Action: 1. Develop specific project actions to maintain coral reefs as green/natural infrastructure to implement over the 5-year implementation period.					
Hazard: Typhoon, Tsunami					
Title: 2024-6-11 Improve and maintain natural resiliency hubs as natural infrastructure.					
DLNR / BECQ	All Islands	Future		NOAA, HMGP, BRIC, USFS, USFWS	Long-Term
Problem: 1. Watersheds, coral reefs, and other suitable habitats that support species of conservation value serve as important natural resiliency hubs that buffer the human and built environments from natural hazards. 2. Active management of this green/natural infrastructure can help retain their protective functions as climate change continues to amplify natural hazards that negatively affect these natural resources.					
Action: 1. Develop specific project actions to maintain coral reefs as green/natural infrastructure to implement over the 5-year implementation period.					
Hazard: Typhoon, Tsunami, Flood, Wildfire, Drought					
Title: 2024-6-12 Develop a green infrastructure feasibility study.					
OPD	All Islands	Future	All	HMGP, BRIC, FMA	Short-Term
Problem: 1. Incorporating green infrastructure into land use planning and the overall hazard mitigation strategy can have many advantages for communities including creating additional open, green space for recreation and other uses. 2. Green infrastructure projects may be more cost-effective than hardened alternatives. 3. Living shorelines, resiliency hubs, rain gardens, and ponding basins are examples of green infrastructure.					
Action: 1. Seek funding to develop a study and plan for increasing the use of green infrastructure solutions, especially along the shoreline.					
Hazard: Typhoon, Flood including Coastal Erosion,					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-6-13 Coordinate access to DCCA maintained cultural resource information as appropriate under federal and commonwealth statues.					
DCCA / HPO	All Islands	Both		HMGP, BRIC	Short-Term
Problem: 1. To assess vulnerability to cultural resources from natural hazards, GIS information about location and resources type would increase the accuracy of the analysis.					
Action: 1. OPD will work with DCCA to develop more accurate GIS layers for cultural resources that can be used for risk assessments. These layers can be only for analysis and not for public release. 2. For sensitive resources, DCCA collaborates with HMGP to conduct a more accurate geospatial exposure analysis and the results are provided for the 2029 SHMP update.					
Hazard: Typhoon, Tsunami, Flood, Earthquake, Wildfire					
Title: 2024-6-14 Coordinate with federal partners to update seismic hazard maps and soil mapping.					
DLNR	All Islands	Future		USGS, NEHRP	Short-Term
Problem: 1. The seismic hazards maps are outdated. 2. Develop a seismic hazard map for the CNMI, including the Northern Islands. 3. Develop a soil and rock map based on standards developed by the National Earthquake Hazards Reduction Program (NEHRP).					
Action: 1. Support and coordinate with USGS to update the seismic hazard maps for the CNMI over the next 5 years. 2. Coordinate with FEMA and USGS to evaluate the feasibility of developing a NERPH soil classification for all islands in the CNMI to more accurately assess risk and for future use in the Hazus tool.					
Hazard: Earthquake					
Title: 2024-6-15 Reduce/convert hazardous fuel in the wildland urban interface to reduce the threat of wildfire to communities and conservation land.					
DPW / DFEMS	All Islands	Both		HMGP, BRIC	Long-Term
Problem: 1. Wildfire mostly impacts grasslands and savannas where it does not threaten many structures currently. 2. Wildfire causes many ecological problems that can degrade habitats and water quality. 3. Some areas selected by DPL for future homestead development on Saipan, Tinian, and Rota are vulnerable to wildfire hazards. 4. Wildfire hazards will likely increase with increased temperatures and changes rainfall patterns due to expected climate change impacts.					
Action: 1. Implement forest restoration actions identified in watershed Conservation Action Plans.					
Hazard: Wildfire					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Objective 7 Ensure that adequate shelter is available to all residents and visitors.					
Title: 2018-7-01 Harden and retrofit identified typhoon shelter facilities (under PSS & DCCA) to include storm shutters, lighting, backup generators, water tanks and water pumps, enclosed walkways and adequate bathroom facilities that are compliant with ADA requirements for people with disabilities.					
PSS / DCCA	All Islands	Existing	Food, Hydration, Shelter	HMGP, BRIC, FMA	Ongoing
Problem: 1. Storm intensity is projected to increase bringing stronger winds and increased wave energy. 2. Requirements to retrofit facilities to reduce risk and damage needs to be identified, assessed, and evaluated.					
Action: 1. Seek funding for technical assistance to evaluate the retrofit needs of each facility and develop actions plans. 2. Seek funding to implement the recommended actions. 3. Incorporate recommendations for retrofitting buildings from the FEMA MAT Team (FEMA, 2021)					
Hazard: Typhoon, Flood					
Title: 2018-7-02 Encourage residents and hotels to harden, retrofit and build safe rooms for typhoon sheltering.					
HSEM / MVA	All Islands	Both	Food, Hydration, Shelter	HMGP, BRIC, FMA, private	Long-Term
Problem: 1. Storm intensity is projected to increase bringing stronger winds and increased wave energy. 2. Requirements to retrofit facilities to reduce risk and damage need to be identified, assessed, and evaluated. 3. Accommodating visitors at the public shelters creates an additional burden on already limited resources.					
Action: 1. Seek funding for technical assistance to evaluate the retrofit needs of each facility and develop action plans. 2. Seek funding to implement the recommended actions. 3. Incorporate recommendations for retrofitting buildings from the FEMA MAT Team (FEMA, 2021)					
Hazard: Typhoon					
Title: 2024-7-03 By 2030 update the MVA Strategic Plan and address natural hazard response and sheltering needs for CNMI visitors.					
MVA	All Islands	Both	Food, Hydration, Shelter	HMGP, BRIC, FMA, private	Short-Term
Problem: 1. Currently the MVA strategic plan does not address risks posed by natural hazards to visitors. 2. When the plan is updated, consider the risks posed by natural hazards to visitors and develop recommendations/guidance for addressing potential emergency response needs for this transient population. 3. Work with HSEM to consider visitors in disaster response planning especially for natural hazards that have no or little warning time such as Tsunami and Earthquake.					
Action: 1. Seek funding to update the MVA Strategic Plan and address the risks natural hazards pose for visitors. 2. Work with HSEM to ensure visitors are considered in emergency response plans.					
Hazard: Typhoon, Tsunami, Flood, Earthquake					

Table 6-1. Mitigation Actions (*cont'd*)

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-7-04 Supply chain disruption preparation (e.g., tabletop exercise).					
HSEM	All Islands	Future	Transportation	HMGP, BRIC	Short-Term
Problem: 1. Almost all goods are imported to CNMI through Maritime shipping. Some goods are delivered via air cargo. 2. Natural hazards can disrupt port facilities, as happened with Super Typhoon *Yutu,* and disrupt deliveries of essential goods and materials delaying recovery efforts. 3. Advanced planning can help prepare for eventual supply chain disruptions of essential goods and materials due to a natural disaster.					
Action: 1. Include supply chain disruptions and response in Emergency Operational Response plans and address this issue in the Threat Identification and Risk Assessment (THIRA) and evaluate capabilities to manage the supply chain in the Stakeholder Preparedness Report (SPR).					
Hazard: Typhoon, Tsunami, Flood, Earthquake					
Title: 2024-7-05 Evaluate vertical evacuation sites for schools.					
HSEM	Saipan	Future	Food, Hydration, Shelter	HMGP, BRIC, FMA, NOAA	Long-Term
Problem: 1. Several schools are located within the tsunami inundation zone. Schools in the inundation zone are at risk for locally generated (i.e., near-field) tsunami. 2. Evacuation to designated safe sites can take over 15 to 20 minutes to reach. 3. A local tsunami generated near Sarigan reached Saipan in a little over 20 minutes.					
Action: 1. Seek funding to evaluate the feasibility of retrofitting school cafeterias, gymnasiums, or other large structures to serve as vertical evaluation zones.					
Hazard: Tsunami, Flood					
Objective 8 Build and maintain a geographic information system and data to improve upon existing risk assessment data.					
Title: 2018-8-01 Improve the database and GIS for hazard risk and vulnerability assessment to make decisions for disaster response plans and mitigation activities.					
OPD	All Islands	Both	All	HMGP, BRIC, CDBG	Ongoing
Problem: 1. Progress was made for the 2024 SHMP Update to spatially geolocate commonwealth assets, including critical facilities, and general building stock. However, data are still incomplete or are generalized (i.e., building types). 2. Develop protocol or SOP for hazard analysis for natural and cultural assets. 3. Update the social vulnerability GIS information with detailed demographic data from the 2020 Census released in February 2024.					
Action: 1. Seek funding to retain contractor services to continue to update GIS information/data required for hazard risk assessments.					
Hazard: All					

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2018-8-02 Develop a protocol to access and share information among CNMI agencies. Develop a protocol to share GIS information with community organizations involved in community planning activities.					
OPD	All Islands	Both	All	HMGP, BRIC	Ongoing
Problem: 1. There is no standard protocol to share and access GIS information developed and maintained by various agencies. 2. A standard repository of GIS layers for hazard risk analysis would improve the consistency of plans and assessment across sectors and throughout the government. This could also reduce duplicative efforts across agencies. 3. As appropriate, this information could be shared by agreement with consultants and non-governmental organizations (NGOs) involved with hazard mitigation activities.					
Action: 1. Draft a protocol for access and share information among CNMI agencies over the next 5-year implementation period. 2. Develop a data sharing agreement template to make this information available to consultants and NGOs involved with hazard mitigation activities.					
Hazard: All					
Title: 2018-8-03 Identify missing data and gaps in the risk and vulnerability assessment and incorporate these into the CNMI GIS system.					
OPD / HMGP	All Islands	Both	All	HMGP, BRIC	Ongoing
Problem: 1. Progress was made for the 2024 SHMP Update to spatially geolocate commonwealth assets, including critical facilities, and general building stock. However, data are still incomplete or are generalized (i.e., building types).					
Action: 1. Work to package and deliver GIS layers developed to support the 2024 SMHP update.					
Hazard: All					
Title: 2018-8-04 Enable use of the GIS system including hazard risk and vulnerability assessment information for the building and land use permit system.					
OPD	All Islands	Both	All	HMGP, BRIC	Ongoing
Problem: **1.** Progress has been made to integrate GIS hazard layers with the permitting system on the BECQ online permitting application portal.					
Action: 1. Update GIS layers that support the BECQ online permitting application with updated GIS layers prepared for the 2024 SMHP update, as appropriate. 2. As GIS data is updated for hazards (e.g., flood and earthquake are planned), ensure the layers that support the BECQ online permitting application are updated.					
Hazard: Typhoon, Tsunami, Flood, Earthquake, Wildfire					

Table 6-1. Mitigation Actions (*cont'd*)

<table>
<tr><th>Department or Agency</th><th>Location</th><th>Existing or Future Development</th><th>Community Lifeline(s)</th><th>Potential Funding Source(s)</th><th>Timeline</th></tr>
<tr><td colspan="6">Title: 2024-8-05 Adopt a sea level rise standard for the CNMI.</td></tr>
<tr><td>OPD</td><td>All Islands</td><td>Both</td><td>All</td><td>HMGP, BRIC</td><td>Ongoing</td></tr>
<tr><td colspan="6">Problem:
1. There is general agreement that sea level is rising but the CNMI Government has not officially adopted a sea level rise standard.
2. With an official standard adopted, plans, assessment, and studies use various emission scenarios and projections to assess the risk of future sea level rise.
3. Sea level rise models are best developed for Saipan with recent improvements for Tinian and Rota. There are no projections for the Northern Islands.
4. Inundation models that combine projected sea level rise and future storm driven waves are lacking for Tinian, Rota, and the Northern Islands.
5. Tsunami inundation models that incorporate sea level rise are lacking for all islands.</td></tr>
<tr><td colspan="6">Action:
1. Develop a Climate Adaption Plan for the CNMI that includes an adopted sea level rise standard to bring consistency to risk assessments.
2. Continue to work with federal partners and NGOs to improve inundation models that include sea level rise and storm wave effects on flooding.
3. Develop future tsunami inundation zones with sea level rise incorporated.</td></tr>
<tr><td colspan="6">Hazard: Typhoon, Flooding,</td></tr>
<tr><td colspan="6">Title: 2024-8-06 Conduct a feasibility study and identify opportunities and obstacles for improving data sharing with national databases and tools to help assess natural hazards and facilitate future risk assessment (e.g., Hazus, National Risk Index, SLOSH, etc.).</td></tr>
<tr><td>HMGP</td><td>All Islands</td><td>Both</td><td>All</td><td>HMGP, BRIC</td><td>Long-Term</td></tr>
<tr><td colspan="6">Problem:
1. Data for natural hazards in the CNMI is not readily available online via many national databases including, National Risk Index, Hazus, SLOSH, NERHP, and US Drought Monitor (historical information).
2. Data for the built environment assets for the CNMI are also not readily available.
3. Online tools to assist with natural hazard risk assessments are not typically available for the CNMI.</td></tr>
<tr><td colspan="6">Action:
1. Work with FEMA to explore the feasibility of incorporating more CNMI information into the next update of Hazus to facilitate future risk analyses.
2. Identify data gaps or update needs to ensure data in Hazus are as accurate as possible.
3. Seek funds to hire a contractor to update data for Hazus over the next 5-year implementation period.</td></tr>
<tr><td colspan="6">Hazard: All</td></tr>
</table>

Table 6-1. Mitigation Actions (*cont'd)*

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
Title: 2024-8-07 Support development of a social vulnerability mapping tool that reflects the characteristics of the CNMI.					
OPD/ HMGP	All Islands	Both	All	HMGP, BRIC	Ongoing
Problem: 1. Progress was made for the 2024 SHMP Update to spatially geolocate commonwealth assets, including critical facilities, and general building stock. However, data are still incomplete or are generalized (i.e., building types). 2. Detailed 2020 Census data were available in February 2024; however, there was insufficient time during the 2024 SHMP Update to use this information to update the Social Vulnerability Index maps for Saipan, Tinian, and Rota.					
Action: 1. Update the social vulnerability GIS information with detailed demographic data from the 2020 Census released in February 2024.					
Hazard: All					

Other funding sources and programs are detailed in Appendix F (Mitigation Strategy Supplement).

6.5.3 Mitigation Action Plan Prioritization

Element S12-b. Was the prioritization of mitigation action and activities updated based on the updated analysis of risks, capabilities, and progress?

Stakeholders prioritized mitigation actions in the 2024 SHMP Update based on hazards in the risk assessment, mitigation capabilities, and progress on previously identified actions. The prioritization schema for action implementation differs from the process and criteria used to rank planning and project proposals for FEMA mitigation grant funding. Each action in the 2024 SHMP Update was ranked based on the following criteria:

- Will the action result in lifeline safety?
- Will the action result in property protection of vulnerable state assets?
- Will the action be cost-effective? (future benefits exceed cost)
- Is the action technically feasible?
- Will the action mitigate impacts from climate change?
- Does the CNMI have the legal authority to implement?
- Is funding available for the action?
- Will the action have a positive impact on the natural environment?
- Does the action benefit socially vulnerable communities?

- Does the Commonwealth have the administrative capability to execute the action?
- Will the action reduce risk to more than one hazard?
- Can the action be completed in less than 5 years?
- Is there an agency/department local champion for the action?
- Will the action support other local objectives (such as capital improvements, economic development, environmental quality, or open space preservation?) or policies of other plans and programs?

The answers to each of these questions are weighted as follows:

- Yes = 3 points
- Not sure, could be either yes or no, or question is difficult to quantify = 1 point
- No = 0 points

Following scoring of each action, priorities are assigned based on the following metrics:

- 35 or more = High Priority
- 20 to less than 35 = Medium Priority
- 0 to less than 20 = Low Priority

This prioritization process was applied to hazards identified by the risk assessment conducted for the 2024 SHMP Update. It was also applied based on updates to the capabilities assessed in Chapter 5.0 (Capability Assessment) and Appendix E (Capability Assessment Supplement), as shown in the prioritization questions above. Table 6-2 shows the implementation priority for each action included in the 2024 SHMP Update, based on the following characteristics of the action:

- **Mitigation Goals**—Goals are listed in detail in Section 6.2 (Mitigation Goals and Objectives)
- **Mitigation Objectives**—Objectives are listed in detail in Section 6.2 (Mitigation Goals and Objectives)
- **Action Type—**Mitigation actions are summarized into the following four types defined by FEMA:
    - **Local Plans and Regulations—**Include government authorities, policies, or codes that encourage risk reduction, such as building codes and state planning regulations. This may also include planning studies.
    - **Structure & Infrastructure Projects**—Involve modifying existing structures and infrastructure or constructing new structures to reduce the impact of hazards.
    - **Natural Systems Protection—**Minimize losses while also preserving or restoring the function of natural systems.

- **Education and Awareness Programs**—Include long-term, sustained programs to inform and educate citizens and stakeholders about hazards and mitigation options. This category could also include training.

- **Implementation Priority**—The ranking criteria discussed above. See Appendix F (Mitigation Strategy Supplement) for the prioritization summary of each action.

In May 2024, stakeholders scored each action according to the criteria above. Scores for each action and action type were averaged and the priority assigned. The averaged scores for criteria for each action are presented in Appendix F, Table F.2-1. The resultant priority for each action is presented in Table 6-2.

Table 6-2. 2024 SHMP Update of the mitigation action plan goals, objectives, action type, and priority.

		Action Type				
Action No.	Mitigation Goals	State Plans & Regs	Structure & Infrastructure Project	Natural Systems Project	Education & Awareness Program	Priority
2018-01-01	1,2,4		X			High
2018-01-02	1,2,4		X			High
2018-01-03	1,2,4		X			High
2018-01-04	2,4	X	X			Medium
2018-01-05	2,4	X	X			High
2018-01-06	2.4	X				High
2024-01-07	2,4	X				High
2024-01-08	1,2,4		X			High
2024-01-09	1,2,4				X	High
2024-01-10	2,3,4		X			High
2024-01-11	2,3,4	X				High
2024-01-12	2,3,4	X				High
2024-01-13	1,2,3,4	X				High
2018-02-01	1,2,3,4	X				High
2018-02-02	1,2,3,4	X				Medium
2018-02-03	1,2,4		X		X	High
2018-02-04	2				X	High
2024-02-05	2		X			Medium
2024-02-06	1,2,4	X				High
2024-02-07	2,4	X				High
2018-03-01	1,2,3,4	X				Medium
2018-03-02	1,2				X	High
2018-04-01	1,2				X	High
2018-04-02	2	X			X	High
2018-04-03	1,2				X	High
2018-04-04	1,2				X	High
2018-04-05	1,2				X	High
2024-04-06	3			X	X	Medium
2024-04-07	3,4				X	Medium
2024-04-08	1,2,3,4				X	High
2018-05-01	2,3,4		X			Medium
2018-05-02	2,3,4	X				Medium

Table 6-2. 2024 SHMP Update of the mitigation action plan goals, objectives, action type, and priority (*cont'd*).

Action No.	Mitigation Goals	Action Type: State Plans & Regs	Action Type: Structure & Infrastructure Project	Action Type: Natural Systems Project	Action Type: Education & Awareness Program	Priority
2018-06-01	3		X	X		Medium
2018-06-02	2,3,4		X			Medium
2018-06-03	2,3,4	X	X			High
2018-06-04	3				X	Medium
2018-06-05	3,4	X				Medium
2018-06-06	3,4		X	X		Medium
2018-06-07	3,4	X				Medium
2018-06-08	2,3,4	X				Medium
2024-06-09	2,3,4	X				Medium
2024-06-10	2,3,4			X		High
2024-06-11	2,3			X		Medium
2024-06-12	2,3,4	X		X		High
2024-06-13	3		X		X	Medium
2024-06-14	1,2,4	X				High
2024-06-15	1,2,3,4			X		High
2018-07-01	1,2,4		X			High
2018-07-02	1,2,4		X		X	Medium
2024-07-03	1,2,4	X				Medium
2024-07-04	1,2,4	X				Medium
2024-07-05	1,2,4	X	X			Medium
2018-08-01	1,2,4	X				High
2018-08-02	4	X				Medium
2018-08-03	1,2,4	X				Medium
2018-08-04	3,4	X				Medium
2024-08-05	2,4	X				High
2024-08-06	1,2,4	X				High
2024-08-07	1,4	X				Medium

6.6 Opportunities for Improving the Mitigation Strategy

FEMA provided recommendations for improvements to the SHMP (Appendix G [FEMA Review of 2024 SHMP Update]). Many of these recommendations are incorporated into this 2024 SHMP Update. Remaining recommendations to be incorporated into the 2029 SHMP Update for the Mitigation Strategy include:

- Along with identifying the goal(s) related to each mitigation action in Table 6-2, provide a narrative of how the action relates to and will further the goal(s) of the plan. Clearly explain how the completed activity or project will help the territory reach the stated goals. This shows the bridge between the goals and actions of the plan.
- It is strongly encouraged that the mitigation strategy include unique actions for each hazard profiled in the plan. While it is acceptable to include multi- and all-hazard actions,

including and implementing hazard-specific actions for the vulnerabilities identified in the risk assessment is the best way to minimize the impacts.

- In the next update, consider building on the discussion of how the prioritization of projects in the plan has changed to reflect the territory's current priorities. Describe the previous plan's prioritization of action method. Specifically, how the criteria identified in F.1.1.2 led to a priority rating or ranking. This will show how the prioritization method for the plan update reflects the updated analysis on risks, capabilities and progress on mitigation actions.

A task to annually review the opportunities for improvement provided by FEMA was added to the Annual Maintenance Schedule for the SHMP (Table 7-1).

References

Cash, H., Shai, H. I., Shirriff, V., & Haanschoten, E. (2021). *Availability of Street-Level Supports for Walking in Saipan*. Commonwealth Healthcare Corporation.

[CHC] Commonwealth Healthcare Corporation. (2022a). *Availability of Street-Level Supports for Walking in Rota* (p. 30). Commonwealth Healthcare Corporation.

[CHC] Commonwealth Healthcare Corporation. (2022b). *Availability of Street-Level Supports for Walking in Tinian* (p. 31). Commonwealth Healthcare Corporation.

[FEMA] Federal Emergency Management Agency. (2021). *Codes, Standards, and Permitting: Mitigation Assessment Team Summary Report and Recommendations, Commonwealth of the Northern Mariana Islands, Super Typhoon Yutu* (p. 23). US Department of Homeland Security.

GHD. (2023). *CNMI 20-Year Highway Master Plan, Final Report* (p. 200). CNMI Department of Public Works.

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Chapter 7.0 Implementation and Maintenance

28 July 2024

Table of Contents

List of Tables

7.0 Plan Implementation and Maintenance

The development of a plan implementation and maintenance process ensures that the State Hazard Mitigation Plan (SHMP) remains a *living* document that is intended to be changed and updated throughout the 5-year performance period. Maintaining momentum in mitigation strategy implementation can lead to significant long-term changes and overall risk reduction. As such, a formal process is necessary to ensure that the SHMP will remain an active and relevant document. The Hazard Mitigation Grant Program (HMGP) is the responsible agency for the preparation and maintenance of the SHMP; and the State Hazard Mitigation Officer (SHMO) is the individual responsible for overseeing the coordination, implementation, and maintenance of the plan collaboratively among stakeholders across the Commonwealth.

This chapter evaluates the challenges and successes of the 2018 Standard State Mitigation Plan (SSMP) maintenance procedures and outlines an updated strategy to maintain the 2024 SHMP Update to ensure it remains current and reflects changes to the Commonwealth mitigation program over time.

7.1 Past Implementation and Performance Plan (2018)

The Commonwealth intends to ensure the 2024 SHMP Update remains a *living* document that will be updated and revised as appropriate as new information becomes available. To implement a formal maintenance process, the previously approved plan method and schedule for monitoring, evaluating, and updating the plan was reviewed. The method and schedule in the previous plan were appropriate. However, the mitigation process was disrupted by several major events.

Due to several natural disasters between 2015 and 2021, the Commonwealth redirected attention to disaster response and recovery and diverted attention and resources away from the 2018 SSMP maintenance process. Due to limited staffing and the number of disaster declarations that occurred, HMGP focused on sustaining those communities most affected by the natural hazard events as well as other unanticipated needs. Disruptions and delays in plan maintenance were particularly challenging due to staffing and logistic complications associated with the coronavirus disease 2019 (COVID-19) pandemic.

Without enough capacity to dedicate to mitigation, there were increased challenges in executing the plan maintenance procedures outlined in the 2018 SSMP; therefore, plan maintenance was not fully actualized. During the 2018 plan performance period, HMGP tracked progress on plans and projects funded by FEMA Hazard Mitigation Assistance (HMA) programs and their implementation progress.

A further complication to plan implementation and maintenance in the past is after adoption of the 2018 SSMP, the responsibility for implementation and plan maintenance shifted from the Homeland Security and Emergency Management (HSEM) to HMGP.

7.2 Keeping the SHMP Current

Element S17. Is there a description of the method and schedule for keeping the plan current? [44 CFR §§ 201.4(c)(5)(i) and 201.4(d)]

To ensure the 2024 SHMP Update reflects current conditions and progress toward implementation, the plan will be regularly reviewed and evaluated. This will be achieved through a systematic process to monitor, evaluate, and update the plan regularly. The 2024 SHMP Update is the fourth update to the original plan written in 2004. Review and evaluation of the 2024 SHMP progress on implementation will occur approximately on a semi-annual basis.

Monitoring means tracking implementation of the plan over the 5-year period.

Evaluating means assessing the effectiveness of the plan at achieving the stated purpose and goals.

Updating means reviewing and revising the plan at least once every 5 years.

This SHMP is a *living* document and is expected to be updated and improved progressively during the five-year implementation period. This section details how the plan is reviewed, revised, and updated as conditions in the Commonwealth evolve. The SHMO is responsible for guiding and directing updates and maintaining the current SHMP. The Commonwealth Government recognizes the importance and value of the SHMP and the positive impact it has on mitigation, and working toward more resilient, safer communities. The Commonwealth Government recognizes the importance of tracking the relevance and implementation of the SHMP to assess plan effectiveness to achieve the stated goals. The HMGP and the SHMO have committed to the following system to keep the plan current.

The HMGP is responsible for monitoring the implementation of the SHMP and may convene an advisory council comprised of key stakeholders to assist with development and coordination of subsequent plans and projects that support the mitigation strategy. The HMGP is responsible and works in coordination with the Disaster Recovery Coordinator to document plan monitoring and update activities. Documentation will occur as frequently as semi-annually, or as the need arises. HMGP will work with stakeholders and other relevant agencies to review mitigation priorities and identify projects for funding under the FEMA Hazard Mitigation Assistance Program as well as other sources of federal funding. HMGP and stakeholders from key government departments will evaluate and revise the most recent plan updates and submit them to FEMA for final consideration.

During the 2024–2029 plan performance period, the most current version of the SHMP will be hosted on the website maintained by the Office of Planning and Development, so that the plan is accessible to all government, public, and non-governmental organizations (NGO) stakeholders. HMGP and key stakeholders will review the plan following any large incidents or disaster declaration to discuss mitigation funding opportunities and priorities of the mitigation plan and to recommend projects for the federal Hazard Mitigation Grant Program.

Although the SHMP is primarily the responsibility of the HMGP, other agencies and key stakeholders are collaborators to monitor plan implementation, to evaluate plan effectiveness, and to update the plan for timely accuracy. The SHMO is primarily responsible for monitoring the hazard mitigation plan and potential mitigation opportunities. The SHMO engages the assistance of HMGP to work with government agencies seeking mitigation funding to complete benefit-cost analyses and grant applications. The SHMO is responsible to maintain the Mitigation Action Tracker (see description in Section 7.3 below) year-round with assistance from the HMGP.

With assistance from the HMGP, each quarter, as well as following any disaster, the SHMO reviews the Mitigation Action Plan to monitor the status of the actions and reviews funding availability or opportunities. The SHMO oversees the preparation of a short report/brief each quarter to document progress toward mitigation action implementation for key stakeholders. This report/brief can be emailed to stakeholders or presented at other agency coordination meetings. At least annually, the SHMO reviews the SHMP in its entirety with HMGP and relevant stakeholders (i.e., the annual review meeting). Following the annual review meeting, the SHMO develops a report that incorporates quarterly progress mitigation action reports and any changes to the Mitigation Strategy or SHMP in general. The annual report can be used to document progress over the 5-year plan performance period for the 2029 SHMP Update. The processes for keeping the plan current over the next 5-year plan performance period are described below.

7.2.1 Annual Review

The SHMP will be reviewed annually to evaluate progress made toward the goals, objectives, and actions identified in the Mitigation Strategy (Chapter 6.0). Changes will be considered based on previous events, changes in regulations, or other relevant activities in the Commonwealth of the Northern Mariana Islands (CNMI). The annual review will be led by HMGP under direction from the SHMO and will include the following tasks:

- Review Mitigation Action Tracker, a customized spreadsheet, to identify actions implemented, funding status of all actions, and the priority order of actions.

- The SHMO will lead a review of the accuracy and relevancy of all SHMP components. Specifically, the mission and goal statements will be reviewed to ensure current priorities throughout the government are represented. In addition, current capabilities will be reviewed to address any new plans, regulations, or challenges. This includes identification of any new risk analyses.
- Develop a written plan amendment, if needed, based on items identified during the annual review process.
- The formal annual review is the time for the SHMO to request that agencies or departments incorporate the Hazard Mitigation Plan into relevant agency or department plans.

7.2.2 Post Disaster Review

Following a Presidential Disaster Declaration, the SHMO and HMGP will meet to review hazard mitigation needs and opportunities and coordinate/meet with other relevant government departments and authorities and stakeholders. Post-disaster is an opportune time to implement mitigation actions and to receive mitigation funding. It is also the time for the HMGP to amend the Hazard Mitigation Plan with input from stakeholders, lessons learned, or new priorities for mitigating risks. A post-disaster review may be substituted for the annual review depending on the timing and circumstances of the disaster.

7.2.3 Five-Year Plan Review

The Commonwealth Government is committed to updating the SHMP every 5 years. The SHMO is committed to working with HMGP and stakeholders to implement a project schedule that addresses information and data gaps during the 5-year plan performance period to facilitate the next update. The SHMO and HMGP will lead the plan update process with engagement from other relevant government authorities over the 5-year plan performance period. Based on the series of annual reviews and other maintenance activities, the 2029 SHMP Update is expected to be timely and efficient.

To continue to address FEMA requirements, the 2029 SHMP Update will improve information and analyses in the following areas:

- Changes in land use and the built environment.
- Changes in population demographics and vulnerability to hazards.
- Changes to the vulnerability of critical facilities, infrastructure, and Commonwealth-owned and operated buildings.
- Relevancy of previously identified goals, objectives, and mitigation actions.
- Availability of resources to implement the mitigation plan.

- Progress made toward completing mitigation actions, current status of those actions, and barriers to their implementation.
- Changes to Federal or Commonwealth laws or regulations that should be addressed in the plan, including funding opportunities.
- Lessons learned from on-going plan implementation.

7.2.4 Consultation with FEMA

In coordination with quarterly plan reports, the SHMO will hold a conference call annually with FEMA Region 9 to review the status of the SHMP and all identified actions. The SHMO will meet more frequently with FEMA if a major disaster is declared or if funding becomes available for identified projects. The technical assistance provided by FEMA to review potential projects is beneficial to ensuring the SHMP is implemented efficiently.

7.2.5 SHMP Maintenance Schedule

Table 7-1. Maintenance schedule for the State Hazard Mitigation Plan

Timeframe	Actions
Annually; Each Year 2024–2028	The SHMO and HMGP meet and coordinate with stakeholders following any major incidents to review the mitigation action plan, discuss new funding opportunities, priority mitigation actions, and new funding priorities. The mitigation action plan will be amended at this time.
	The SMHO and HMGP meet with stakeholders to discuss mitigation action implementation progress/status.
	The SHMO and HMGP request agencies incorporate mitigation actions into their relevant action plans.
	The SHMO and HMGP work with departments seeking mitigation funding to complete benefit-cost analyses and grant applications.
	The Departments and stakeholders proceed with implementation.
	The SHMO maintains the Mitigation Action Tracker.
	Review the Opportunities for Improvement provided by FEMA in the State Mitigation Plan Review Tool (Appendix G). Develop specific actions to be achieved each year during the 5 year plan performance period.
	Prepare quarterly reports.

Table 7-1. Maintenance schedule for the State Hazard Mitigation Plan (*cont'd*).

Timeframe	Actions
August 2024–July 2025	Continue work to modernize and improve the GIS data for Commonwealth buildings, including critical facilities and community lifelines, and general building stock and make the data layers available for other planning efforts.
	Within 6 months of approval of the 2024 SHMP Update, HMGP will develop the Mitigation Action Tracker and implement project tracking by mitigation action number to facilitate progress tracking and reporting.
	Update the social vulnerability geodatabase and maps with detailed demographics released by the US Census Bureau in February 2024.
	HMGP seeks funding for additional consulting services to assist with an update to this plan.
	Per FEMA recommendation, track territorial planning efforts to integrate with SHMP updates by gathering information from stakeholders at the annual SHMP review meeting; maintain a list of planning efforts.
	All annual action items listed above.
August 2025–July 2026	Continue to work with HSEM, CUC, PSS, DCCA, CHCC, and other relevant departments and offices to identify and characterize critical facilities and community lifelines for more accurate vulnerability assessments. Update stakeholder and community Lifeline information in Table 3-1 as needed.
	Per FEMA recommendation, review stakeholder list and consider expanding participation to external stakeholders, including other federal agencies (e.g., EPA, HUD, USFWS, etc.).
	Begin coordination with departments, offices, and agencies that maintain geospatial data regarding Commonwealth assets to ensure information will be updated and available for the 2029 SHMP Update.
	HMGP seeks funding for additional consulting services to assist with the 2029 SHMP Update.
	Per FEMA recommendation, track territorial planning efforts to integrate with SHMP updates by gathering information from stakeholders at the annual SHMP update meeting; maintain a list of planning efforts.
	All annual action items listed above.
August 2026–July 2027	Seek technical assistance and/or training for relevant CNMI agencies to improve data for the Commonwealth and general building stock. Investigate the feasibility or requirements to include the data in national databases and tools to facilitate future hazard risk analysis. Identify information/data gaps or obstacles that will impede use of these databases/tools in future SHMP updates.
	HMGP seeks funding for additional consulting services to assist with an update to this plan.
	Continue with all annual action items listed above.

Table 7-1. Maintenance schedule for the State Hazard Mitigation Plan (*cont'd*).

Timeframe	Actions
	Continue work to include CNMI data in US national databases for natural hazards and risk analysis.
	Review hazard maps from the 2024 SMHP Update and identify remaining data gaps and limitations. Develop an action plan to address any shortcomings before the 2029 SHMP Update.
	Review and update the methods and approaches used for the hazard vulnerability analyses.
	HMGP seeks funding for additional consulting services to assist with an update to this plan.
	Per FEMA recommendation, track territorial planning efforts to integrate with SHMP updates by gathering information from stakeholders at the annual SHMP update meeting; maintain a list of planning efforts.
	Continue with all annual action items listed above.
August 2027–July 2028	HMGP seeks funding for additional consulting services to assist with an update to this plan.
	Issue RFP to retain consulting services to produce the 2029 SHMP Update.
	Per FEMA recommendation, track territorial planning efforts to integrate with SHMP updates by gathering information from stakeholders at the annual SHMP update meeting; maintain a list of planning efforts.
	All annual action items listed above.
August 2028–2029	Begin public stakeholder engagement regarding the update process and to gather input for the update process. Review recommendations for improving public engagement in Chapter 3.3.4.
	HMGP seeks funding for additional consulting services to assist with the 2029 SHMP Update.
	Continue with all annual action items listed above.

7.3 Process to Monitor SHMP Implementation

Element S18. Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§ 201.4(c)(5)(ii) and 201.4(c)(5)(iii)]

The primary purpose of the SHMP is to identify and prioritize mitigation actions the Commonwealth can implement to reduce the impacts from natural hazards. Monitoring mitigation action implementation is a good way to measure plan success. Ultimately, through plan implementation the Commonwealth seeks to reduce risk from natural hazards and work toward community resiliency and sustainable development to create healthier, safer communities for residents and visitors. Plan implementation is achieved through consistent monitoring, evaluating, and updating the mitigation actions as new priorities arise or new information becomes available. Each department or agency is responsible to implement mitigations actions defined in this plan that fall under their respective responsibility.

The SHMO and HMGP will use the process described below to track the implementation of mitigation actions identified in the Mitigation Strategy (Chapter 6.0). The process identifies responsible parties and their roles. The criteria for evaluating progress toward the goals, objectives and mitigation actions are also defined. Lastly, a schedule for actions over the 5-year plan performance period is provided.

Each department or agency that is assigned a mitigation action is responsible to implement that action. The HMGP and the SHMO will assist agencies with project development, benefit-cost-analysis, and grant applications. HMGP and the SHMO continually monitor funding opportunities and make the information available to potential grantees.

To monitor and evaluate plan implementation, the SHMO will use a Mitigation Action Tracker, a customized spreadsheet, with details about each mitigation action and its status. All mitigation actions identified in the mitigation strategy will be tracked regardless of funding sources.

Information included in the Mitigation Action Tracker for progress reporting includes:

- Project Start Date
- Project Completion Date
- Project delay or cost overrun notes
- Quarterly accomplishment for each reporting period
- Challenges or obstacles encountered for each reporting period
- Next quarter plans.

The SHMO will prepare quarterly mitigation action implementation progress reports combined with any disaster write-up to support the formal SHMP annual review. Following the annual review, the SHMO will develop an annual report to document any changes to the Mitigation Strategy or SHMP in general. The annual reports will support the 2029 SHMP Update.

The following four-step process outlines the monitoring activities.

1. **Plan Monitoring**: The SHMO initiates the plan monitoring process by requesting a meeting of the SHMP stakeholders. At this meeting mitigation activity updates will be requested by way of a project update worksheet. Before the first annual review meeting, HMGP will develop a project update worksheet to facilitate data reporting by departments and agencies and to standardize the project status updates. This project update

worksheet will also be used to by departments and agencies to request new mitigation actions.

2. **Maintain Mitigation Action Data**: The SHMO will maintain data regarding the implementation of all mitigation actions through the Mitigation Action Tracker.
3. **New Mitigation Opportunities**: The SHMO will work with department and agency leaders to identify new mitigation opportunities in each of their respective agencies. In addition, following a major disaster declaration, the SHMO and HMGP will advise stakeholders about current funding opportunities.
4. **Gather Updated Planning Documents**: The SHMO will request additional planning documents from all relevant government agencies and departments to include in the update of this plan. HMGP will be the recipient of all documents and maintain a list of on-going mitigation efforts.

On an annual basis, the SHMO will provide a status or project summary for stakeholders. Minutes from each meeting where the SHMP is discussed will also be included in the annual update record. The reports and minutes will serve as a permanent record for mitigation progress and support the 2029 SHMP Update process. The SHMO and HMGP will update the 2024 SHMP Update, as needed, through the 5-year plan performance period.

7.4 Opportunities for Improvements to Plan Review, Evaluation, and Implementation

FEMA provided recommendations for improvements to the SHMP (Appendix G). Many of these recommendations are incorporated into this 2024 SHMP Update. Remaining recommendations to be incorporated into the 2029 SHMP Update for the Plan Review, Evaluation, and Implementation include:

- Further prepare the SHMO and HMGP for plan maintenance efforts, it is recommended that the Mitigation Action Tracker be fully developed and functional at the time of plan finalization. Having a tracker that is ready for use will help ensure the monitoring process is carried out as stated in Chapter 7.
- Although not required, there is opportunity for the Territory to build on the public engagement that was conducted during the planning process. This could be done by including active continued public outreach in the plan maintenance efforts. Carrying out the suggested improvements in Chapter 3.3.4 for public outreach efforts during the next five years to prepare for the full update will enhance the 20209 SHMP.

A task to annually review the opportunities for improvement provided by FEMA was added to the Annual Maintenance Schedule for the SHMP (Table 7-1).

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Appendix A Planning Process Documentation

28 July 2024

Table of Contents

List of Tables

List of Figures

Appendix A Planning Process Documentation

A.1 Introduction

This appendix provides supporting information on the planning process captured in Chapter 3.0 (Planning Process). Information on agency, stakeholder, subject matter experts (SME), and public outreach conducted as part of the 2024 SHMP Update planning process not already captured in Chapter 3.0 (Planning Process) is included below. This includes public announcements, stakeholder survey results, meeting agendas, sign-in sheets, presentations for agency and public stakeholder meetings, and a conference presentation used for the development of the 2024 SHMP Update.

When the draft 2024 SHMP Update was completed on April 22, 2024, the SHMO identified lead and supporting reviewers to ensure the first-round of review was conducted by SMEs. The draft 2024 SHMP Update sections were distributed to the lead reviewers on the PDAC. All comments received from the SMEs were considered and incorporated into the draft, where appropriate.

A.2 Public Outreach

Public announcements publicizing the six meetings on the Tinian, Rota, and Saipan, which included the Northern Islands, for the 2024 SHMP Update are found in Figure A.2-1 through Figure A.2-3. Social media announcements are discussed in Chapter 3.0 (Planning Process).

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS | OFFICE OF THE GOVERNOR

HAZARD MITIGATION GRANT PROGRAM

JUAN A. SABLAN BUILDING | CALLER BOX 10007 | SAIPAN, MP 96950 | 670.664.2410 | INFO@HM.GOV.MP

HMGP TO HOST MEETINGS FOR HAZARD MITIGATION PLANNING

The Hazard Mitigation Grant Program, under the Office of the Governor, is updating the *Standard State Mitigation Plan* for the 5-year period beginning 2024 (SSMP 2024). The SSMP presents the range of natural hazards likely to occur in the CNMI, provides risk and vulnerability assessments, identifies mitigation strategies, and proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters.

The Federal Emergency Management Agency (FEMA) requires the CNMI to have an updated and current 5-year SSMP to maintain eligibility for a range of funding and other assistance during disasters and for non-emergency purposes.

Hazard characteristics and effects may vary across the islands of the CNMI based on local socio-economic conditions and population distribution, so hazard considerations may vary among the islands. HMGP will hold hybrid meetings on Tinian, Rota, and Saipan to allow members of the public and government agencies to provide input for the SSMP 2024 Update. The Saipan meeting will include the Northern Islands.

All are welcome to attend in person at the time and locations below or use the Zoom meeting link to attend virtually.

- February 6th, Tinian - Northern Marianas College Tinian Campus (Room D)
  1:30 – 3:30pm https://marianas.zoom.us/j/84517619572
  6:30 – 8:30pm https://marianas.zoom.us/j/89389621247

- February 8th, Rota - Northern Marianas College Rota Campus (Room A1)
  1:30 – 3:30pm https://marianas.zoom.us/j/82331972151
  6:30 – 8:30pm https://marianas.zoom.us/j/87022146628

- February 13th, Saipan - Northern Marianas College Saipan Campus (Pod T-1)
  1:30 – 3:30pm https://marianas.zoom.us/j/86941172354
  6:30 – 8:30pm https://marianas.zoom.us/j/83018473618

For those who cannot attend one of the meetings in person or virtually, please provide input on the SSMP 2024 Update through the on-line via scanning the QR code below or online at https://www.surveymonkey.com/r/HZHZVGQ

Access the link or QR code to see the opening and closing dates of the survey.

To learn more about the SSMP and general aspects of hazard mitigation, please visit the CNMI Homeland Security & Emergency Management Archives | Office of Planning and Development (gov.mp) website.

HMGP looks forward to a productive stakeholder engagement for this important initiative.

Figure A.2-1. Public service announcement.

Marianas Variety News & Views
MICRONESIA'S LEADING NEWSPAPER SINCE 1972

https://www.mvariety.com/news/local/hazard-mitigation-grant-program-to-host-meetings/article_575d6f64-bf40-11ee-b4b3-6bc6c3edeb30.html

Hazard Mitigation Grant Program to host meetings

Press Release
Jan 31, 2024

THE Hazard Mitigation Grant Program, under the Office of the Governor, is updating the Standard State Mitigation Plan for the five-year period beginning 2024. The SSMP presents the range of natural hazards likely to occur in the CNMI, provides risk and vulnerability assessments, identifies mitigation strategies, and proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters.

The Federal Emergency Management Agency requires the CNMI to have an updated and current five-year SSMP to maintain eligibility for a range of funding and other assistance during disasters and for non-emergency purposes.

Hazard characteristics and effects may vary across the islands of the CNMI based on local socio-economic conditions and population distribution, so hazard considerations may vary among the islands. HMGP will hold hybrid meetings on Tinian, Rota, and Saipan to allow members of the public and government agencies to provide input for the SSMP 2024 Update. The Saipan meeting will include the Northern Islands.

All are welcome to attend in person at the time and locations below or use the Zoom meeting link to attend virtually.

- Feb. 6, Tinian - Northern Marianas College Tinian Campus (Room D)

1:30 p.m. to 3:30 p.m. https://marianas.zoom.us/j/84517619572

6:30 p.m. to 8:30 p.m. https://marianas.zoom.us/j/89389621247

- Feb. 8, Rota - Northern Marianas College Rota Campus (Room A1)

1:30 p.m. to 3:30 p.m. https://marianas.zoom.us/j/82331972151

6:30 p.m. to 8:30 p.m. https://marianas.zoom.us/j/87022146628

- Feb. 13, Saipan - Northern Marianas College Saipan Campus (Pod T-1)

1:30 p.m. to 3:30 p.m. https://marianas.zoom.us/j/86941172354

6:30p.m. to8:30p.m.

https://marianas.zoom.us/j/83018473618

For those who cannot attend one of the meetings in person or virtually, please provide input on the SSMP 2024 Update online at https://www.surveymonkey.com/r/HZHZVGQ

To learn more about the SSMP and general aspects of hazard mitigation, visit the CNMI Homeland Security & Emergency Management Archive, Office of Planning and Development (gov.mp) website.

HMGP looks forward to a productive stakeholder engagement for this important initiative.

Figure A.2-2. Marianas Variety News & Views announcement.

Saipan Tribune

https://www.saipantribune.com/news/local/hmgp-to-host-meeting-for-hazard-mitigation-planning/article_aaddffea-bffa-11ee-96b1-f3fb106b79e4.html

HMGP to host meeting for hazard mitigation planning

Feb 1, 2024

The Hazard Mitigation Grant Program, under the Office of the Governor, is updating the Standard State Mitigation Plan for the five-year period beginning in 2024.

The SSMP presents the range of natural hazards likely to occur in the CNMI, provides risk and vulnerability assessments, identifies mitigation strategies, and proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters.

The Federal Emergency Management Agency requires the CNMI to have an updated and current five-year SSMP to maintain eligibility for a range of funding and other assistance during disasters and for non-emergency purposes.

Hazard characteristics and effects may vary across the islands of the CNMI based on local socio-economic conditions and population distribution, so hazard considerations may vary among the islands. HMGP will hold hybrid meetings on Tinian, Rota, and Saipan to allow members of the public and government agencies to provide input for the SSMP 2024 Update. The Saipan meeting will include the Northern Islands.

All are welcome to attend in person or use the Zoom meeting link to attend virtually.

For those who cannot attend one of the meetings in person or virtually, please provide input on the SSMP 2024 Update through the on-line via scanning the QR code or online at https://www.surveymonkey.com/r/HZHZVGQ.

Access the link or QR code to see the opening and closing dates of the survey.

To learn more about the SSMP and general aspects of hazard mitigation, please visit the CNMI Homeland Security & Emergency Management Archives/Office of Planning and Development (gov.mp) website.

HMGP looks forward to a productive stakeholder engagement for this important initiative. ***(PR)***

Figure A.2-3. Saipan Tribune announcement.

A.3 Summary of Survey Results

As part of the 2024 SHMP Update planning process, stakeholder surveys were released on January 30, 2024 through a cloud based software platform offered by SurveyMonkey. The public service announcements in Figures A.2-1 through A.2-3 include the QR barcode and URL or website address for the online surveys. Paper versions of the surveys were also available during the February 2024 public meetings. During the meetings, stakeholders were again provided with the QR barcode and URL website address. To encourage survey participation, the Northern Marianas College Office of Information Technology provided wireless internet access for in person meeting participants. Surveys were kept open until March 31, 2024 to allow for ample stakeholder participation. The purpose of the surveys is to foster collaboration while engaging stakeholders in the process of assessing natural hazard risks within the CNMI. Stakeholders helped to identify and prioritize natural hazard risks, shared risk awareness and experience with past natural hazards. To the extent possible, stakeholder survey information was integrated into the 2024 SHMP Update. Thirteen community stakeholders and 30 government agency stakeholders provided input via survey. The survey results include recommended actions to reduce vulnerability and ways the Commonwealth can assist residents and business prepare for a natural disaster and become more resilient.

Eight-five (85%) percent of community stakeholder respondents reported feeling prepared for a natural hazard event because of past experience with natural hazards. Seventy-seven (77%) percent of community respondents ranked typhoons and tropical storms pose the highest risk to the community, followed by typhoon related coastal flooding (23%) (Table A.3-1). Saltwater incursion on the water table and invasive species were identified as other significant natural hazards that pose a risk to the community. Over 60% of the community respondents reported having installed storm shutters or structural/roof bracing on their homes or businesses to reduce wind damage, and 46% installed back up water supply. Thirty-one (31%) percent reported social media as the preferred method of receiving information about how to protect their family and prepare their homes and businesses against natural hazard events. Community stakeholder survey results are available in Section A.3.1.

Ninety-seven percent (97%) of government agency stakeholder respondents ranked typhoons and tropical storms pose the highest risk to the CNMI followed by climate change (83%), coastal erosion (67%), and typhoon related coastal flooding (63%) (Table A.3-12). Ninety-two (92%) reported critical infrastructure in areas at risk from tropical storms hazards with loss of power, water, and wastewater service outages during and after a tropical storm event hinder communication and services to the community. Respondents reported public health risk (e.g. pandemic) a moderate risk to the community and cited lessons learned during COVID-19 on how best to mitigate the risk. Information on specific areas in the community that are particularly vulnerable to natural hazards are included in the survey results available in Section A.3.2. There is an opportunity to adopt this useful information in the 2029 SHMP update.

Table A.3-1. Community stakeholder ranking of natural hazard risks

Natural Hazard	Definition	Rank 1 to 14 (1 highest, 14 lowest)
Typhoons & Tropical Storms	Is a tropical cyclone or localized, low-pressure weather system that has organized thunderstorms but no front (a boundary separating two air masses of different densities) and maximum sustained winds of at least 74 miles per hour.	**1**
Coastal Flooding (Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of high or rising tides or storm surges.	**2**
Coastal Erosion	Occurs as a result of flooding, typhoons or storm surges that wear away land resulting in beach, shoreline, or dune loss. This hazard can be long-term or short-term in scale.	**3**
Coastal Flooding (Non-Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of rising sea level.	**4**
Public Health Risk	A disease outbreak that spans several countries and affects a large number of people.	**5**
Earthquake	The shaking of the earth's surface by energy waves emitted by slowly moving tectonic plates overcoming friction with one another underneath the earth's surface.	**6**
Climate Change	Global or regional changes in climate patterns. For example, an increase in air and surface temperatures increase storm and wave frequency and intensity. Changes in rain, sea level rise, and changes in aquatic and terrestrial invasives species are all examples of changing climate patterns.	**7**
Tsunami	A wave, or series of waves, generated by an earthquake, landslide, volcanic eruption, or a large meteor strike in the ocean causing a rise or mounding of water at the ocean surface.	**8**
Wildfire	An unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.	**9**
Water Course Flooding	Occurs when streams or rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land.	**10**
Heatwave	A period of abnormally and uncomfortably hot and unusually humid weather (greater than 90° F) typically lasting two or more days with temperatures outside the historical averages for a given area.	**11**
Drought	A deficiency of rain over an extended period of time resulting in a water shortage.	**12**
Volcanic Activity	Occurs via vents that act as a conduit between the Earth's surface and inner layers, and erupt gas, molten rock, and volcanic ash when gas pressure and buoyancy drive molten rock upward and through zones of weakness in the Earth's crust.	**13**
Landslide	The movement of a mass of rock, debris, or earth down a slope.	**14**

Table A.3-2. Government agency stakeholder natural hazard risk priority

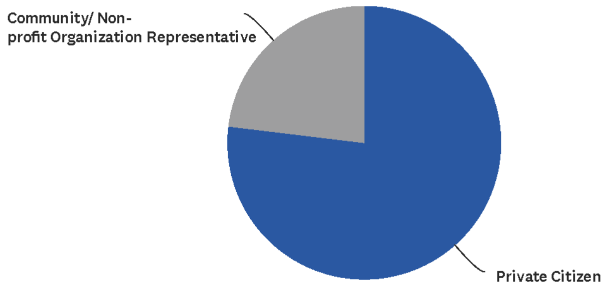
Natural Hazard	Definition	Priority Rating
Typhoons & Tropical Storms	Is a tropical cyclone or localized, low-pressure weather system that has organized thunderstorms but no front (a boundary separating two air masses of different densities) and maximum sustained winds of at least 74 miles per hour.	**High**
Coastal Flooding (Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of high or rising tides or storm surges.	**High**
Coastal Erosion	Occurs as a result of flooding, typhoons or storm surges that wear away land resulting in beach, shoreline, or dune loss. This hazard can be long-term or short-term in scale.	**High**
Public Health Risk	A disease outbreak that spans several countries and affects a large number of people.	**High**
Coastal Flooding (Non-Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of rising sea level.	**Moderate**
Earthquake	The shaking of the earth's surface by energy waves emitted by slowly moving tectonic plates overcoming friction with one another underneath the earth's surface.	**Moderate**
Wildfire	An unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.	**Moderate**
Water Course Flooding	Occurs when streams or rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land.	**Moderate**
Heatwave	A period of abnormally and uncomfortably hot and unusually humid weather (greater than 90° F) typically lasting two or more days with temperatures outside the historical averages for a given area.	**Moderate**
Drought	A deficiency of rain over an extended period of time resulting in a water shortage.	**Moderate**
Tsunami	A wave, or series of waves, generated by an earthquake, landslide, volcanic eruption, or a large meteor strike in the ocean causing a rise or mounding of water at the ocean surface.	**Low**
Volcanic Activity	Occurs via vents that act as a conduit between the Earth's surface and inner layers, and erupt gas, molten rock, and volcanic ash when gas pressure and buoyancy drive molten rock upward and through zones of weakness in the Earth's crust.	**Low**
Landslide	The movement of a mass of rock, debris, or earth down a slope.	**Low**

A.3.1 Community Stakeholder Survey Results

2024 Standard State Mitigation Plan Update SurveyMonkey

Q1 Responding as:

Answered: 13 Skipped: 0

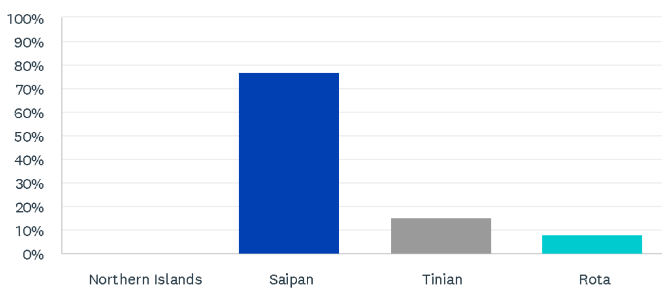


ANSWER CHOICES	RESPONSES	
Private Citizen	76.92%	10
Business/Commercial Sector	0.00%	0
Community/ Non-profit Organization Representative	23.08%	3
TOTAL		13

2024 Standard State Mitigation Plan Update SurveyMonkey

Q2 What island do you live on or responding for?

Answered: 13 Skipped: 0

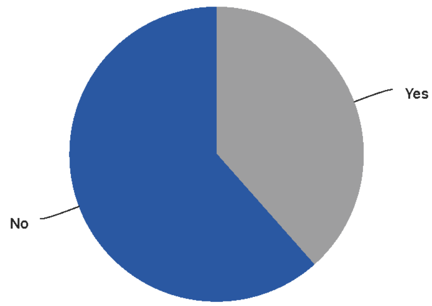


ANSWER CHOICES	RESPONSES	
Northern Islands	0.00%	0
Saipan	76.92%	10
Tinian	15.38%	2
Rota	7.69%	1
Total Respondents: 13		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q3 Have you heard of the Standard Mitigation Plan or referred to it in the past?

Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	38.46%	5
No	61.54%	8
TOTAL		13

2024 Standard State Mitigation Plan Update SurveyMonkey

Q4 How did you hear about the Standard State Mitigation Plan?

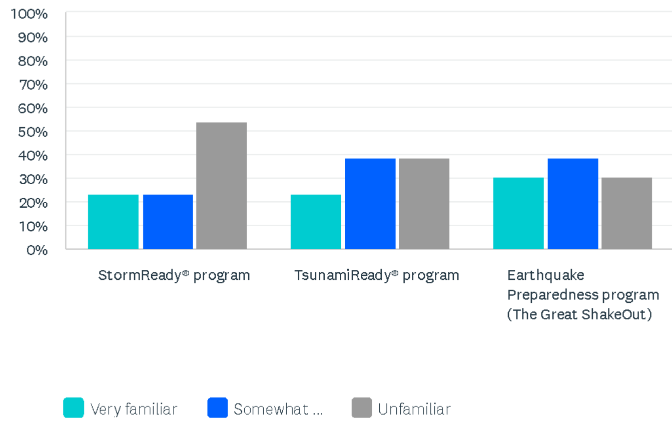
Answered: 13 Skipped: 0

#	RESPONSES	DATE
1	From a friend.	2/21/2024 9:59 PM
2	Somebody invited me	2/12/2024 11:07 PM
3	From the disability network partners	2/12/2024 7:46 PM
4	Through FEMA/CNMI HSEM	2/12/2024 7:38 PM
5	Through an email correspondence	2/12/2024 6:52 PM
6	HMGP	2/12/2024 5:20 PM
7	I have not	2/11/2024 7:16 PM
8	Working with FEMA and other CNMI government agencies.	2/11/2024 7:06 PM
9	Updates on it occasionally show up on the news.	2/9/2024 5:38 PM
10	I was learned about this after being invited to attend the upcoming meeting for this plan.	2/9/2024 5:14 PM
11	N/A	2/9/2024 5:02 PM
12	Flier	2/9/2024 4:51 PM
13	Marianas Variety	2/9/2024 4:35 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q5 How familiar are you with the following hazard mitigation programs?

Answered: 13 Skipped: 0

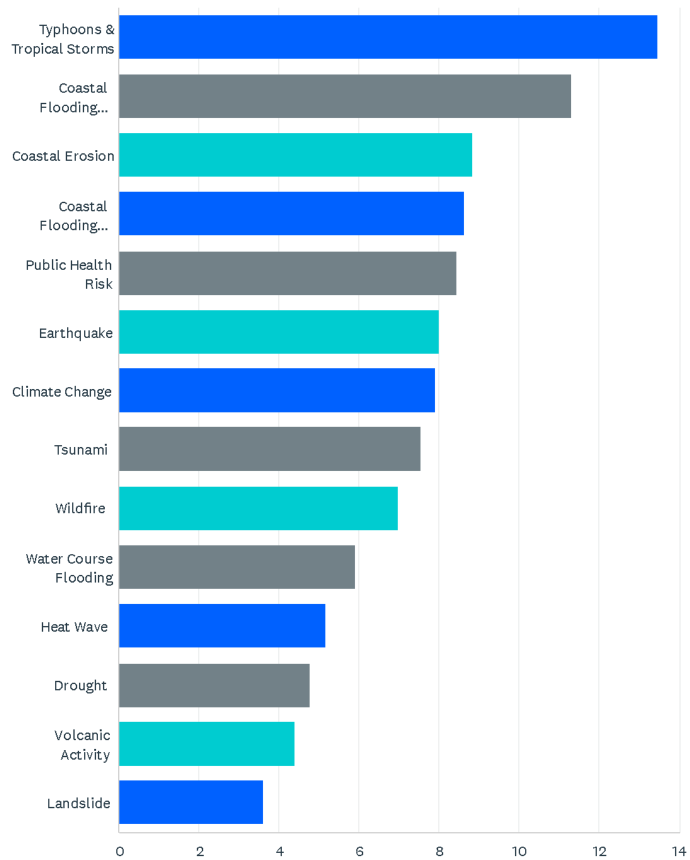


	VERY FAMILIAR	SOMEWHAT FAMILIAR	UNFAMILIAR	TOTAL
StormReady® program	23.08% 3	23.08% 3	53.85% 7	13
TsunamiReady® program	23.08% 3	38.46% 5	38.46% 5	13
Earthquake Preparedness program (The Great ShakeOut)	30.77% 4	38.46% 5	30.77% 4	13

2024 Standard State Mitigation Plan Update SurveyMonkey

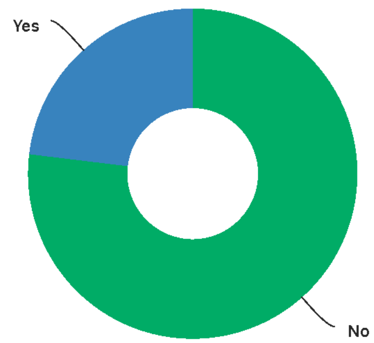
Q6 The Federal Emergency Management Agency (FEMA) has identified the following hazards in the National Risk Index (National Risk Index | FEMA.gov). Please rank the following natural hazards in order of the threat they pose to your community with 1 representing the highest threat and 14 the lowest threat.

Answered: 13 Skipped: 0



Q7 Is there another significant natural hazard that is a threat to your community?

Answered: 13 Skipped: 0

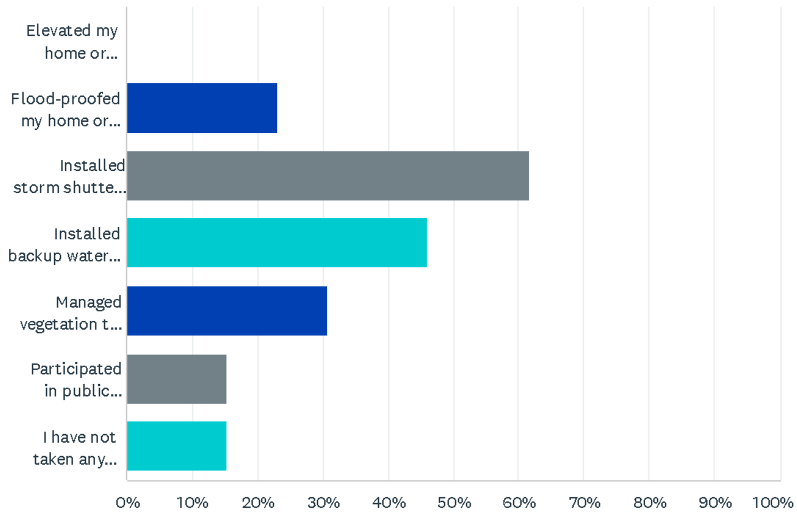


ANSWER CHOICES	RESPONSES	
No	76.92%	10
Yes	23.08%	3
TOTAL		13

2024 Standard State Mitigation Plan Update SurveyMonkey

Q8 What actions have you taken to reduce the risk or vulnerability of your family, home, or business from future natural hazard events (select all that apply)?

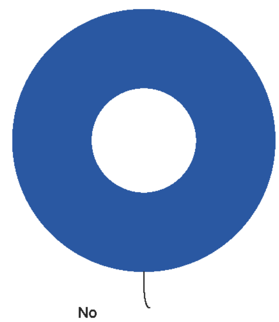
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Elevated my home or business to reduce flood damage.	0.00%	0
Flood-proofed my home or business to reduce flood damage.	23.08%	3
Installed storm shutters or structural/roof bracing to reduce wind damage.	61.54%	8
Installed backup water supply.	46.15%	6
Managed vegetation to reduce the risk of windfalls or wildland fire reaching my home or business.	30.77%	4
Participated in public meeting(s) to discuss and approve changes to zoning or subdivision regulations.	15.38%	2
I have not taken any action.	15.38%	2
Total Respondents: 13		

Q9 Is your home or business located in a FEMA-designated flood area?

Answered: 13 Skipped: 0

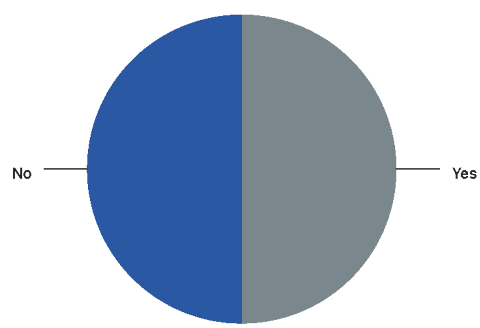


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	13
TOTAL		13

2024 Standard State Mitigation Plan Update SurveyMonkey

Q10 If the answer to Question 9 is Yes, do you have flood insurance?

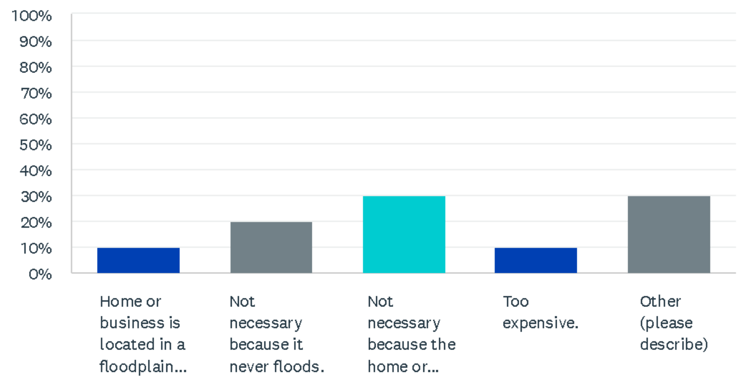
Answered: 2 Skipped: 11



ANSWER CHOICES	RESPONSES	
Yes	50.00%	1
No	50.00%	1
TOTAL		2

Q11 If the answer to Question 10 is No, why not?

Answered: 10 Skipped: 3

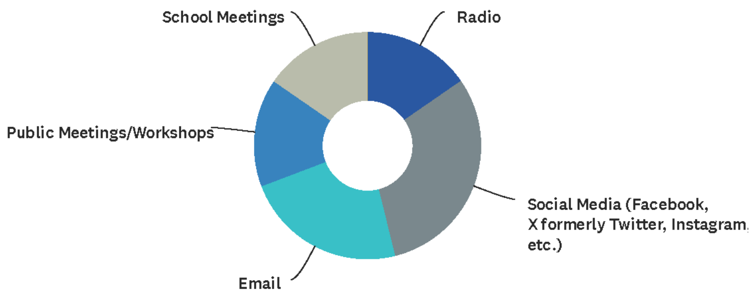


ANSWER CHOICES	RESPONSES	
Home or business is located in a floodplain, but mortgage does not require flood insurance (or no mortgage).	10.00%	1
Not necessary because it never floods.	20.00%	2
Not necessary because the home or business is elevated or otherwise protected.	30.00%	3
Too expensive.	10.00%	1
Other (please describe)	30.00%	3
TOTAL		10

2024 Standard State Mitigation Plan Update SurveyMonkey

Q12 What is the best way for you to receive information about how to protect your family and prepare your home/business against natural hazard events?

Answered: 13 Skipped: 0

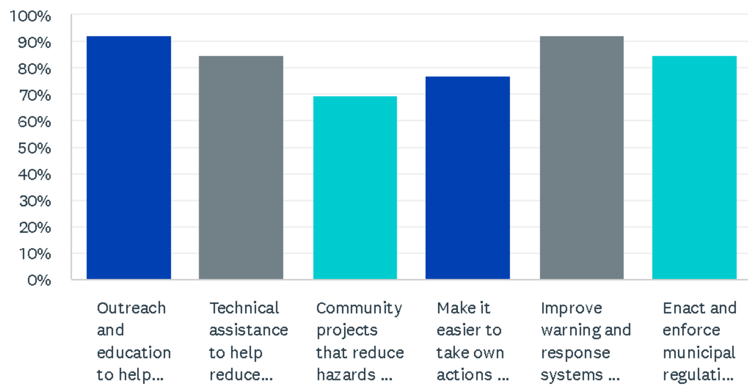


ANSWER CHOICES	RESPONSES	
Television	0.00%	0
Radio	15.38%	2
Social Media (Facebook, X formerly Twitter, Instagram, etc.)	30.77%	4
Mail	0.00%	0
Email	23.08%	3
Public Meetings/Workshops	15.38%	2
School Meetings	15.38%	2
Community Leaders/Faith Organizations	0.00%	0
TOTAL		13

2024 Standard State Mitigation Plan Update SurveyMonkey

Q13 What are the most important ways government or municipal leaders can help residents and businesses prepare for a disaster, and become more resilient over time? (select all that apply)

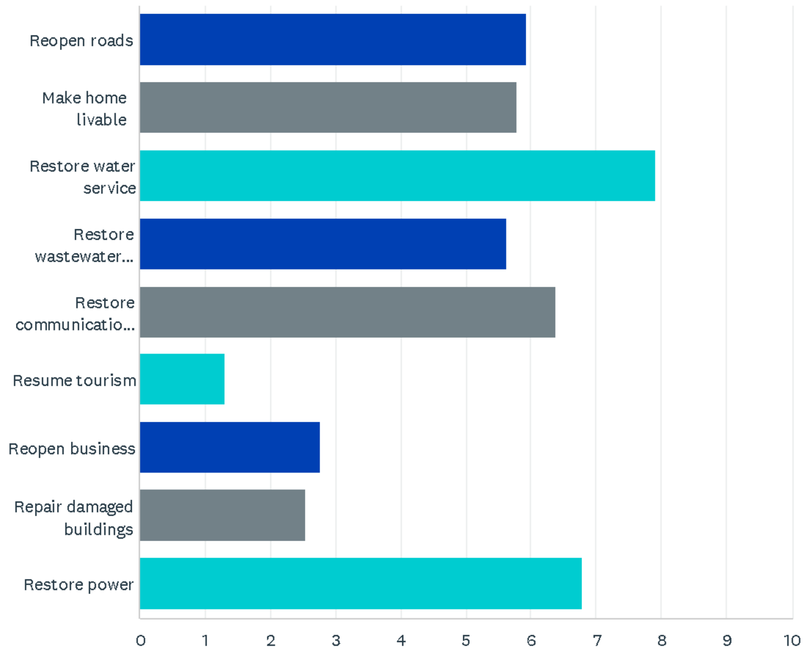
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Outreach and education to help understand the risks and be prepared.	92.31%	12
Technical assistance to help reduce losses from hazards and disasters.	84.62%	11
Community projects that reduce hazards and become more resilient to disasters.	69.23%	9
Make it easier to take own actions to reduce hazards and become more resilient to disasters.	76.92%	10
Improve warning and response systems to improve disaster management.	92.31%	12
Enact and enforce municipal regulations, codes, and ordinances to protect residents and businesses from natural disasters.	84.62%	11
Total Respondents: 13		

Q14 Rank the following actions intended to restore daily life after a natural hazard event, from most important to you (1) to least important to you (9).

Answered: 13 Skipped: 0

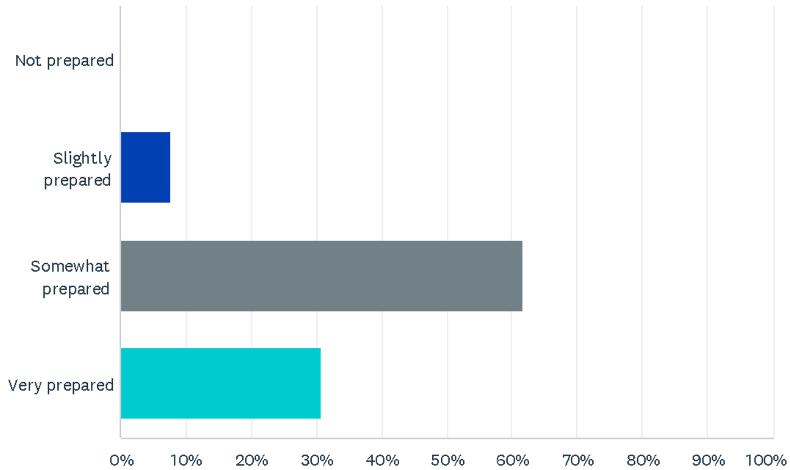


2024 Standard State Mitigation Plan Update SurveyMonkey

	1	2	3	4	5	6	7	8	9	TOTAL	SCORE
Restore water service	38.46% 5	30.77% 4	15.38% 2	15.38% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	13	7.92
Restore power	15.38% 2	23.08% 3	23.08% 3	15.38% 2	15.38% 2	0.00% 0	7.69% 1	0.00% 0	0.00% 0	13	6.77
Restore communications (telephone, cell phone, internet)	15.38% 2	15.38% 2	23.08% 3	0.00% 0	30.77% 4	15.38% 2	0.00% 0	0.00% 0	0.00% 0	13	6.38
Reopen roads	7.69% 1	7.69% 1	7.69% 1	46.15% 6	7.69% 1	23.08% 3	0.00% 0	0.00% 0	0.00% 0	13	5.92
Make home livable	15.38% 2	0.00% 0	30.77% 4	0.00% 0	30.77% 4	7.69% 1	7.69% 1	7.69% 1	0.00% 0	13	5.77
Restore wastewater collection and disposal (sewer or septic)	7.69% 1	23.08% 3	0.00% 0	23.08% 3	7.69% 1	23.08% 3	7.69% 1	7.69% 1	0.00% 0	13	5.62
Reopen business	0.00% 0	0.00% 0	0.00% 0	0.00% 0	7.69% 1	7.69% 1	46.15% 6	30.77% 4	7.69% 1	13	2.77
Repair damaged buildings	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	23.08% 3	23.08% 3	38.46% 5	15.38% 2	13	2.54
Resume tourism	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	7.69% 1	15.38% 2	76.92% 10	13	1.31

Q15 How prepared do you feel your household or business is for impacts from natural hazard events that are likely to occur?

Answered: 13 Skipped: 0

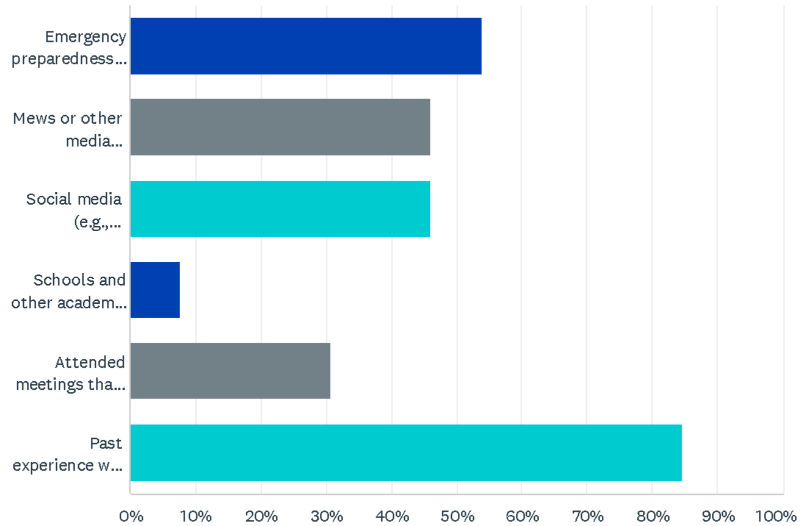


ANSWER CHOICES	RESPONSES	
Not prepared	0.00%	0
Slightly prepared	7.69%	1
Somewhat prepared	61.54%	8
Very prepared	30.77%	4
Total Respondents: 13		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q16 Why do you feel prepared?

Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Emergency preparedness information from a government source (e.g., federal or CNMI)	53.85%	7
Mews or other media information	46.15%	6
Social media (e.g., Facebook, X formerly Twitter, Instagram, etc.)	46.15%	6
Schools and other academic institutions	7.69%	1
Attended meetings that have dealt with disaster preparedness.	30.77%	4
Past experience with natural hazards	84.62%	11
Total Respondents: 13		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q17 Do you have any specific ideas for mitigation projects associated with the identified hazards that you would like the planning team to consider?

Answered: 13 Skipped: 0

#	RESPONSES	DATE
1	Developing more plans for erosion control by planting vegetation to control erosion and run-offs.	2/21/2024 9:59 PM
2	None yet	2/12/2024 11:07 PM
3	People with disability	2/12/2024 7:47 PM
4	Shelters	2/12/2024 7:38 PM
5	More outreach to the public, townhalls to include worst case scenarios and more information on resources.	2/12/2024 6:53 PM
6	Structure hardening like concrete roofs and typhoon proofing, infrastructure hardening for water and power	2/12/2024 5:20 PM
7	None	2/11/2024 7:17 PM
8	Ponding on road ways during storms, over grown vegetation on power lines, lose junks at blighted properties, securing 20 and 40 foot containers at business and residential properties, confining outdoor trash receptacles, home roof inspection and financial assistance, coconut tree trimmers available in preparation for a storm.	2/11/2024 7:06 PM
9	n/a	2/9/2024 5:38 PM
10	provide education and awareness of various resources that can assist individuals during hazards or events	2/9/2024 5:14 PM
11	Not at the moment	2/9/2024 5:02 PM
12	Build retaining walls around the flood zone areas, such as a water dam	2/9/2024 4:51 PM
13	.	2/9/2024 4:35 PM

A.3.2 Government Agency Stakeholder Survey Results

2024 Standard State Mitigation Plan Update SurveyMonkey

Q1 Name

Answered: 30 Skipped: 0

ANSWER CHOICES	RESPONSES	
First name	100.00%	30
Last name	100.00%	30
	0.00%	0
	0.00%	0
	0.00%	0

2024 Standard State Mitigation Plan Update SurveyMonkey

Q2 Department/Division/Branch/Agency

Answered: 30 Skipped: 0

#	RESPONSES	DATE
1	Bureau of Environmental and Coastal Quality (BECQ)/Division of Coastal Resources Management (DCRM)	3/17/2024 7:47 PM
2	DPL	2/22/2024 1:49 PM
3	CUC	2/13/2024 6:13 PM
4	CNMI Council on Developmental Disabilities	2/12/2024 7:46 PM
5	CNMI Assistive Technology Program	2/12/2024 7:12 PM
6	Northern Marianas Housing Corporation /Community Development Block Grant / Disaster Recovery	2/12/2024 6:13 PM
7	Northern Marianas Technical Institute	2/12/2024 5:18 PM
8	CHCC Public Health and Hospital Emergency Preparedness Program	2/12/2024 4:41 PM
9	Power Transmission and Distribution	2/12/2024 3:46 PM
10	CNMI Office of the Governor- Hazard Mitigation Grant Program	2/12/2024 3:24 PM
11	Division of Grants and Financial Integrity	2/12/2024 1:57 PM
12	Tinian Mayor's Office/Grants & Project Management	2/9/2024 5:43 PM
13	COMMONWEALTH UTILITIES CORPORATION -TINIAN	2/8/2024 6:43 PM
14	Public Works	2/8/2024 2:58 PM
15	Northern Marianas Housing Corporation	2/7/2024 3:35 PM
16	Northern Islands Mayors Office (NIMO)	2/7/2024 2:18 PM
17	Bureau of Environmental and Coastal Quality	2/6/2024 7:56 PM
18	Municipality of the Northern Islands	2/6/2024 3:01 PM
19	BECQ-DEQ	2/6/2024 11:45 AM
20	BECQ-DCRM	2/5/2024 7:31 PM
21	Department of Public Lands	2/5/2024 6:18 PM
22	Tinian Mayor's Office	2/5/2024 3:54 PM
23	Northern Marianas Housing Corporation Community Development Block Grant Disaster Recovery (NMHC CDBG DR)	2/5/2024 1:06 PM
24	BECQ/DCRM/Enforcement	2/5/2024 1:01 PM
25	Commonwealth Ports Authority (CPA) Admin/Grants department	2/4/2024 8:15 PM
26	Northern Marianas Housing Corporation Community Development Block Grant Disaster Recovery Division	2/4/2024 5:53 PM
27	CNMI BECQ - Division of Coastal Resources Management	2/4/2024 2:43 PM
28	NMHC CDBG-DR	2/4/2024 2:40 PM
29	Division of Coastal Resources Management	2/4/2024 2:24 PM
30	Department of Public Lands	2/4/2024 1:09 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q3 Email

Answered: 30 Skipped: 0

ANSWER CHOICES	RESPONSES	
Email address	100.00%	30

2024 Standard State Mitigation Plan Update SurveyMonkey

Q4 Phone

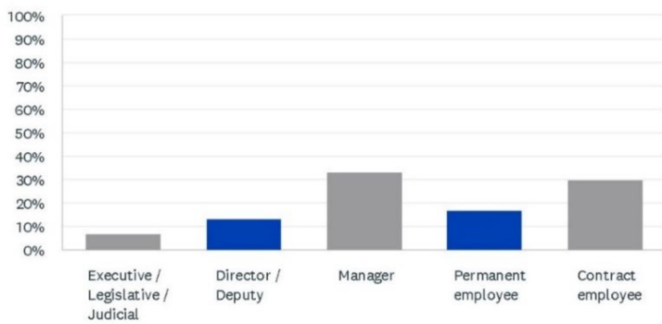
Answered: 30 Skipped: 0

ANSWER CHOICES	RESPONSES	
Phone number	100.00%	30
	0.00%	0

2024 Standard State Mitigation Plan Update SurveyMonkey

Q5 Responding as

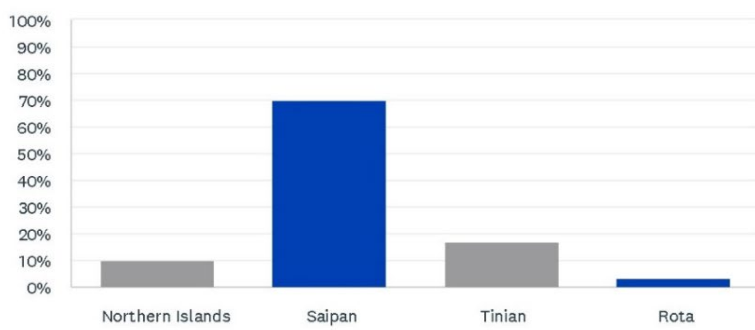
Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Executive / Legislative / Judicial	6.67%	2
Director / Deputy	13.33%	4
Manager	33.33%	10
Permanent employee	16.67%	5
Contract employee	30.00%	9
TOTAL		30

Q6 What island are you responding for?

Answered: 30 Skipped: 0



ANSWER CHOICES	RESPONSES	
Northern Islands	10.00%	3
Saipan	70.00%	21
Tinian	16.67%	5
Rota	3.33%	1
TOTAL		30

2024 Standard State Mitigation Plan Update SurveyMonkey

Q7 What is your area of professional expertise (e.g., biologist, geologist, natural resources manager, administrator, technician)?

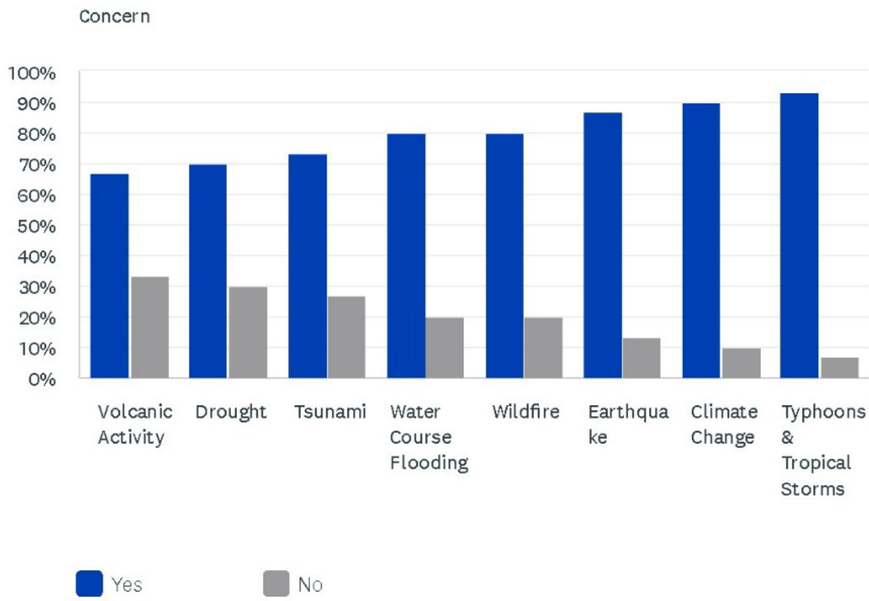
Answered: 30 Skipped: 0

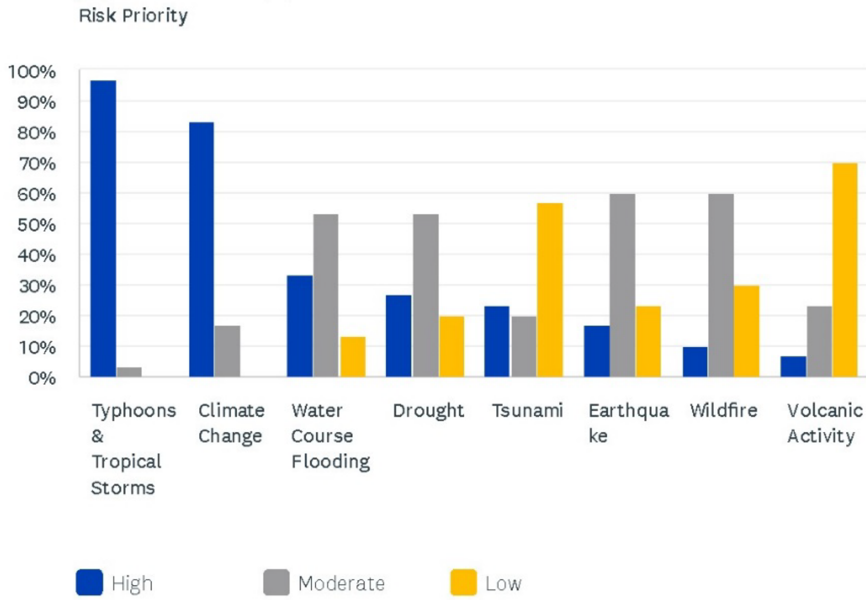
#	RESPONSES	DATE
1	Division of Coastal Resources Management Director	3/17/2024 7:47 PM
2	Administrative	2/22/2024 1:49 PM
3	Engineer	2/13/2024 6:13 PM
4	Program Manager	2/12/2024 7:46 PM
5	Administration	2/12/2024 7:12 PM
6	Project Manager	2/12/2024 6:13 PM
7	Administrator	2/12/2024 5:18 PM
8	Public Health and Hospital Emergency Preparedness Program Senior Planner	2/12/2024 4:41 PM
9	Electrical Engineer	2/12/2024 3:46 PM
10	Administration	2/12/2024 3:24 PM
11	Cat Z - Project Coordinator	2/12/2024 1:57 PM
12	Grants & Project Management/Administrative/Business Management	2/9/2024 5:43 PM
13	Fiscal Technician	2/8/2024 6:43 PM
14	Floodplain Management	2/8/2024 2:58 PM
15	Housing	2/7/2024 3:35 PM
16	Manager	2/7/2024 2:18 PM
17	Environmental Engineer	2/6/2024 7:56 PM
18	Special Assistant to Northern Island Mayor	2/6/2024 3:01 PM
19	Environmental Specialist	2/6/2024 11:45 AM
20	Coastal Coordinator	2/5/2024 7:31 PM
21	Administrative Officer	2/5/2024 6:18 PM
22	Grants Writer and Projects Management	2/5/2024 3:54 PM
23	Disaster Recovery Project Manager for Infrastructure and Housing	2/5/2024 1:06 PM
24	natural resource manager	2/5/2024 1:01 PM
25	Grants Specialist for CPA	2/4/2024 8:15 PM
26	Administrator	2/4/2024 5:53 PM
27	coastal zone management planner/manager	2/4/2024 2:43 PM
28	Compliance Manager	2/4/2024 2:40 PM
29	Community Planning Liaison	2/4/2024 2:24 PM
30	Administrator/ Brownfield Manager	2/4/2024 1:09 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q8 Are the following natural hazards still a concern to the community? Have risk priorities changed since the last SSMP update?

Answered: 30 Skipped: 0





2024 Standard State Mitigation Plan Update SurveyMonkey

Concern

	YES	NO	TOTAL
Volcanic Activity	66.67% 20	33.33% 10	30
Drought	70.00% 21	30.00% 9	30
Tsunami	73.33% 22	26.67% 8	30
Water Course Flooding	80.00% 24	20.00% 6	30
Wildfire	80.00% 24	20.00% 6	30
Earthquake	86.67% 26	13.33% 4	30
Climate Change	90.00% 27	10.00% 3	30
Typhoons & Tropical Storms	93.33% 28	6.67% 2	30

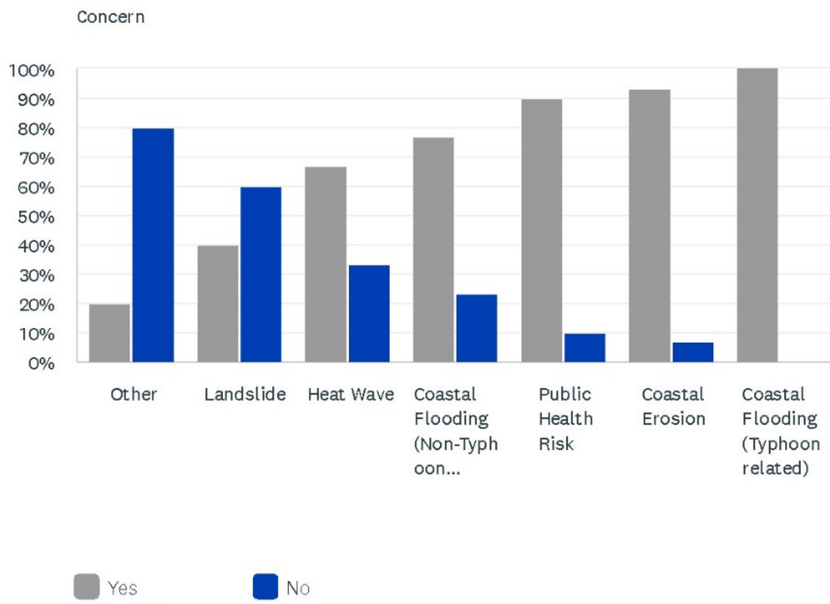
Risk Priority

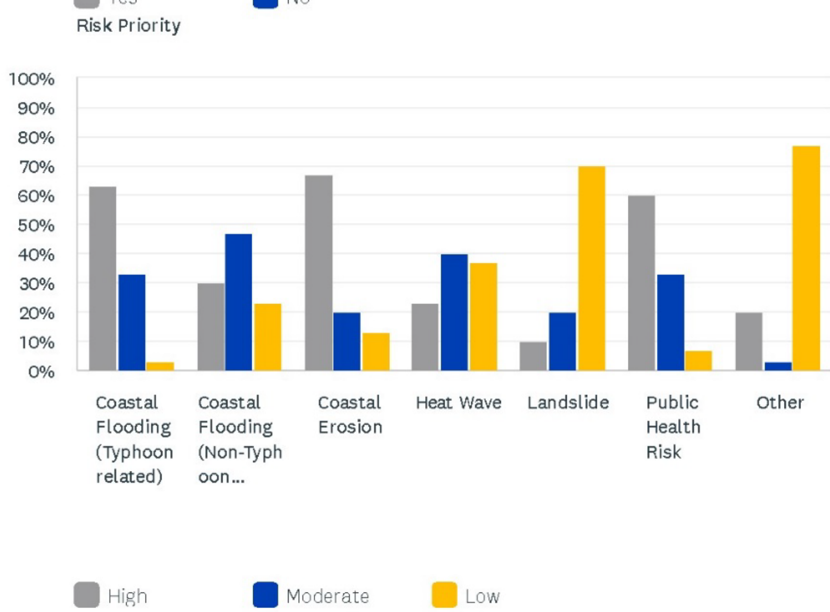
	HIGH	MODERATE	LOW	TOTAL
Typhoons & Tropical Storms	96.67% 29	3.33% 1	0.00% 0	30
Climate Change	83.33% 25	16.67% 5	0.00% 0	30
Water Course Flooding	33.33% 10	53.33% 16	13.33% 4	30
Drought	26.67% 8	53.33% 16	20.00% 6	30
Tsunami	23.33% 7	20.00% 6	56.67% 17	30
Earthquake	16.67% 5	60.00% 18	23.33% 7	30
Wildfire	10.00% 3	60.00% 18	30.00% 9	30
Volcanic Activity	6.67% 2	23.33% 7	70.00% 21	30

2024 Standard State Mitigation Plan Update SurveyMonkey

Q9 Are the following natural hazards a concern to the community? If so, please rate the risk to the community (high, moderate, low)? Is there another significant hazard that is a threat to the community that is not listed?

Answered: 30 Skipped: 0





2024 Standard State Mitigation Plan Update SurveyMonkey

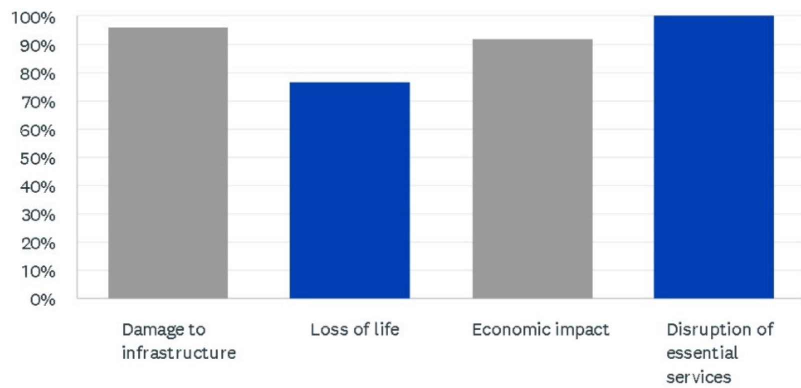
Concern	YES	NO	TOTAL
Other	20.00% 6	80.00% 24	30
Landslide	40.00% 12	60.00% 18	30
Heat Wave	66.67% 20	33.33% 10	30
Coastal Flooding (Non-Typhoon related)	76.67% 23	23.33% 7	30
Public Health Risk	90.00% 27	10.00% 3	30
Coastal Erosion	93.33% 28	6.67% 2	30
Coastal Flooding (Typhoon related)	100.00% 30	0.00% 0	30

Risk Priority	HIGH	MODERATE	LOW	TOTAL
Coastal Flooding (Typhoon related)	63.33% 19	33.33% 10	3.33% 1	30
Coastal Flooding (Non-Typhoon related)	30.00% 9	46.67% 14	23.33% 7	30
Coastal Erosion	66.67% 20	20.00% 6	13.33% 4	30
Heat Wave	23.33% 7	40.00% 12	36.67% 11	30
Landslide	10.00% 3	20.00% 6	70.00% 21	30
Public Health Risk	60.00% 18	33.33% 10	6.67% 2	30
Other	20.00% 6	3.33% 1	76.67% 23	30

2024 Standard State Mitigation Plan Update SurveyMonkey

Q10 What will be affected by Typhoons & Tropical Storms (select all that apply)?

Answered: 26 Skipped: 4



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	96.15%	25
Loss of life	76.92%	20
Economic impact	92.31%	24
Disruption of essential services	100.00%	26
Total Respondents: 26		

Q11 Are there specific areas in the community that are particularly vulnerable to Typhoons & Tropical Storms? (Describe locations using street intersections or landmarks)

Answered: 26 Skipped: 4

#	RESPONSES	DATE
1	Saipan: San Antonio to Susupe Area, Garapan/ Micro Beach Area, Lower Base to Achugao. Rota: Songsong Village to Teneto. Tinian: San Jose Village	3/17/2024 8:09 PM
2	Songsong Village and entire island of Rota	2/22/2024 1:51 PM
3	Coastal areas on the western region of Saipan.	2/13/2024 6:18 PM
4	Coastal and low lying areas on the island	2/12/2024 7:49 PM
5	Coastline homes and the CUC powerplant	2/12/2024 7:19 PM
6	Whole area of Garapan, Kagman	2/12/2024 5:31 PM
7	Lower Base Industrial Area and Tanapag Village residential areas on the westside.	2/12/2024 5:04 PM
8	Areas in exposed and higher elevation are more vulnerable to strong winds. Areas in lower (coastal) areas are susceptible to storm surge, flooding, erosion.	2/12/2024 4:11 PM
9	Beach Road	2/12/2024 3:53 PM
10	Saipan, Tinian and Rota	2/12/2024 3:29 PM
11	houses not made of full concrete	2/12/2024 2:18 PM
12	The whole island of Tinian is vulnerable.	2/9/2024 5:46 PM
13	islandwide	2/8/2024 6:50 PM
14	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/7/2024 3:45 PM
15	no specific area- entire CNMI	2/7/2024 3:38 PM
16	Yes. most of the islands I represent lack basic infrastructures	2/7/2024 2:24 PM
17	All non concrete buildings. Any areas low enough and close enough to water that will see storm surges.	2/6/2024 8:00 PM
18	beach fronts	2/6/2024 11:52 AM
19	Cnmi	2/5/2024 6:21 PM
20	I would say residences and buildings that is along the coastline.	2/5/2024 4:05 PM
21	1. Kagman Village 2. CUC Power Plant	2/5/2024 1:15 PM
22	CNMI AIRPORT(s) & SEAPORT (s)	2/4/2024 8:24 PM
23	Residential, schools, and hospital--islandwide (Saipan)	2/4/2024 5:55 PM
24	Exposed areas close to the ocean, on bare ridge, and in high building density areas are more vulnerable to typhoons and tropical storms. However, the whole island is vulnerable with targeted areas during landfall considered highly vulnerable.	2/4/2024 3:10 PM
25	All the individuals in the South whom are still living in tents/or tin houses	2/4/2024 2:43 PM
26	San Vicente	2/4/2024 1:17 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q12 How many people are in those areas/locations?

Answered: 26 Skipped: 4

#	RESPONSES	DATE
1	https://www.census.gov/data/tables/2020/dec/2020-commonwealth-northern-mariana-islands.html	3/18/2024 4:09 PM
2	1700	2/23/2024 9:51 AM
3	Refer to Census 2020 data.	2/14/2024 2:18 PM
4	Not sure	2/13/2024 3:49 PM
5	not sure of totals	2/13/2024 3:19 PM
6	Unknown	2/13/2024 1:31 PM
7	About 1/4 of Saipan population of 50k+	2/13/2024 1:04 PM
8	All! 43000+ per 2020 census	2/13/2024 12:11 PM
9	15000	2/13/2024 11:53 AM
10	15,000	2/13/2024 11:29 AM
11	majority of the Saipan population	2/13/2024 10:18 AM
12	.	2/10/2024 1:46 PM
13	islandwide	2/9/2024 2:50 PM
14	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/8/2024 11:45 AM
15	close to 50K	2/8/2024 11:38 AM
16	At the moment, Northern islands have a small community spread out through the islands of Alamagan, Pagan, Agrigan, and Anatahan. We anticipate growth once homestead waivers are enacted and implemented throughout the island chain. About 600	2/8/2024 10:24 AM
17	Estimate 2,000-3,000	2/7/2024 4:00 PM
18	500+	2/7/2024 7:52 AM
19	60,000-80,000	2/6/2024 2:21 PM
20	There isn't much people living in those areas/locations.	2/6/2024 12:05 PM
21	+/- 2,000	2/6/2024 9:15 AM
22	Approximately 3000 people	2/5/2024 4:24 PM
23	Over 20,000	2/5/2024 1:55 PM
24	Best to reference Census maps on density	2/5/2024 11:10 AM
25	Probably around 5K	2/5/2024 10:43 AM
26	3,000	2/5/2024 9:17 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

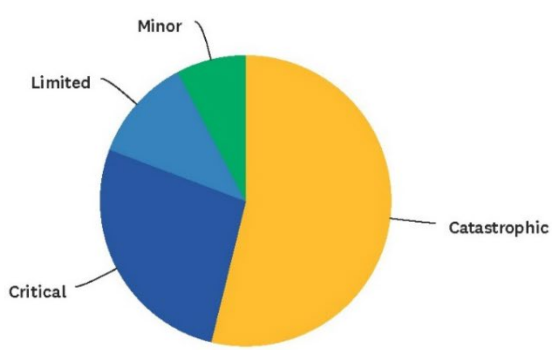
Q13 Is there critical infrastructure in the area/location?

Answered: 26 Skipped: 4

ANSWER CHOICES	RESPONSES	
Yes	92.31%	24
No	7.69%	2
TOTAL		26

Q14 What is the potential magnitude or severity of Typhoons & Tropical Storms?

Answered: 26 Skipped: 4

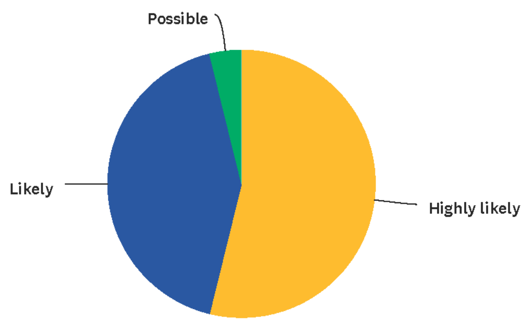


ANSWER CHOICES	RESPONSES	
Catastrophic	53.85%	14
Critical	26.92%	7
Limited	11.54%	3
Minor	7.69%	2
TOTAL		26

2024 Standard State Mitigation Plan Update SurveyMonkey

Q15 Based on past occurrences, what is the expected frequency of future occurrences of Typhoons & Tropical Storms?

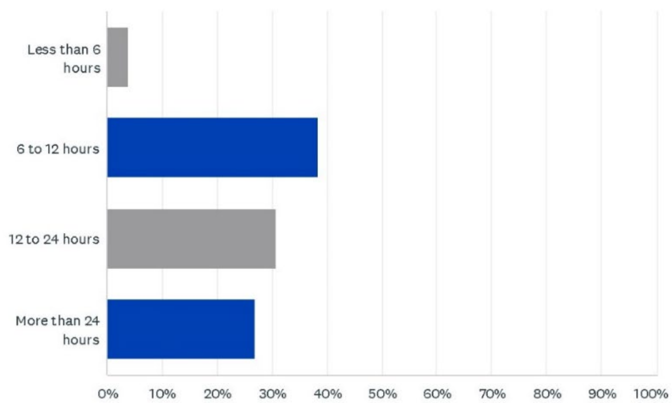
Answered: 26 Skipped: 4



ANSWER CHOICES	RESPONSES	
Highly likely	53.85%	14
Likely	42.31%	11
Possible	3.85%	1
Unlikely	0.00%	0
TOTAL		26

Q16 What is the probable duration of Typhoons & Tropical Storms?

Answered: 26 Skipped: 4

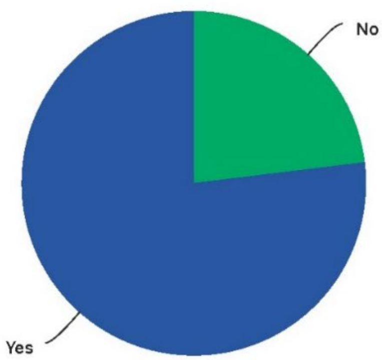


ANSWER CHOICES	RESPONSES	
Less than 6 hours	3.85%	1
6 to 12 hours	38.46%	10
12 to 24 hours	30.77%	8
More than 24 hours	26.92%	7
TOTAL		26

2024 Standard State Mitigation Plan Update SurveyMonkey

Q17 Have Typhoons & Tropical Storms impacted your program or ability to serve your function?

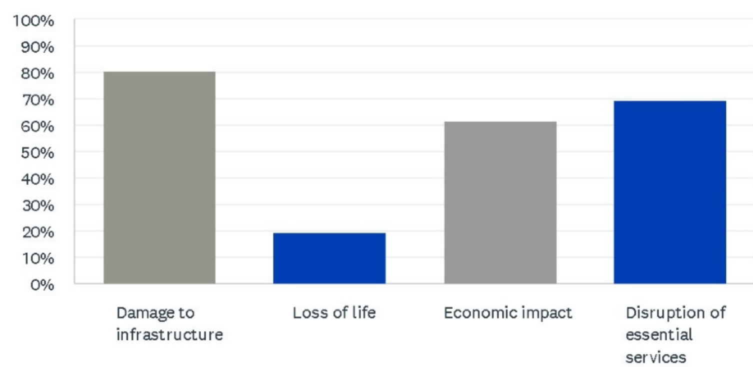
Answered: 26 Skipped: 4



ANSWER CHOICES	RESPONSES	
No	23.08%	6
Yes	76.92%	20
TOTAL		26

Q18 What will be affected by Water Course Flooding (select all that apply)?

Answered: 26 Skipped: 4



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	80.77%	21
Loss of life	19.23%	5
Economic impact	61.54%	16
Disruption of essential services	69.23%	18
Total Respondents: 26		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q19 Are there specific areas in the community that are particularly vulnerable to Water Course Flooding? (Describe locations using street intersections or landmarks)

Answered: 26 Skipped: 4

#	RESPONSES	DATE
1	Saipan: Achugao, Talafofo. Rota: Sasanhaya	3/17/2024 8:09 PM
2	Route 10 the road from Songsong to Pinatang Park	2/22/2024 1:51 PM
3	Low elevation areas located below higher elevation areas including coastal areas. Secondary roads with no drainage system.	2/13/2024 6:18 PM
4	Areas and villages near Susupe Lake	2/12/2024 7:49 PM
5	the Susupe Lake area	2/12/2024 7:19 PM
6	Lower Base drive, Tanapag, Chalan Pale Arnold Road	2/12/2024 5:31 PM
7	Susupe Lake, Joeten Dandan intersection.	2/12/2024 5:04 PM
8	Tanapag Stream intersecting Chalan Pale Arnold and adjacent to Tanapag Avenue (lat. 15.239118 deg., long. 145.755544 deg.)approaches peak flow during seasonal rain events, eroding banks and threatening nearby homes. Susupe Lake (lat. 15.15238, long. 145.711925) also may overflow due to prolonged heavy seasonal rain/storms.	2/12/2024 4:11 PM
9	Beach Road Wet lands	2/12/2024 3:53 PM
10	Susupe village and Beach Road	2/12/2024 3:29 PM
11	not sure	2/12/2024 2:18 PM
12	The coastal areas.	2/9/2024 5:46 PM
13	na	2/8/2024 6:50 PM
14	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/7/2024 3:45 PM
15	beside coastal waters	2/7/2024 3:38 PM
16	Flat land areas on Pagan island	2/7/2024 2:24 PM
17	Susupe lake, Talafofo streams.	2/6/2024 8:00 PM
18	N/A on Tinian	2/6/2024 11:52 AM
19	Low laying areas	2/5/2024 6:21 PM
20	Not that I know of.	2/5/2024 4:05 PM
21	1. Shell Gas Station Dandan/As Lito Intersection	2/5/2024 1:15 PM
22	No, not much.	2/4/2024 8:24 PM
23	No	2/4/2024 5:55 PM
24	Tanapag Village, Lao Lao Bay	2/4/2024 3:10 PM
25	more so along beach road and the south side as San Antonio	2/4/2024 2:43 PM
26	Low laying areas	2/4/2024 1:17 PM

Q20 How many people are in those areas/locations?

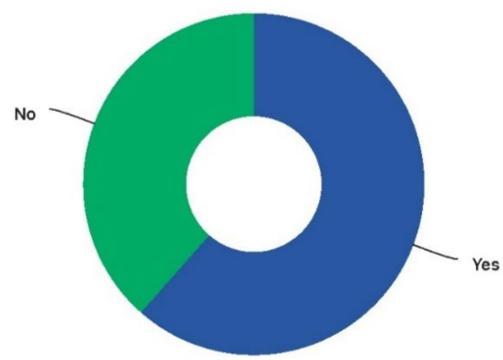
Answered: 26 Skipped: 4

#	RESPONSES	DATE
1	See previous	3/18/2024 4:09 PM
2	not sure of the number	2/23/2024 9:51 AM
3	Refer to Census Data.	2/14/2024 2:18 PM
4	Not sure	2/13/2024 3:49 PM
5	not sure	2/13/2024 3:19 PM
6	Unknown	2/13/2024 1:31 PM
7	Less than 1/4 of the current census population.	2/13/2024 1:04 PM
8	30 to 150	2/13/2024 12:11 PM
9	20000	2/13/2024 11:53 AM
10	Not sure	2/13/2024 11:29 AM
11	not sure	2/13/2024 10:18 AM
12	.	2/10/2024 1:46 PM
13	na	2/9/2024 2:50 PM
14	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/8/2024 11:45 AM
15	unsure	2/8/2024 11:38 AM
16	Again we anticipate about 600	2/8/2024 10:24 AM
17	0-100	2/7/2024 4:00 PM
18	N/A on Tinian	2/7/2024 7:52 AM
19	10,000	2/6/2024 2:21 PM
20	I don't know of anyone who may be at risk from water course flooding on Tinian.	2/6/2024 12:05 PM
21	+/- 1,000	2/6/2024 9:15 AM
22	approximately 1000	2/5/2024 4:24 PM
23	Unsure	2/5/2024 1:55 PM
24	According to the 2020 Census, 784 residents for Tanapag and 121 residents for Lao Lao Bay.	2/5/2024 11:10 AM
25	15k give or take	2/5/2024 10:43 AM
26	10,000	2/5/2024 9:17 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q21 Is there critical infrastructure in the area/location?

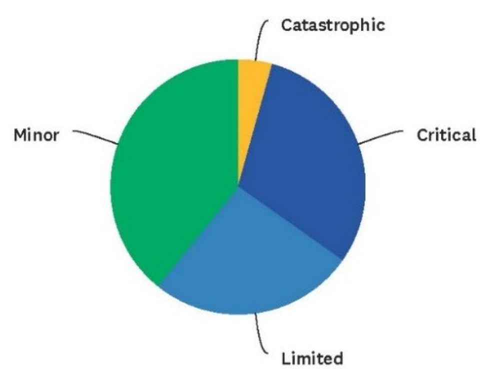
Answered: 26 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	61.54%	16
No	38.46%	10
TOTAL		26

Q22 What is the potential magnitude or severity of Water Course Flooding?

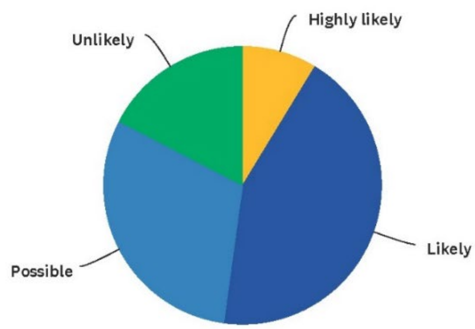
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Catastrophic	4.35%	1
Critical	30.43%	7
Limited	26.09%	6
Minor	39.13%	9
TOTAL		23

Q23 Based on past occurrences, what is the expected frequency of future occurrences of Water Course Flooding?

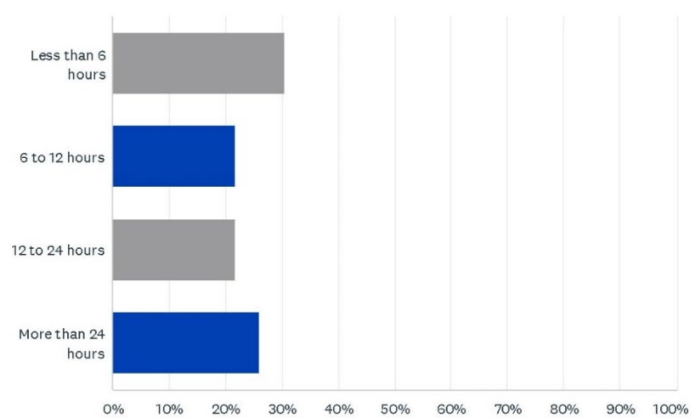
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Highly likely	8.70%	2
Likely	43.48%	10
Possible	30.43%	7
Unlikely	17.39%	4
TOTAL		23

Q24 What is the probable duration of Water Course Flooding?

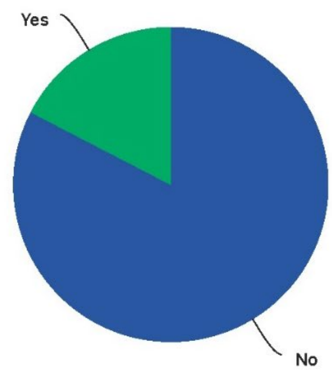
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Less than 6 hours	30.43%	7
6 to 12 hours	21.74%	5
12 to 24 hours	21.74%	5
More than 24 hours	26.09%	6
TOTAL		23

Q25 Has Water Course Flooding impacted your program or ability to serve your function?

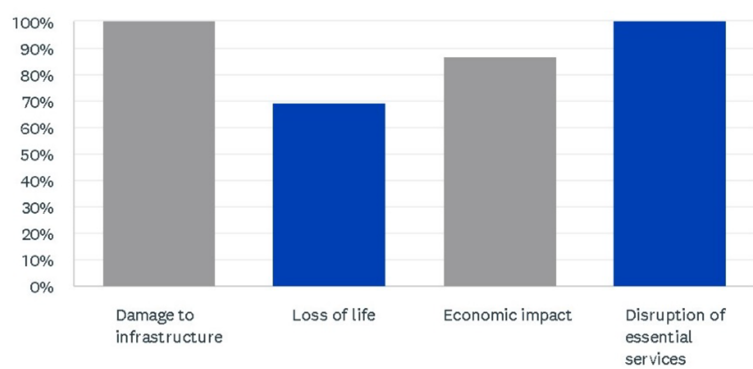
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
No	82.61%	19
Yes	17.39%	4
TOTAL		23

Q26 What will be affected by an Earthquake (select all that apply)?

Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	100.00%	23
Loss of life	69.57%	16
Economic impact	86.96%	20
Disruption of essential services	100.00%	23
Total Respondents: 23		

2024 Standard State Mitigation Plan Update   SurveyMonkey

Q27 Are there specific areas in the community that are particularly vulnerable to Earthquakes? (Describe locations using street intersections or landmarks)

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	N/A	3/17/2024 8:12 PM
2	the whole island	2/22/2024 1:52 PM
3	The whole island of Saipan and the CNMI.	2/13/2024 6:20 PM
4	High rise buildings	2/12/2024 7:51 PM
5	multi-story buildings	2/12/2024 7:21 PM
6	Unknown	2/12/2024 5:35 PM
7	Skyscraper buildings. Like most hotels on island.	2/12/2024 5:11 PM
8	Critical facilities like hospitals, police and fire stations may lose uninterrupted power and water supplies. Power and communications interruptions can impede operations.	2/12/2024 4:14 PM
9	Island wide	2/12/2024 3:56 PM
10	Northern Mariana Islands	2/12/2024 3:32 PM
11	Buildings	2/12/2024 2:20 PM
12	Maui Well Pump Station Water reservoir Tinian power plant	2/8/2024 6:53 PM
13	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/7/2024 3:48 PM
14	Yes most of the islands north of Saipan and volcanic and are very vulnerable to earthquakes	2/7/2024 2:27 PM
15	No	2/6/2024 8:01 PM
16	Cnmi	2/5/2024 6:23 PM
17	Not that I know.	2/5/2024 4:06 PM
18	All	2/5/2024 1:16 PM
19	The entire island	2/4/2024 8:27 PM
20	Not specific; island wide	2/4/2024 5:56 PM
21	Areas with high density of buildings	2/4/2024 3:12 PM
22	Those families staying on the hillsides such as As Falipe, etc.	2/4/2024 2:44 PM
23	the whole cnmi	2/4/2024 1:19 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q28 How many people are in those areas/locations?

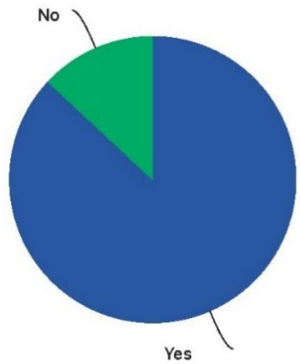
Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	See previous.	3/18/2024 4:12 PM
2	1700	2/23/2024 9:52 AM
3	Refer to Census 2020 data.	2/14/2024 2:20 PM
4	Not sure	2/13/2024 3:51 PM
5	unsure	2/13/2024 3:21 PM
6	Unknown	2/13/2024 1:35 PM
7	Approximately, 2k averaging daily, to include staff and another 1k for visitors.	2/13/2024 1:11 PM
8	47000+	2/13/2024 12:14 PM
9	100%	2/13/2024 11:56 AM
10	Not sure	2/13/2024 11:32 AM
11	Working population, schools.	2/13/2024 10:20 AM
12	islandwide	2/9/2024 2:53 PM
13	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/8/2024 11:48 AM
14	600	2/8/2024 10:27 AM
15	0-50,000	2/7/2024 4:01 PM
16	60,000	2/6/2024 2:23 PM
17	Not that I know.	2/6/2024 12:06 PM
18	All	2/6/2024 9:16 AM
19	approximately 35,000 people	2/5/2024 4:27 PM
20	All residents of Saipan	2/5/2024 1:56 PM
21	The amount of people on high density villages such as Garapan, Chalan Kanoa, etc.	2/5/2024 11:12 AM
22	Less than 150	2/5/2024 10:44 AM
23	60,000-80,000	2/5/2024 9:19 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q29 Is there critical infrastructure in the area/location?

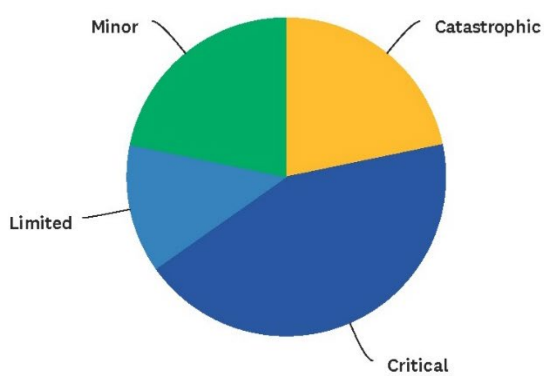
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	86.96%	20
No	13.04%	3
TOTAL		23

Q30 What is the potential magnitude or severity of an Earthquake?

Answered: 23 Skipped: 7

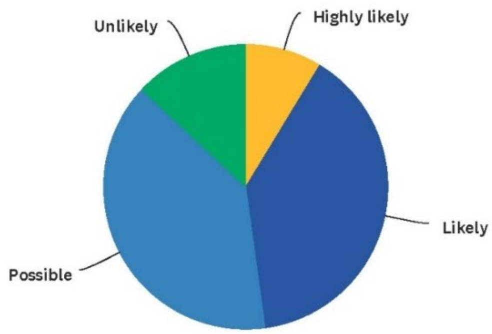


ANSWER CHOICES	RESPONSES	
Catastrophic	21.74%	5
Critical	43.48%	10
Limited	13.04%	3
Minor	21.74%	5
TOTAL		23

2024 Standard State Mitigation Plan Update SurveyMonkey

Q31 Based on past occurrences, what is the expected frequency of future occurrences of Earthquakes?

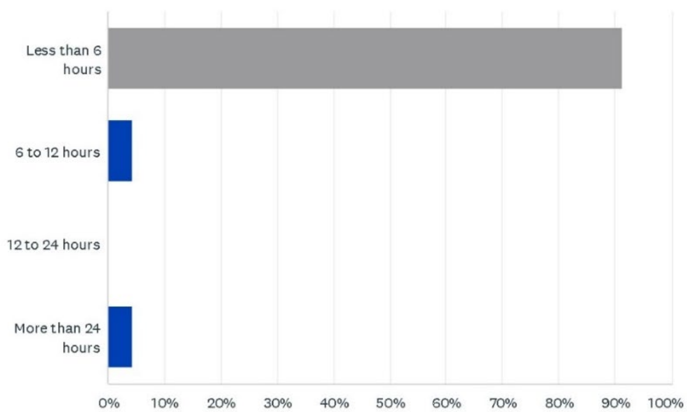
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Highly likely	8.70%	2
Likely	39.13%	9
Possible	39.13%	9
Unlikely	13.04%	3
TOTAL		23

Q32 What is the probable duration of an Earthquake?

Answered: 23 Skipped: 7

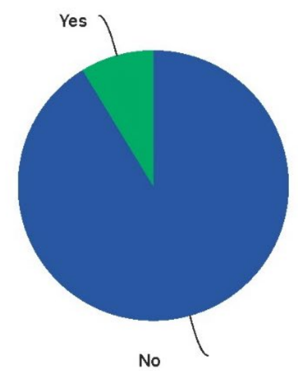


ANSWER CHOICES	RESPONSES	
Less than 6 hours	91.30%	21
6 to 12 hours	4.35%	1
12 to 24 hours	0.00%	0
More than 24 hours	4.35%	1
TOTAL		23

2024 Standard State Mitigation Plan Update SurveyMonkey

Q33 Has an Earthquake impacted your program or ability to serve your function?

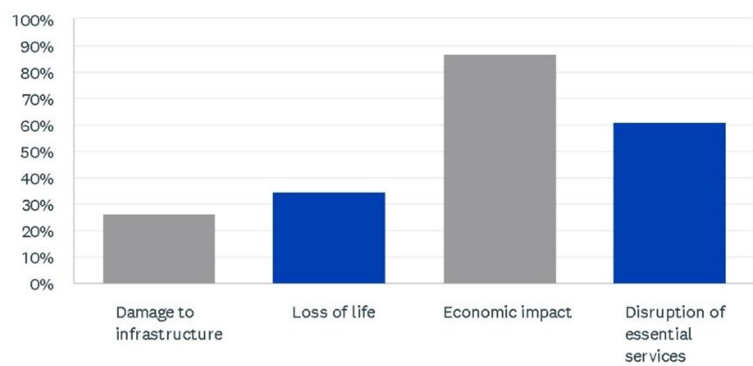
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
No	91.30%	21
Yes	8.70%	2
TOTAL		23

Q34 What will be affected by Drought (select all that apply)?

Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	26.09%	6
Loss of life	34.78%	8
Economic impact	86.96%	20
Disruption of essential services	60.87%	14
Total Respondents: 23		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q35 Are there specific areas in the community that are particularly vulnerable to Drought? (Describe locations using street intersections or landmarks)

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Saipan, Tinian, and Rota.	3/17/2024 8:15 PM
2	agricultural homestead lots, mountains, sometimes river	2/22/2024 1:54 PM
3	The entire island of Saipan.	2/13/2024 6:24 PM
4	Everywhere	2/12/2024 7:53 PM
5	Farming areas	2/12/2024 7:24 PM
6	Unknown	2/12/2024 5:40 PM
7	Farmers all over the island.	2/12/2024 5:25 PM
8	Likely everyone.	2/12/2024 4:16 PM
9	Island wide	2/12/2024 3:59 PM
10	Northern Mariana Islands	2/12/2024 3:34 PM
11	None	2/12/2024 2:25 PM
12	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:25 PM
13	Maui Well Pump Station	2/8/2024 6:57 PM
14	yes with the lack of basic infrastructures, we are very vulnerable to droght	2/7/2024 2:30 PM
15	No entire island can be affected if groundwater goes away.	2/7/2024 12:05 PM
16	Kagman	2/5/2024 6:27 PM
17	No.	2/5/2024 4:07 PM
18	All	2/5/2024 1:18 PM
19	the entire island will be affected by drought.	2/4/2024 8:32 PM
20	High and farm areas	2/4/2024 5:58 PM
21	Drought can impact the wells, critical sources of water, for villages on Saipan. High density areas may be vulnerable given the allocation of water resources and the higher water use.	2/4/2024 3:18 PM
22	The whole island.	2/4/2024 2:45 PM
23	cnmi	2/4/2024 1:21 PM

Q36 How many people are in those areas/locations?

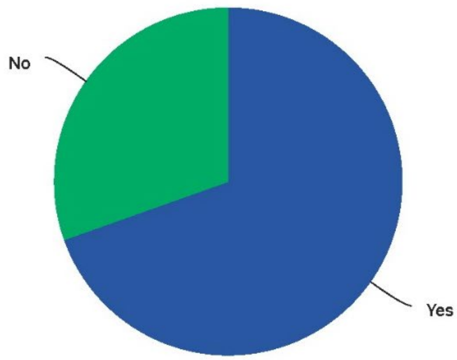
Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	See Census table.	3/18/2024 4:15 PM
2	not sure	2/23/2024 9:54 AM
3	Refer to 2020 Census data.	2/14/2024 2:24 PM
4	Many	2/13/2024 3:53 PM
5	unsure	2/13/2024 3:24 PM
6	Unknown	2/13/2024 1:40 PM
7	Approximately 3 to 4 hundred.	2/13/2024 1:25 PM
8	47000+	2/13/2024 12:16 PM
9	100%	2/13/2024 11:59 AM
10	Not sure	2/13/2024 11:34 AM
11	None	2/13/2024 10:25 AM
12	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:25 AM
13	islandwide	2/9/2024 2:57 PM
14	600	2/8/2024 10:30 AM
15	Entire island	2/8/2024 8:05 AM
16	10,000	2/6/2024 2:27 PM
17	Not a whole lot of people.	2/6/2024 12:07 PM
18	All	2/6/2024 9:18 AM
19	approximately 35,000 people on the island	2/5/2024 4:32 PM
20	Unsure	2/5/2024 1:58 PM
21	The population would be dependent on the impacted well.	2/5/2024 11:18 AM
22	45k	2/5/2024 10:45 AM
23	60,000-80,000	2/5/2024 9:21 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q37 Is there critical infrastructure in the area/location?

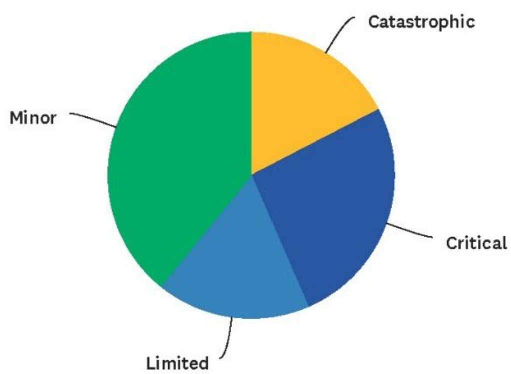
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	69.57%	16
No	30.43%	7
TOTAL		23

Q38 What is the potential magnitude or severity of Drought?

Answered: 23 Skipped: 7

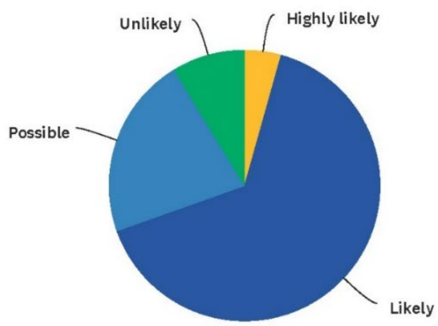


ANSWER CHOICES	RESPONSES	
Catastrophic	17.39%	4
Critical	26.09%	6
Limited	17.39%	4
Minor	39.13%	9
TOTAL		23

2024 Standard State Mitigation Plan Update SurveyMonkey

Q39 Based on past occurrences, what is the expected frequency of future occurrences of Drought?

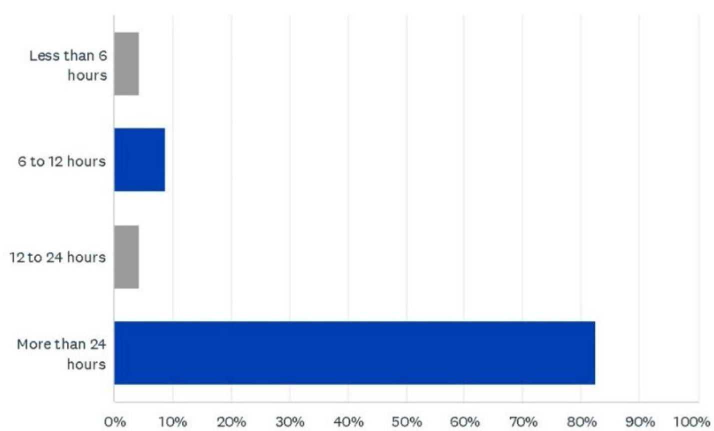
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Highly likely	4.35%	1
Likely	65.22%	15
Possible	21.74%	5
Unlikely	8.70%	2
TOTAL		23

Q40 What is the probable duration of Drought?

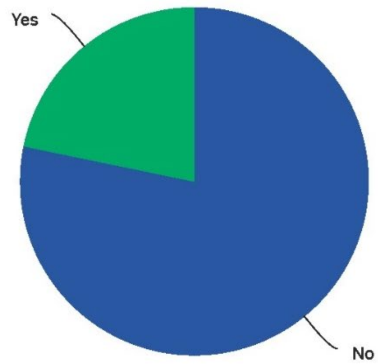
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Less than 6 hours	4.35%	1
6 to 12 hours	8.70%	2
12 to 24 hours	4.35%	1
More than 24 hours	82.61%	19
TOTAL		23

Q41 Has Drought impacted your program or ability to serve your function?

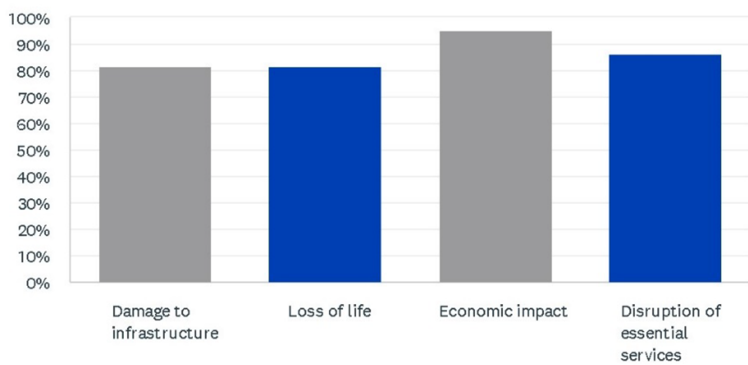
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
No	78.26%	18
Yes	21.74%	5
TOTAL		23

Q42 What will be affected by Volcanic Activity (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	81.82%	18
Loss of life	81.82%	18
Economic impact	95.45%	21
Disruption of essential services	86.36%	19
Total Respondents: 22		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q43 Are there specific areas in the community that are particularly vulnerable to Volcanic Activity? (Describe locations using street intersections or landmarks)

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Northern Islands. Saipan, Tinian, and Rota if VOG reaches the southern portion of CNMI.	3/17/2024 8:15 PM
2	.	2/22/2024 1:54 PM
3	The entire CNMI.	2/13/2024 6:24 PM
4	Not sure	2/12/2024 7:53 PM
5	Northern Islands	2/12/2024 7:24 PM
6	Entire CNMI	2/12/2024 5:40 PM
7	Yes, vulnerable population with respiratory issues.	2/12/2024 5:25 PM
8	Saipan, Tinian and the Northern Islands	2/12/2024 4:16 PM
9	Island wide	2/12/2024 3:59 PM
10	Northern Islands	2/12/2024 3:34 PM
11	All areas	2/12/2024 2:25 PM
12	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:25 PM
13	NA	2/8/2024 6:57 PM
14	most of the islands are volcanic	2/7/2024 2:30 PM
15	Not sure	2/7/2024 12:05 PM
16	Pagan	2/5/2024 6:27 PM
17	No.	2/5/2024 4:07 PM
18	All	2/5/2024 1:18 PM
19	The entire island will be affected	2/4/2024 8:32 PM
20	Unsure	2/4/2024 5:58 PM
21	Volcanic islands, such as Pagan. The impact for Saipan is dependent on the direction of winds and how they pick up vog and ash from any of the volcanic northern island. Impacts to internet connectivity and communication may be concerns.	2/4/2024 3:18 PM
22	The nothern islands	2/4/2024 2:45 PM
23	Northern Islands	2/4/2024 1:21 PM

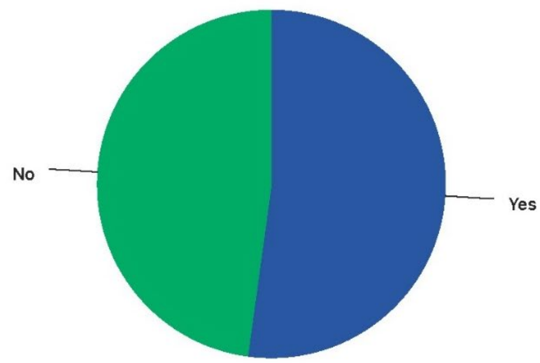
Q44 How many people are in those areas/locations?

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	See Census.	3/18/2024 4:15 PM
2	.	2/23/2024 9:54 AM
3	Refer to Census 2020 data.	2/14/2024 2:24 PM
4	Not sure	2/13/2024 3:53 PM
5	unsure	2/13/2024 3:24 PM
6	Above 40k	2/13/2024 1:40 PM
7	Population with respiratory conditions. Such as Asthma and other respiratory diseases.	2/13/2024 1:25 PM
8	43000+	2/13/2024 12:16 PM
9	100%	2/13/2024 11:59 AM
10	Not sure	2/13/2024 11:34 AM
11	Whole population	2/13/2024 10:25 AM
12	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:25 AM
13	Na	2/9/2024 2:57 PM
14	600	2/8/2024 10:30 AM
15	Not sure	2/8/2024 8:05 AM
16	5-10	2/6/2024 2:27 PM
17	N/A	2/6/2024 12:07 PM
18	All	2/6/2024 9:18 AM
19	Approximately 35,000 people	2/5/2024 4:32 PM
20	Unsure	2/5/2024 1:58 PM
21	Less than 5?	2/5/2024 11:18 AM
22	10	2/5/2024 10:45 AM
23	5-20	2/5/2024 9:21 AM

Q45 Is there critical infrastructure in the area/location?

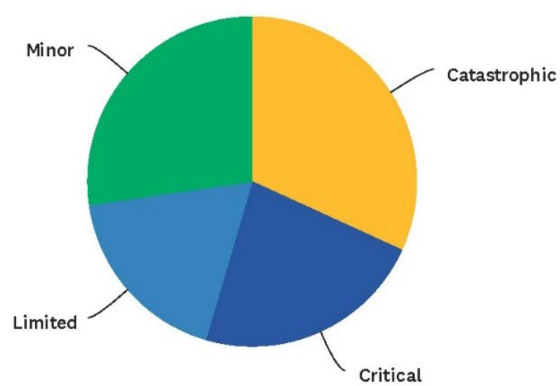
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	52.17%	12
No	47.83%	11
TOTAL		23

Q46 What is the potential magnitude or severity of Volcanic Activity?

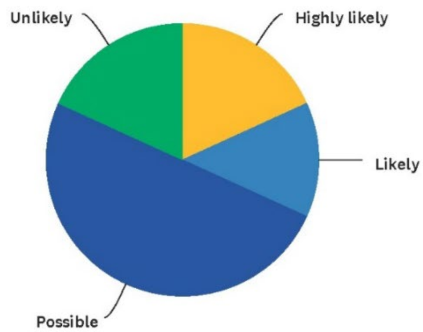
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Catastrophic	31.82%	7
Critical	22.73%	5
Limited	18.18%	4
Minor	27.27%	6
TOTAL		22

Q47 Based on past occurrences, what is the expected frequency of future occurrences of Volcanic Activity?

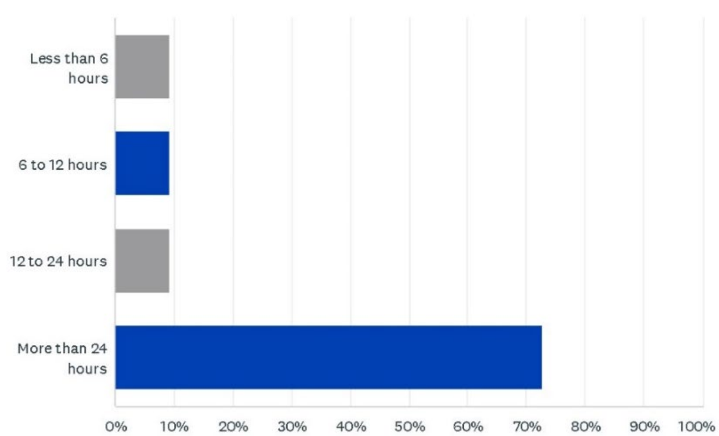
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	18.18%	4
Likely	13.64%	3
Possible	50.00%	11
Unlikely	18.18%	4
TOTAL		22

Q48 What is the probable duration of Volcanic Activity?

Answered: 22 Skipped: 8

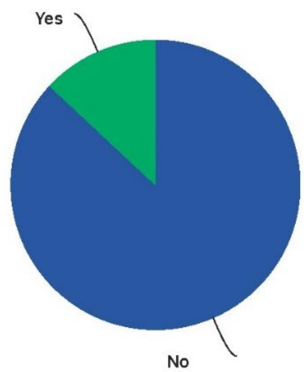


ANSWER CHOICES	RESPONSES	
Less than 6 hours	9.09%	2
6 to 12 hours	9.09%	2
12 to 24 hours	9.09%	2
More than 24 hours	72.73%	16
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q49 Has Volcanic Activity impacted your program or ability to serve your function?

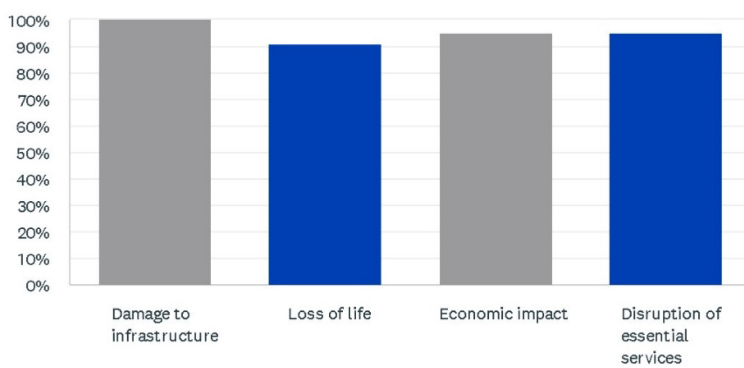
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
No	86.96%	20
Yes	13.04%	3
TOTAL		23

Q50 What will be affected by a Tsunami (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	100.00%	22
Loss of life	90.91%	20
Economic impact	95.45%	21
Disruption of essential services	95.45%	21
Total Respondents: 22		

2024 Standard State Mitigation Plan Update — SurveyMonkey

Q51 Are there specific areas in the community that are particularly vulnerable to a Tsunami? (Describe locations using street intersections or landmarks)

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Lower lying areas on western sides of the islands if a tsunami were to occur in the Philippine Sea. If a tsunami were to occur in the Pacific Ocean then the following areas may be impacted: Saipan: Kagman, Dandan, Laolao Tinian: San Jose	3/17/2024 8:22 PM
2	.	2/22/2024 1:55 PM
3	Low elevation areas and the coastal areas in Saipan.	2/13/2024 6:31 PM
4	Low lying areas	2/12/2024 7:55 PM
5	coastal homes and businesses as well as the CUC power plant	2/12/2024 7:28 PM
6	Lower lying areas within the CNMI	2/12/2024 6:04 PM
7	Coastal Areas. San Antonio to San Roque.	2/12/2024 5:29 PM
8	Saipan, Tinian, Rota and the Northern Islands	2/12/2024 4:19 PM
9	All low lying areas	2/12/2024 4:04 PM
10	Northern Mariana Islands	2/12/2024 3:37 PM
11	Low elevation areas	2/12/2024 2:28 PM
12	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:25 PM
13	San Jose Village, Tinian power plant, Maui Well pump station	2/8/2024 7:08 PM
14	Pagan island	2/7/2024 2:32 PM
15	All coastal zone areas that are at elevations under 10 ft MSL	2/7/2024 12:07 PM
16	Beach road	2/5/2024 6:29 PM
17	Not that I know of.	2/5/2024 4:09 PM
18	All Coastal Beach Road	2/5/2024 1:21 PM
19	The entire Beach Road on the island of Saipan	2/4/2024 8:37 PM
20	low-lying areas	2/4/2024 5:59 PM
21	Low-lying coastal areas	2/4/2024 3:20 PM
22	None	2/4/2024 2:48 PM
23	Saipan, Rota, Tinian	2/4/2024 1:22 PM

Q52 How many people are in those areas/locations?

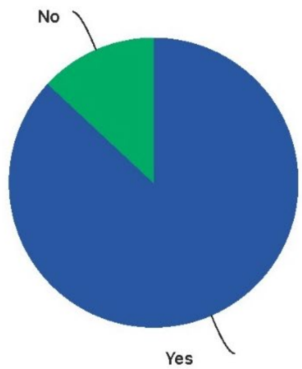
Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Census.	3/18/2024 4:22 PM
2	.	2/23/2024 9:55 AM
3	Refer to Census 2020 data.	2/14/2024 2:31 PM
4	Many	2/13/2024 3:55 PM
5	several thousands	2/13/2024 3:28 PM
6	Unknown	2/13/2024 2:04 PM
7	Half of the population.	2/13/2024 1:29 PM
8	47000+	2/13/2024 12:19 PM
9	70%	2/13/2024 12:04 PM
10	Not sure	2/13/2024 11:37 AM
11	Majority of population	2/13/2024 10:28 AM
12	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:25 AM
13	50-60% of pipulation	2/9/2024 3:08 PM
14	600	2/8/2024 10:32 AM
15	5-10k	2/8/2024 8:07 AM
16	10,000	2/6/2024 2:29 PM
17	N/A	2/6/2024 12:09 PM
18	+/- 20,000	2/6/2024 9:21 AM
19	Approximately 10,000 people	2/5/2024 4:37 PM
20	residents of low-lying areas	2/5/2024 1:59 PM
21	Most of the population	2/5/2024 11:20 AM
22	Areas closer to the beach	2/5/2024 10:48 AM
23	60,000-80,000	2/5/2024 9:22 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q53 Is there critical infrastructure in the area/location?

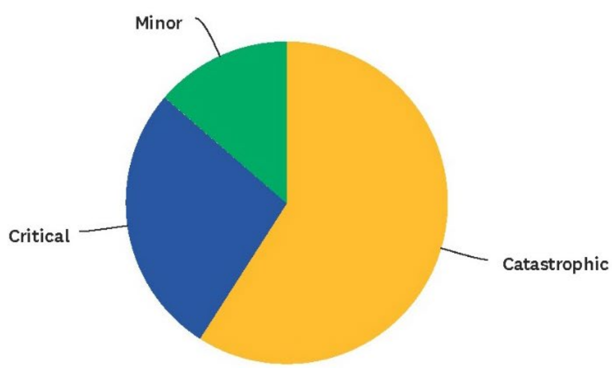
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	86.96%	20
No	13.04%	3
TOTAL		23

Q54 What is the potential magnitude or severity of a Tsunami?

Answered: 22 Skipped: 8

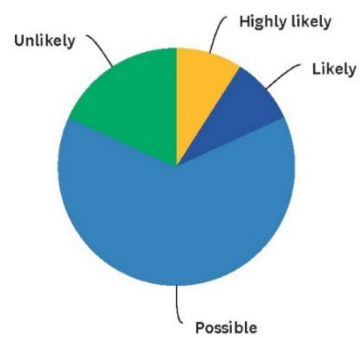


ANSWER CHOICES	RESPONSES	
Catastrophic	59.09%	13
Critical	27.27%	6
Limited	0.00%	0
Minor	13.64%	3
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q55 Based on past occurrences, what is the expected frequency of future occurrences of Tsunami?

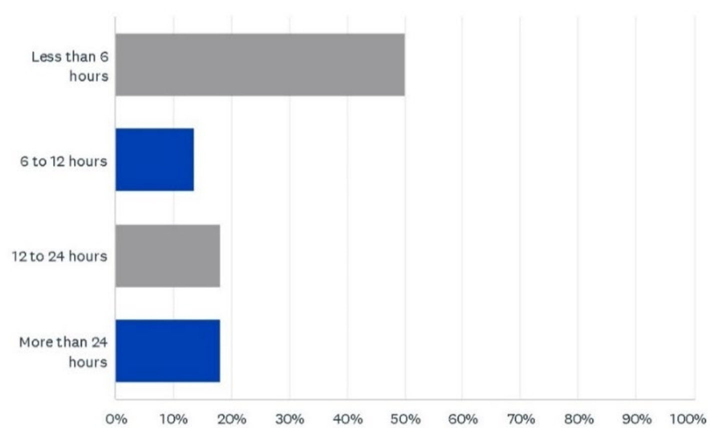
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	9.09%	2
Likely	9.09%	2
Possible	63.64%	14
Unlikely	18.18%	4
TOTAL		22

Q56 What is the probable duration of a Tsunami?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Less than 6 hours	50.00%	11
6 to 12 hours	13.64%	3
12 to 24 hours	18.18%	4
More than 24 hours	18.18%	4
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

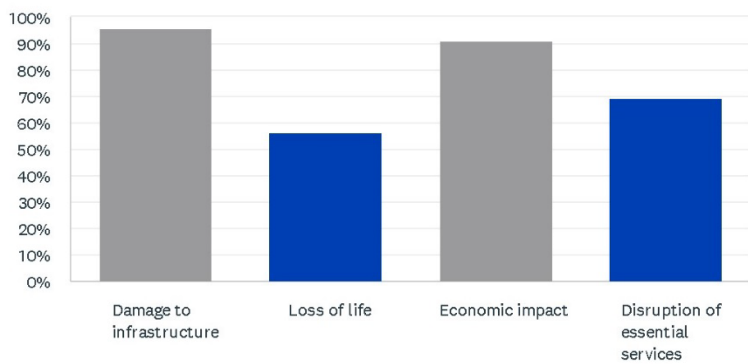
Q57 Has a Tsunami impacted your program or ability to serve your function?

Answered: 23 Skipped: 7

ANSWER CHOICES	RESPONSES	
No	95.65%	22
Yes	4.35%	1
TOTAL		23

Q58 What will be affected by a Wildfire (select all that apply)?

Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	95.65%	22
Loss of life	56.52%	13
Economic impact	91.30%	21
Disruption of essential services	69.57%	16
Total Respondents: 23		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q59 Are there specific areas in the community that are particularly vulnerable to Wildfire? (Describe locations using street intersections or landmarks)

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Saipan: Watersheds: W. Takpochau, Achugao, Talafofo, Laolao.	3/17/2024 8:22 PM
2	farmlands or areas close to the villages	2/22/2024 1:55 PM
3	Remote areas in the central/northern grassy areas: Chalan Galaide, Wireless Ridge, Talafofo, Marpi, As Matuis, Kannat Tabla, eastern area: Kagman and southern areas: Koblerville, As Gonno, Obyan.	2/13/2024 6:31 PM
4	Grassy areas located everywhere on island	2/12/2024 7:55 PM
5	northern and eastern areas	2/12/2024 7:28 PM
6	Wireless Ridge, Marpi	2/12/2024 6:04 PM
7	No	2/12/2024 5:29 PM
8	Farms	2/12/2024 4:19 PM
9	Chalan Monsignor Martinez Rd, Route 36 (Talafofo Rd)	2/12/2024 4:04 PM
10	Northern Mariana Islands	2/12/2024 3:37 PM
11	All areas	2/12/2024 2:28 PM
12	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:25 PM
13	power plant	2/8/2024 7:08 PM
14	most of the islands	2/7/2024 2:32 PM
15	Wireless ridge, Kannat Tabla areas below Tapachao, Obyan	2/7/2024 12:07 PM
16	As Gonno, Koblerville	2/5/2024 6:29 PM
17	Yes, areas with dense vegetation and forest land.	2/5/2024 4:09 PM
18	Wetlands in Susupe, San Jose, and CHalan Laulau Wireless Ridge area	2/5/2024 1:21 PM
19	unpredictable	2/4/2024 8:37 PM
20	Farm areas and high lands	2/4/2024 5:59 PM
21	Wireless Ridge, Talofofo area, anywhere with high flammability	2/4/2024 3:20 PM
22	All over the island with overgrown and dried grasslands. Though the Wireless Ridge and As lito/As gonna are most affected	2/4/2024 2:48 PM
23	As Gonno, Kagman	2/4/2024 1:22 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

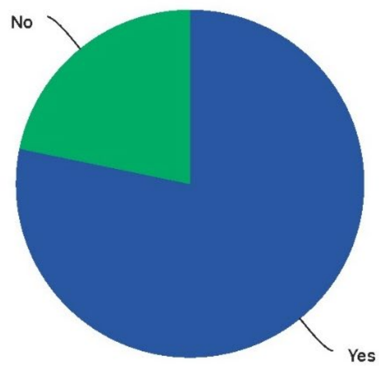
Q60 How many people are in those areas/locations?

Answered: 23 Skipped: 7

#	RESPONSES	DATE
1	Census	3/18/2024 4:22 PM
2	not sure	2/23/2024 9:55 AM
3	Refer to Census 2020 data.	2/14/2024 2:31 PM
4	Many	2/13/2024 3:55 PM
5	unsure	2/13/2024 3:28 PM
6	Unknown	2/13/2024 2:04 PM
7	1/10 of population.	2/13/2024 1:29 PM
8	200+	2/13/2024 12:19 PM
9	1000	2/13/2024 12:04 PM
10	Not sure	2/13/2024 11:37 AM
11	whole population	2/13/2024 10:28 AM
12	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:25 AM
13	islandwide	2/9/2024 3:08 PM
14	600	2/8/2024 10:32 AM
15	Approximetely 2,000	2/8/2024 8:07 AM
16	10,000-20,000	2/6/2024 2:29 PM
17	There are quite a few people who live in areas like these on Tinian.	2/6/2024 12:09 PM
18	+/-1,000	2/6/2024 9:21 AM
19	Approximately 15,000 people	2/5/2024 4:37 PM
20	Unsure	2/5/2024 1:59 PM
21	I do not know	2/5/2024 11:20 AM
22	15k	2/5/2024 10:48 AM
23	10,000	2/5/2024 9:22 AM

Q61 Is there critical infrastructure in the area/location?

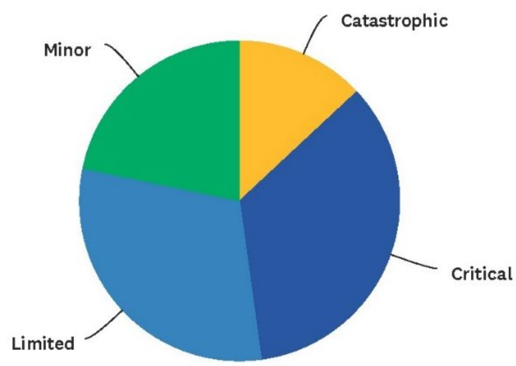
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes	78.26%	18
No	21.74%	5
TOTAL		23

Q62 What is the potential magnitude or severity of Wildfire?

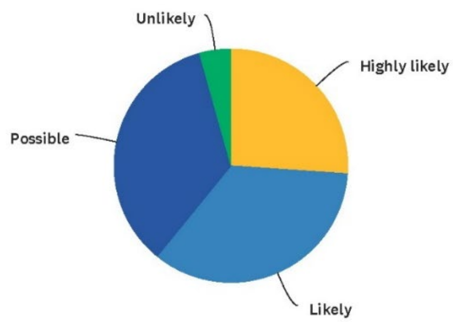
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Catastrophic	13.04%	3
Critical	34.78%	8
Limited	30.43%	7
Minor	21.74%	5
TOTAL		23

Q63 Based on past occurrences, what is the expected frequency of future occurrences of Wildfire?

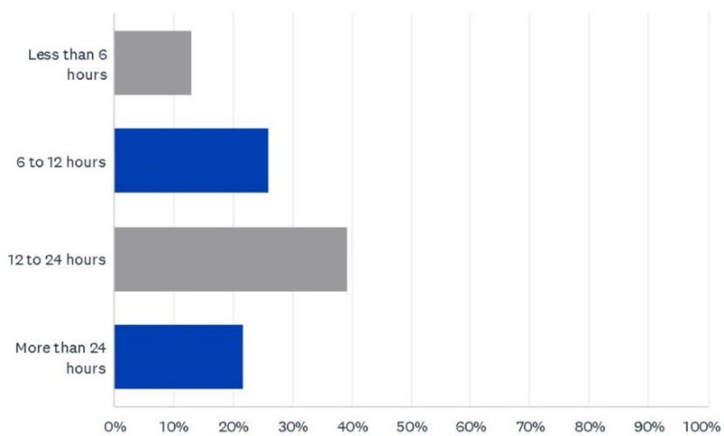
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Highly likely	26.09%	6
Likely	34.78%	8
Possible	34.78%	8
Unlikely	4.35%	1
TOTAL		23

Q64 What is the probable duration of a Wildfire?

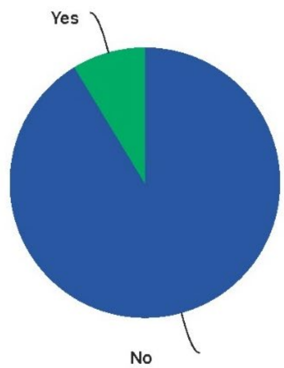
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
Less than 6 hours	13.04%	3
6 to 12 hours	26.09%	6
12 to 24 hours	39.13%	9
More than 24 hours	21.74%	5
TOTAL		23

Q65 Has Wildfire impacted your program or ability to serve your function?

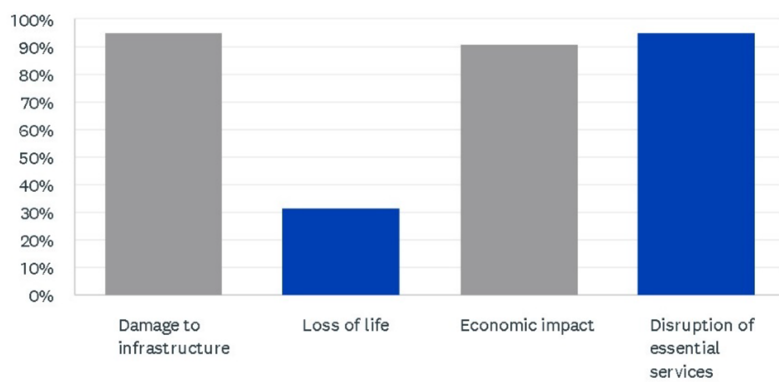
Answered: 23 Skipped: 7



ANSWER CHOICES	RESPONSES	
No	91.30%	21
Yes	8.70%	2
TOTAL		23

Q66 What will be affected by Coastal Flooding (Typhoon related) (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	95.45%	21
Loss of life	31.82%	7
Economic impact	90.91%	20
Disruption of essential services	95.45%	21
Total Respondents: 22		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q67 Are there specific areas in the community that are particularly vulnerable to Coastal Flooding (Typhoon related)? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Low lying areas.	3/17/2024 8:26 PM
2	Songsong village along coastal areas	2/22/2024 1:57 PM
3	Coastal areas on the western region of Saipan: San Antonio, Chalan Piao, Chalan Kanoa, Susupe, Oleai, San Jose, Chalan Laulau, Garapan, Puerto Rico, Lower Base, Tanapag, San Roques and Marpi.	2/13/2024 6:39 PM
4	Coastal areas mostly stretch of Beach Road	2/12/2024 8:00 PM
5	All the western side of residential areas from San Antonio to San Roque.	2/12/2024 7:33 PM
6	Beach Road	2/12/2024 7:31 PM
7	Unknown	2/12/2024 6:07 PM
8	Coastal areas designated as Special Flood Hazard Areas are particularly vulnerable.	2/12/2024 4:21 PM
9	Beach Road, Pale Arnold Rd	2/12/2024 4:08 PM
10	Saipan, Tinian and Rota	2/12/2024 3:40 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:27 PM
12	power plant	2/8/2024 7:09 PM
13	Flat lands like Pagan	2/7/2024 2:33 PM
14	All areas near coast.	2/7/2024 12:10 PM
15	Beach Road areas	2/5/2024 6:31 PM
16	Not that I know of.	2/5/2024 4:09 PM
17	West Saipan Coast	2/5/2024 1:25 PM
18	Beach Road on the island of Saipan	2/4/2024 8:40 PM
19	Low-lying areas	2/4/2024 6:00 PM
20	Low-lying coastal areas	2/4/2024 3:24 PM
21	beach road	2/4/2024 2:52 PM
22	Beach Road areas	2/4/2024 1:24 PM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q68 How many people are in those areas/locations?

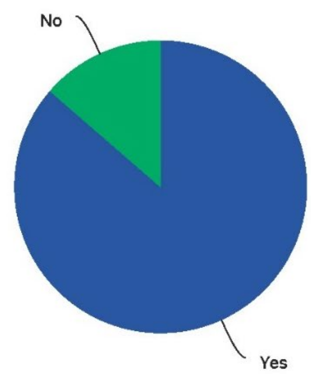
Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Census.	3/18/2024 4:26 PM
2	not sure	2/23/2024 9:57 AM
3	Refer to Census 2020 data.	2/14/2024 2:39 PM
4	Many	2/13/2024 4:00 PM
5	Approximately, half of the population.	2/13/2024 3:33 PM
6	Unsure	2/13/2024 3:31 PM
7	N/A	2/13/2024 2:07 PM
8	5000+	2/13/2024 12:21 PM
9	18000	2/13/2024 12:08 PM
10	Not sure	2/13/2024 11:40 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:27 AM
12	30	2/9/2024 3:09 PM
13	600	2/8/2024 10:33 AM
14	Appr. 5,000	2/8/2024 8:10 AM
15	10,000	2/6/2024 2:31 PM
16	N/A	2/6/2024 12:09 PM
17	+/- 20, 000	2/6/2024 9:25 AM
18	20,000 people	2/5/2024 4:40 PM
19	Unsure	2/5/2024 2:00 PM
20	Not sure but at least 40% of the population	2/5/2024 11:24 AM
21	15k	2/5/2024 10:52 AM
22	20,000-30,000	2/5/2024 9:24 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q69 Is there critical infrastructure in the area/location?

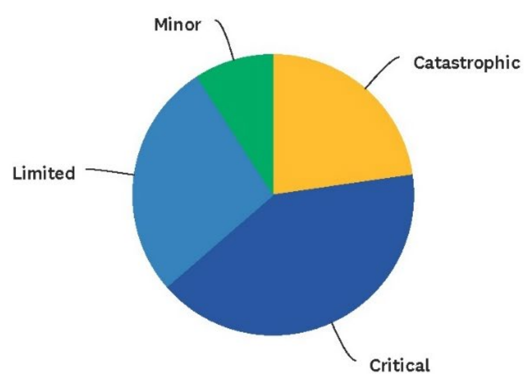
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	86.36%	19
No	13.64%	3
TOTAL		22

Q70 What is the potential magnitude or severity of Coastal Flooding (Typhoon related)?

Answered: 22 Skipped: 8

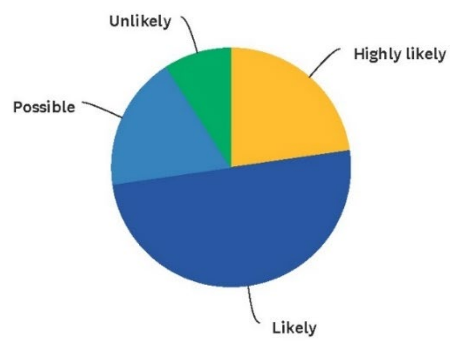


ANSWER CHOICES	RESPONSES	
Catastrophic	22.73%	5
Critical	40.91%	9
Limited	27.27%	6
Minor	9.09%	2
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q71 Based on past occurrences, what is the expected frequency of future occurrences of Coastal Flooding (Typhoon related)?

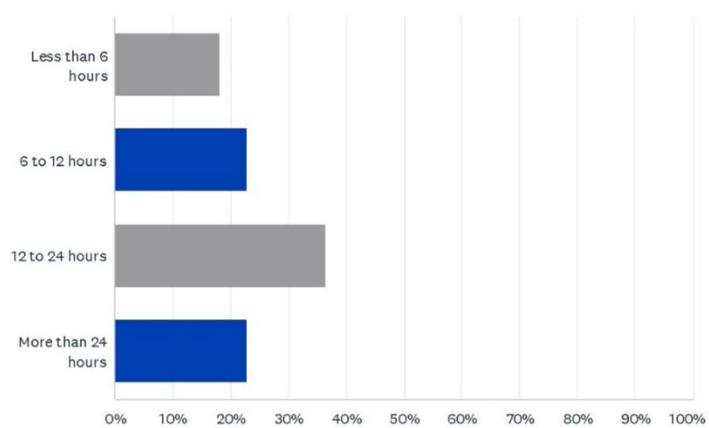
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	22.73%	5
Likely	50.00%	11
Possible	18.18%	4
Unlikely	9.09%	2
TOTAL		22

Q72 What is the probable duration of Coastal Flooding (Typhoon related)?

Answered: 22 Skipped: 8

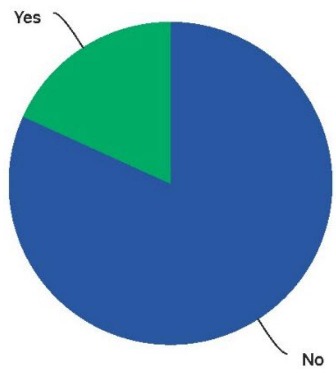


ANSWER CHOICES	RESPONSES	
Less than 6 hours	18.18%	4
6 to 12 hours	22.73%	5
12 to 24 hours	36.36%	8
More than 24 hours	22.73%	5
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q73 Has Coastal Flooding (Typhoon related) impacted your program or ability to serve your function?

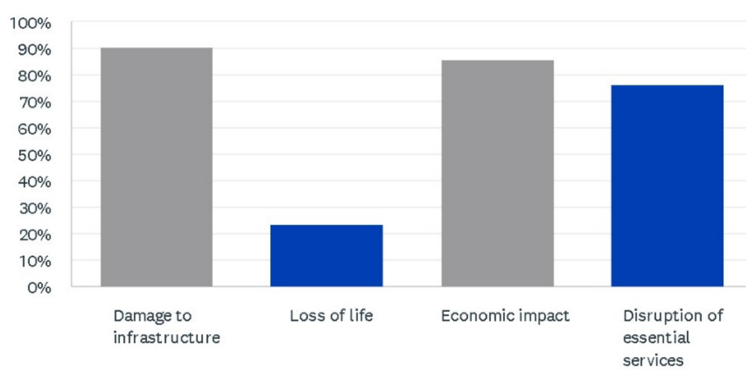
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	81.82%	18
Yes	18.18%	4
TOTAL		22

Q74 What will be affected by Coastal Flooding (Non-Typhoon related) (select all that apply)?

Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	90.48%	19
Loss of life	23.81%	5
Economic impact	85.71%	18
Disruption of essential services	76.19%	16
Total Respondents: 21		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q75 Are there specific areas in the community that are particularly vulnerable to Coastal Flooding (Non-Typhoon related)? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Saipan: W. Takpochau watershed, Laolao, Achugao, San Antonio.	3/17/2024 8:26 PM
2	.	2/22/2024 1:57 PM
3	Low elevation areas with no drainage or inadequate storm drainage systems. Chalan Msgr. Guerrero and Chalan Msgr. Martinez intersection. Beach road from San Antonio to American Memorial Park.	2/13/2024 6:39 PM
4	Coastal areas along Beach Road	2/12/2024 8:00 PM
5	Yes, residential areas mostly on the westside of the island that is densely populated.	2/12/2024 7:33 PM
6	Low lying areas	2/12/2024 7:31 PM
7	Unknown	2/12/2024 6:07 PM
8	Coastal areas designated as Special Flood Hazard Areas are particularly vulnerable.	2/12/2024 4:21 PM
9	Beach Road	2/12/2024 4:08 PM
10	Saipan	2/12/2024 3:40 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:27 PM
12	power plant	2/8/2024 7:09 PM
13	Flat areas on Pagan	2/7/2024 2:33 PM
14	All areas near coast. Starting to erode beaches to the point of no return if something doesn't happen.	2/7/2024 12:10 PM
15	Beach road areas	2/5/2024 6:31 PM
16	Not that I know of.	2/5/2024 4:09 PM
17	West Saipan	2/5/2024 1:25 PM
18	Beach Road on the island of Saipan will be impacted	2/4/2024 8:40 PM
19	low-lying areeas	2/4/2024 6:00 PM
20	Garapan, Lao Lao Bay	2/4/2024 3:24 PM
21	as lito road, beach road areas	2/4/2024 2:52 PM
22	Beach Road areas	2/4/2024 1:24 PM

Q76 How many people are in those areas/locations?

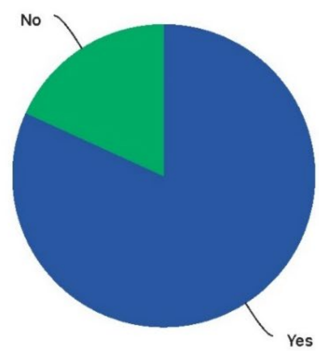
Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Census.	3/18/2024 4:26 PM
2	.	2/23/2024 9:57 AM
3	Refer to Census 2020 data.	2/14/2024 2:39 PM
4	Many	2/13/2024 4:00 PM
5	Approximately half of the population, from San Antonio to Tanapag and some parts of San Roque	2/13/2024 3:33 PM
6	unsure	2/13/2024 3:31 PM
7	N/A	2/13/2024 2:07 PM
8	5000+	2/13/2024 12:21 PM
9	15000	2/13/2024 12:08 PM
10	Not sure	2/13/2024 11:40 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:27 AM
12	30	2/9/2024 3:09 PM
13	600	2/8/2024 10:33 AM
14	Appr. 5,000	2/8/2024 8:10 AM
15	10,000	2/6/2024 2:31 PM
16	N/A	2/6/2024 12:09 PM
17	+/- 20,000	2/6/2024 9:25 AM
18	20,000	2/5/2024 4:40 PM
19	unsure	2/5/2024 2:00 PM
20	Not sure but at least 40% of the population	2/5/2024 11:24 AM
21	15k	2/5/2024 10:52 AM
22	20,000-30,000	2/5/2024 9:24 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q77 Is there critical infrastructure in the area/location?

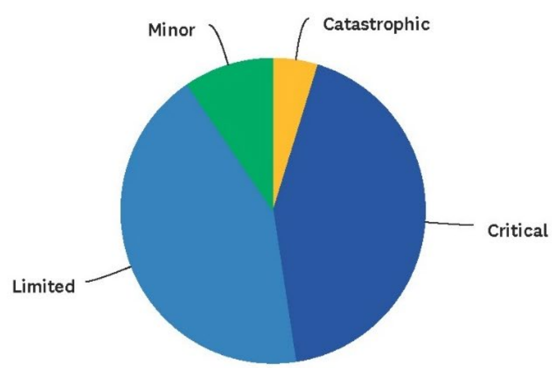
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	81.82%	18
No	18.18%	4
TOTAL		22

Q78 What is the potential magnitude or severity of Coastal Flooding (Non-Typhoon related)?

Answered: 21 Skipped: 9

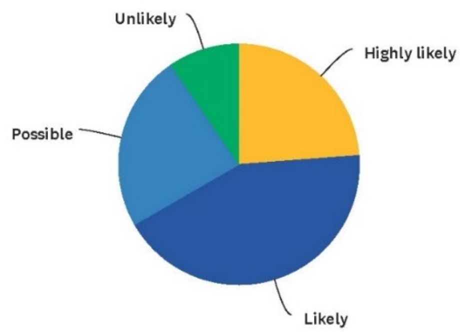


ANSWER CHOICES	RESPONSES	
Catastrophic	4.76%	1
Critical	42.86%	9
Limited	42.86%	9
Minor	9.52%	2
TOTAL		21

2024 Standard State Mitigation Plan Update SurveyMonkey

Q79 Based on past occurrences, what is the expected frequency of future occurrences of Coastal Flooding (Non-Typhoon related)?

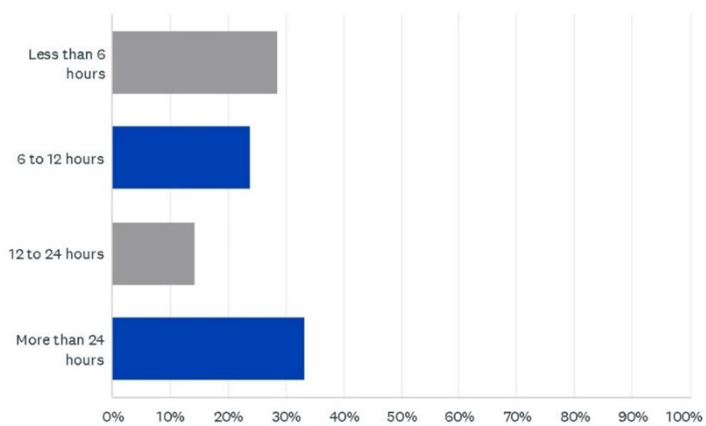
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Highly likely	23.81%	5
Likely	42.86%	9
Possible	23.81%	5
Unlikely	9.52%	2
TOTAL		21

Q80 What is the probable duration of Coastal Flooding (Non-Typhoon related)?

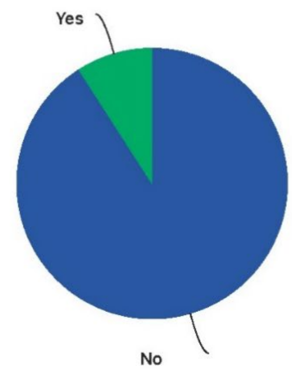
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Less than 6 hours	28.57%	6
6 to 12 hours	23.81%	5
12 to 24 hours	14.29%	3
More than 24 hours	33.33%	7
TOTAL		21

Q81 Has Coastal Flooding (Non-Typhoon related) impacted your program or ability to serve your function?

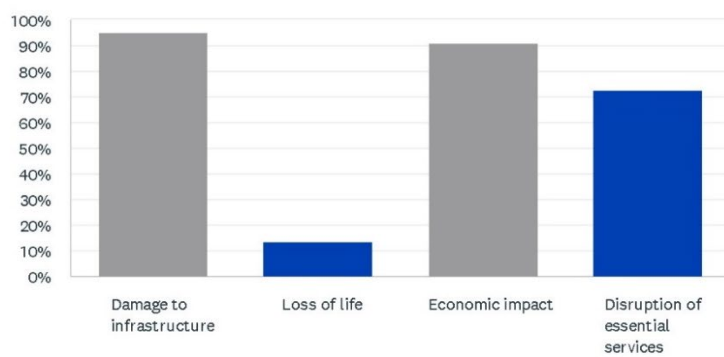
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	90.91%	20
Yes	9.09%	2
TOTAL		22

Q82 What will be affected by Coastal Erosion (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	95.45%	21
Loss of life	13.64%	3
Economic impact	90.91%	20
Disruption of essential services	72.73%	16
Total Respondents: 22		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q83 Are there specific areas in the community that are particularly vulnerable to Coastal Erosion? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Saipan: Garapan, Susupe, San Antonio, Achugao, Laolao, portions of Kagman (potentially)	3/17/2024 8:30 PM
2	Songsong village	2/22/2024 1:58 PM
3	San Antonio, Chalan Piao, Chalan Kanoa, Susupe, Oleai, San Jose, Chalan Laulau, Garapan, Lower Base, Tanapag, San Roque, Marpi, San Juan, Kagman, Obyan.	2/13/2024 6:44 PM
4	All areas along Beach Road (Both residential and commercial)	2/12/2024 8:05 PM
5	All along the walk pathway from The Shack all the way to Fishing Base. Areas at Micro Beach	2/12/2024 7:53 PM
6	Beach road from north to south	2/12/2024 7:33 PM
7	Micro Beach, Garapan Fishing Base	2/12/2024 6:14 PM
8	Shorelines and beaches along western Saipan, Rota and Tinian.	2/12/2024 4:23 PM
9	Beach Road	2/12/2024 4:10 PM
10	Saipan	2/12/2024 3:42 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:29 PM
12	power plant	2/8/2024 7:12 PM
13	Agrigan, Alamagan, Pagan and Anatahan	2/7/2024 2:36 PM
14	The Garapan Micro beach area is currently majorly affected. All other coastal areas are vulnerable as well	2/7/2024 12:14 PM
15	Garapan, Susupe, Beach Road	2/5/2024 6:33 PM
16	Not that I know of.	2/5/2024 4:11 PM
17	Saipan Seaport Beach Road CUC Power Plant AMP	2/5/2024 1:28 PM
18	entire Beach Road on the island of Saipan	2/4/2024 8:43 PM
19	unsure	2/4/2024 6:01 PM
20	Garapan shoreline (short and long-term), Beach Road (long-term)	2/4/2024 3:29 PM
21	hillside homes. navy hill, as falipe, mt. tapochau	2/4/2024 2:57 PM
22	Garapan and beach road areas	2/4/2024 1:26 PM

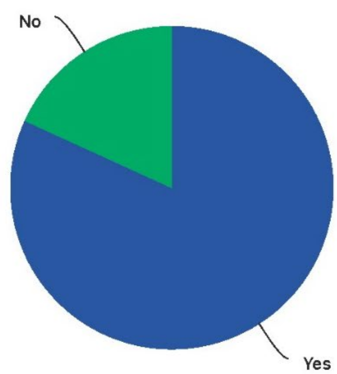
Q84 How many people are in those areas/locations?

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Census.	3/18/2024 4:30 PM
2	not sure	2/23/2024 9:58 AM
3	Refer to Census 2020 data.	2/14/2024 2:44 PM
4	Many	2/13/2024 4:05 PM
5	About 1/10 of the population.	2/13/2024 3:53 PM
6	Thousands	2/13/2024 3:33 PM
7	Unknown	2/13/2024 2:14 PM
8	12000+	2/13/2024 12:23 PM
9	15000	2/13/2024 12:10 PM
10	Not sure	2/13/2024 11:42 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:29 AM
12	30	2/9/2024 3:12 PM
13	600	2/8/2024 10:36 AM
14	Appr. 5,000	2/8/2024 8:14 AM
15	3,000	2/6/2024 2:33 PM
16	N/A	2/6/2024 12:11 PM
17	+/-1000	2/6/2024 9:28 AM
18	20,000 people	2/5/2024 4:43 PM
19	unsure	2/5/2024 2:01 PM
20	Not sure	2/5/2024 11:29 AM
21	less than 7k?	2/5/2024 10:57 AM
22	20,000-30,000	2/5/2024 9:26 AM

Q85 Is there critical infrastructure in the area/location?

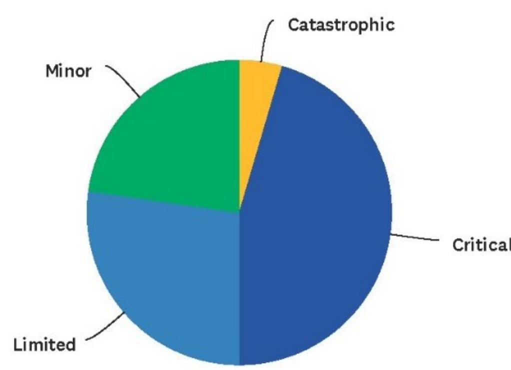
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	81.82%	18
No	18.18%	4
TOTAL		22

Q86 What is the potential magnitude or severity of Coastal Erosion?

Answered: 22 Skipped: 8

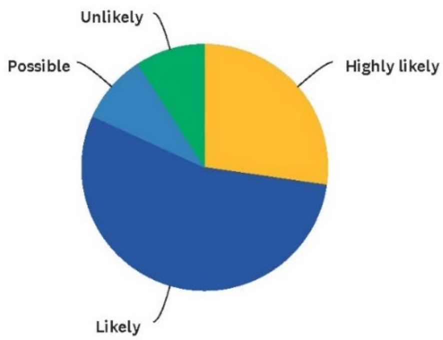


ANSWER CHOICES	RESPONSES	
Catastrophic	4.55%	1
Critical	45.45%	10
Limited	27.27%	6
Minor	22.73%	5
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q87 Based on past occurrences, what is the expected frequency of future occurrences of Coastal Erosion?

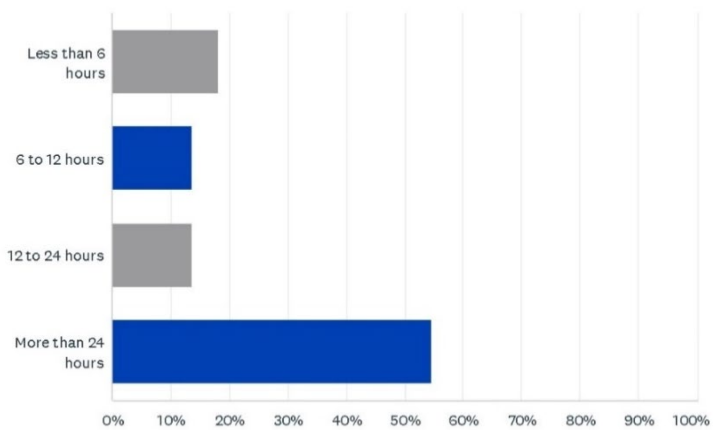
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	27.27%	6
Likely	54.55%	12
Possible	9.09%	2
Unlikely	9.09%	2
TOTAL		22

Q88 What is the probable duration of Coastal Erosion?

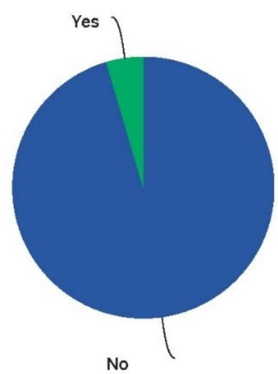
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Less than 6 hours	18.18%	4
6 to 12 hours	13.64%	3
12 to 24 hours	13.64%	3
More than 24 hours	54.55%	12
TOTAL		22

Q89 Has Coastal Erosion impacted your program or ability to serve your function?

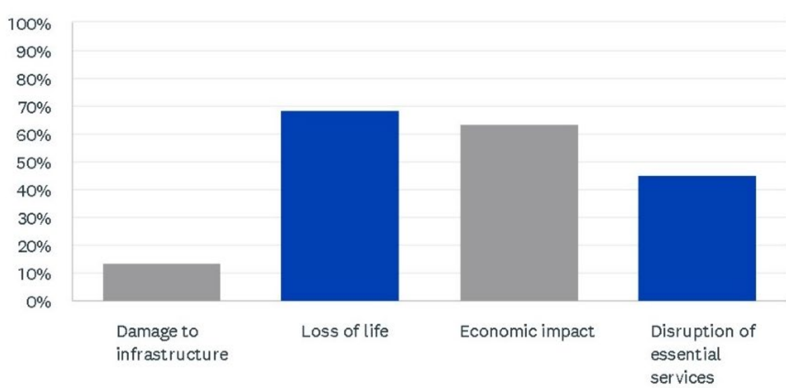
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	95.45%	21
Yes	4.55%	1
TOTAL		22

Q90 What will be affected by a Heat Wave (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	13.64%	3
Loss of life	68.18%	15
Economic impact	63.64%	14
Disruption of essential services	45.45%	10
Total Respondents: 22		

Q91 Are there specific areas in the community that are particularly vulnerable to Heat Wave? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Elderly population of CNMI	3/17/2024 8:30 PM
2	the whole island	2/22/2024 1:58 PM
3	The entire CNMI.	2/13/2024 6:44 PM
4	Low lying areas	2/12/2024 8:05 PM
5	Most of the areas on the islands, if a Heat Wave occurs would be affected.	2/12/2024 7:53 PM
6	all areas	2/12/2024 7:33 PM
7	Entire CNMI	2/12/2024 6:14 PM
8	All of CNMI	2/12/2024 4:23 PM
9	Island wide	2/12/2024 4:10 PM
10	None	2/12/2024 3:42 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:29 PM
12	islandwide	2/8/2024 7:12 PM
13	Pagan, Alamagan, Agrigan and Anatahan	2/7/2024 2:36 PM
14	N/A	2/7/2024 12:14 PM
15	Cnmi	2/5/2024 6:33 PM
16	Everywhere on Tinian has the potential for impacts from a heat wave.	2/5/2024 4:11 PM
17	All	2/5/2024 1:28 PM
18	No real issues with Heat Wave for the island of Saipan	2/4/2024 8:43 PM
19	unsure	2/4/2024 6:01 PM
20	Not that we know of, it would be interesting to have GIS data and modeling done for heat wave prediction using existing infrastructure and green space data.	2/4/2024 3:29 PM
21	all over the island	2/4/2024 2:57 PM
22	cnmi	2/4/2024 1:26 PM

Q92 How many people are in those areas/locations?

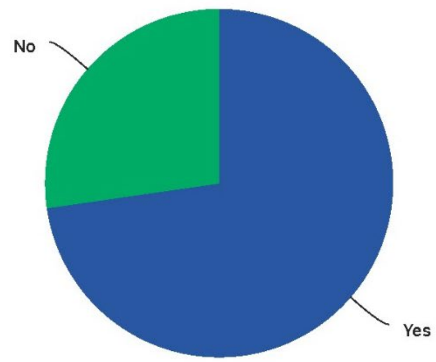
Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	N/A	3/18/2024 4:30 PM
2	not sure	2/23/2024 9:58 AM
3	Refer to Census 2020 data.	2/14/2024 2:44 PM
4	Many	2/13/2024 4:05 PM
5	Most of the population of Saipan, Tinian and Rota. Especially folks with pre-existing health conditions that are vulnerable to heat that could contribute to the conditions of their illnesses. The less fortunate without air conditioning system in their homes to keep their environment cool during a heat wave.	2/13/2024 3:53 PM
6	unsure	2/13/2024 3:33 PM
7	Above 40k	2/13/2024 2:14 PM
8	47000+	2/13/2024 12:23 PM
9	100%	2/13/2024 12:10 PM
10	Not sure	2/13/2024 11:42 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:29 AM
12	islandwide	2/9/2024 3:12 PM
13	600	2/8/2024 10:36 AM
14	Entire island	2/8/2024 8:14 AM
15	30,000	2/6/2024 2:33 PM
16	There are a decent amount of people living in these areas.	2/6/2024 12:11 PM
17	All	2/6/2024 9:28 AM
18	35,000 people	2/5/2024 4:43 PM
19	unsure	2/5/2024 2:01 PM
20	Most of the population	2/5/2024 11:29 AM
21	45k	2/5/2024 10:57 AM
22	60,000-80,000	2/5/2024 9:26 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q93 Is there critical infrastructure in the area/location?

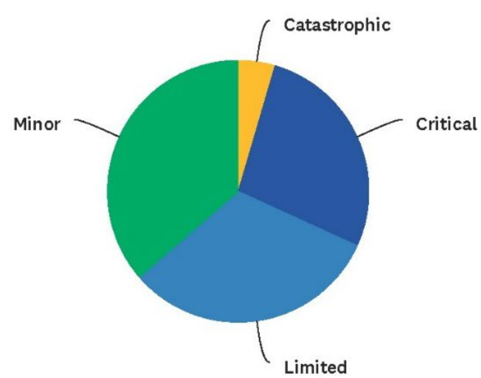
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	72.73%	16
No	27.27%	6
TOTAL		22

Q94 What is the potential magnitude or severity of a Heat Wave?

Answered: 22 Skipped: 8

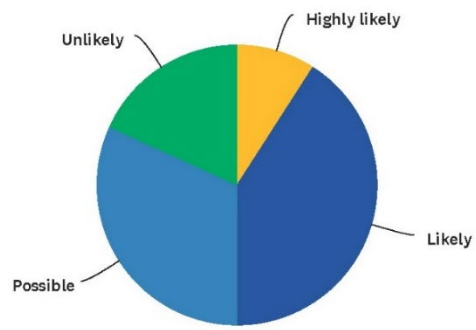


ANSWER CHOICES	RESPONSES	
Catastrophic	4.55%	1
Critical	27.27%	6
Limited	31.82%	7
Minor	36.36%	8
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q95 Based on past occurrences, what is the expected frequency of future occurrences of Heat Wave?

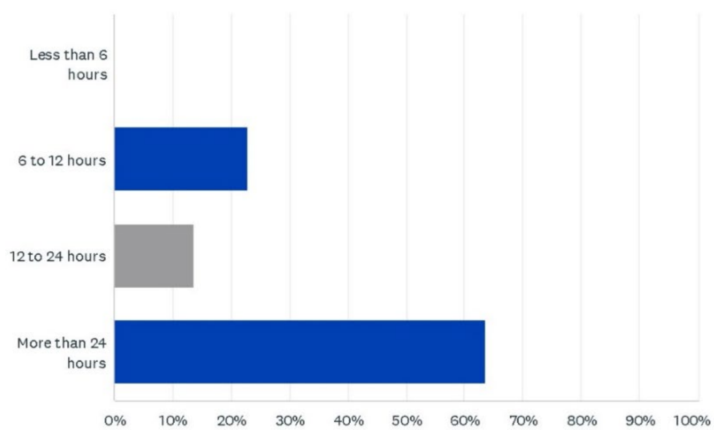
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	9.09%	2
Likely	40.91%	9
Possible	31.82%	7
Unlikely	18.18%	4
TOTAL		22

Q96 What is the probable duration of a Heat Wave?

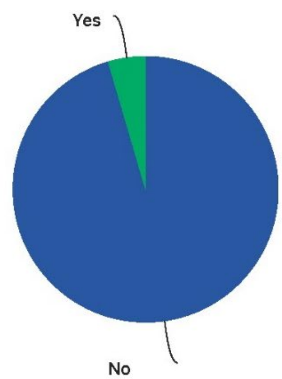
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Less than 6 hours	0.00%	0
6 to 12 hours	22.73%	5
12 to 24 hours	13.64%	3
More than 24 hours	63.64%	14
TOTAL		22

Q97 Has a Heat Wave impacted your program or ability to serve your function?

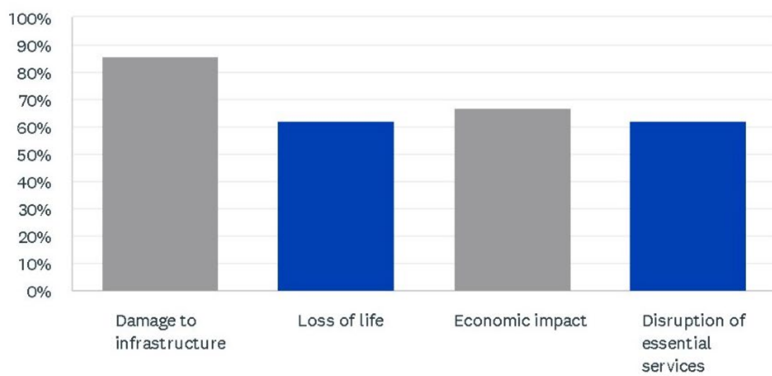
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	95.45%	21
Yes	4.55%	1
TOTAL		22

Q98 What will be affected by a Landslide (select all that apply)?

Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	85.71%	18
Loss of life	61.90%	13
Economic impact	66.67%	14
Disruption of essential services	61.90%	13
Total Respondents: 21		

Q99 Are there specific areas in the community that are particularly vulnerable to Landslides? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Perhaps Rota.	3/17/2024 8:34 PM
2	.	2/22/2024 2:00 PM
3	Areas below quarry plants and sloped elevations. Sadog Tasi Wastewater Treatment Plant, Donni Springs Well site in As Teo.	2/13/2024 6:53 PM
4	None	2/12/2024 8:08 PM
5	None	2/12/2024 8:04 PM
6	Those living in the hillside areas	2/12/2024 7:36 PM
7	Unknown	2/12/2024 6:25 PM
8	No	2/12/2024 4:25 PM
9	None	2/12/2024 4:14 PM
10	No	2/12/2024 3:44 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:31 PM
12	Carolinas Heights .5M Gallon Tank	2/8/2024 7:20 PM
13	Anatahan, Alamagan, Pagan and Agrigan	2/7/2024 2:37 PM
14	Kannat Tabla	2/7/2024 12:31 PM
15	Gualo Rai, Navy Hill	2/5/2024 6:35 PM
16	Not that I know of.	2/5/2024 4:11 PM
17	none	2/5/2024 1:29 PM
18	None	2/4/2024 8:51 PM
19	unsure	2/4/2024 6:02 PM
20	Areas within the higher elevation areas, such as Wireless Ridge, Talofofo, etc.	2/4/2024 3:34 PM
21	hillside homes. navy hill, as falipe, gualo rai, mt. tapochau	2/4/2024 2:59 PM
22	navy hill, sadog tasi areas	2/4/2024 1:28 PM

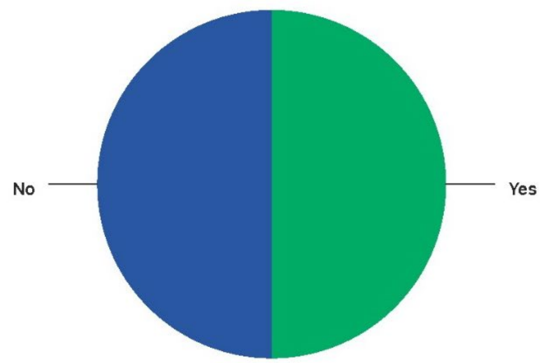
Q100 How many people are in those areas/locations?

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	N/A	3/18/2024 4:34 PM
2	.	2/23/2024 10:00 AM
3	Refer to Census 2020 data.	2/14/2024 2:53 PM
4	None	2/13/2024 4:08 PM
5	None	2/13/2024 4:04 PM
6	unsure	2/13/2024 3:36 PM
7	N/A	2/13/2024 2:25 PM
8	0	2/13/2024 12:25 PM
9	None	2/13/2024 12:14 PM
10	No	2/13/2024 11:44 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:31 AM
12	60	2/9/2024 3:20 PM
13	600	2/8/2024 10:37 AM
14	500-1,000	2/8/2024 8:31 AM
15	10,000	2/6/2024 2:35 PM
16	N/A	2/6/2024 12:11 PM
17	none	2/6/2024 9:29 AM
18	Not applicable	2/5/2024 4:51 PM
19	unsure	2/5/2024 2:02 PM
20	Less than 300	2/5/2024 11:34 AM
21	12k?	2/5/2024 10:59 AM
22	30,000-40,000	2/5/2024 9:28 AM

Q101 Is there critical infrastructure in the area/location?

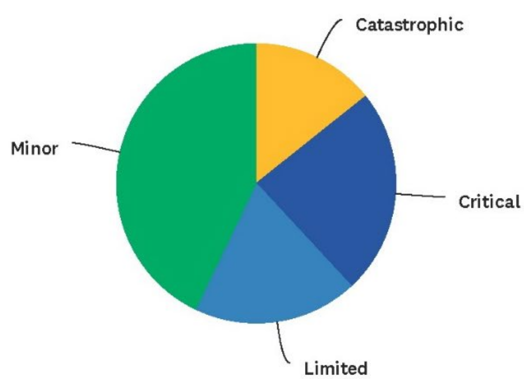
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	50.00%	11
No	50.00%	11
TOTAL		22

Q102 What is the potential magnitude or severity of a Landslide?

Answered: 21 Skipped: 9

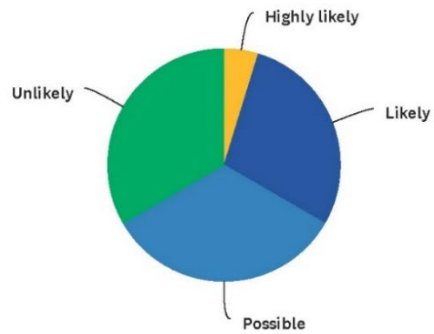


ANSWER CHOICES	RESPONSES	
Catastrophic	14.29%	3
Critical	23.81%	5
Limited	19.05%	4
Minor	42.86%	9
TOTAL		21

2024 Standard State Mitigation Plan Update SurveyMonkey

Q103 Based on past occurrences, what is the expected frequency of future occurrences of Landslides?

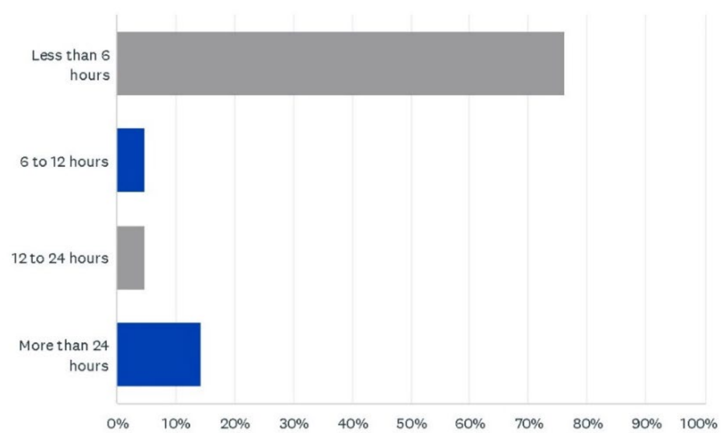
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Highly likely	4.76%	1
Likely	28.57%	6
Possible	33.33%	7
Unlikely	33.33%	7
TOTAL		21

Q104 What is the probable duration of a Landslide?

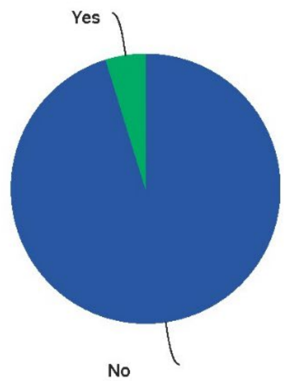
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Less than 6 hours	76.19%	16
6 to 12 hours	4.76%	1
12 to 24 hours	4.76%	1
More than 24 hours	14.29%	3
TOTAL		21

Q105 Has a Landslide impacted your program or ability to serve your function?

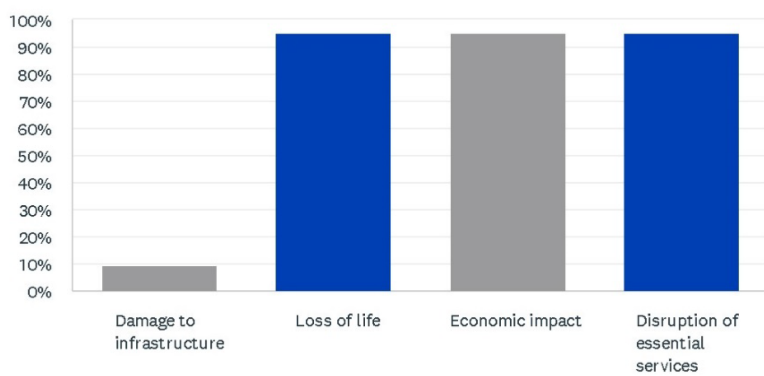
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
No	95.24%	20
Yes	4.76%	1
TOTAL		21

Q106 What will be affected by a Public Health Risk (select all that apply)?

Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	9.52%	2
Loss of life	95.24%	20
Economic impact	95.24%	20
Disruption of essential services	95.24%	20
Total Respondents: 21		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q107 Are there specific areas in the community that are particularly vulnerable to a Public Health Risk? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	The community at large.	3/17/2024 8:34 PM
2	.	2/22/2024 2:00 PM
3	The entire CNMI.	2/13/2024 6:53 PM
4	Everywhere	2/12/2024 8:08 PM
5	Throughout the entire community on most residential trash management. Stagnant water puddles, breeding ground for vectors that may carry diseases. Pile ups of junk cars that harbors rat nesting. Sewer overflow.	2/12/2024 8:04 PM
6	affects everyone	2/12/2024 7:36 PM
7	Entire CNMI	2/12/2024 6:25 PM
8	All	2/12/2024 4:25 PM
9	Island wide	2/12/2024 4:14 PM
10	Northern Mariana Islands	2/12/2024 3:44 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:31 PM
12	islandwide	2/8/2024 7:20 PM
13	Anatahan, Alamagan, Pagan and Agrigan	2/7/2024 2:37 PM
14	N/A	2/7/2024 12:31 PM
15	Cnmi	2/5/2024 6:35 PM
16	Not that I know of.	2/5/2024 4:11 PM
17	All	2/5/2024 1:29 PM
18	The entire population on the island of Saipan	2/4/2024 8:51 PM
19	unsure	2/4/2024 6:02 PM
20	High density areas may have higher vulnerability to public health risk.	2/4/2024 3:34 PM
21	All island	2/4/2024 2:59 PM
22	cnmi	2/4/2024 1:28 PM

Q108 How many people are in those areas/locations?

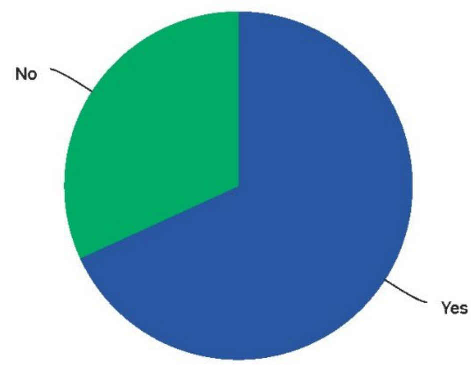
Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	Roughly 48,000	3/18/2024 4:34 PM
2	.	2/23/2024 10:00 AM
3	Refer to Census 2020 data.	2/14/2024 2:53 PM
4	Many	2/13/2024 4:08 PM
5	The majority of the population of Saipan. Especially in Chalan Kanoa areas.	2/13/2024 4:04 PM
6	Unsure	2/13/2024 3:36 PM
7	Above 40k	2/13/2024 2:25 PM
8	47000+	2/13/2024 12:25 PM
9	100%	2/13/2024 12:14 PM
10	Not sure	2/13/2024 11:44 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:31 AM
12	islandwide	2/9/2024 3:20 PM
13	600	2/8/2024 10:37 AM
14	Entire island	2/8/2024 8:31 AM
15	60,000	2/6/2024 2:35 PM
16	N/A	2/6/2024 12:11 PM
17	All	2/6/2024 9:29 AM
18	approximately 35,000	2/5/2024 4:51 PM
19	unsure	2/5/2024 2:02 PM
20	Not sure	2/5/2024 11:34 AM
21	45k	2/5/2024 10:59 AM
22	60,000-80,000	2/5/2024 9:28 AM

2024 Standard State Mitigation Plan Update SurveyMonkey

Q109 Is there critical infrastructure in the area/location?

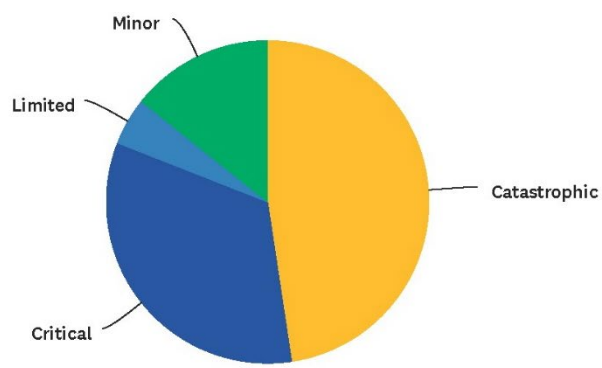
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	68.18%	15
No	31.82%	7
TOTAL		22

Q110 What is the potential magnitude or severity of a Public Health Risk?

Answered: 21 Skipped: 9

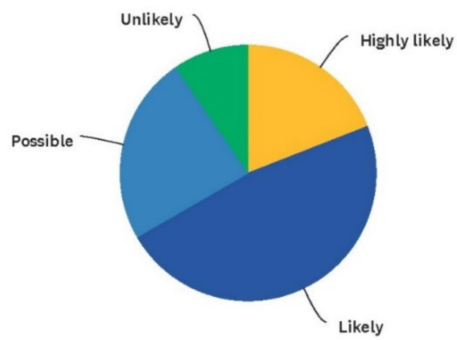


ANSWER CHOICES	RESPONSES	
Catastrophic	47.62%	10
Critical	33.33%	7
Limited	4.76%	1
Minor	14.29%	3
TOTAL		21

2024 Standard State Mitigation Plan Update SurveyMonkey

Q111 Based on past occurrences, what is the expected frequency of future occurrences of a Public Health Risk?

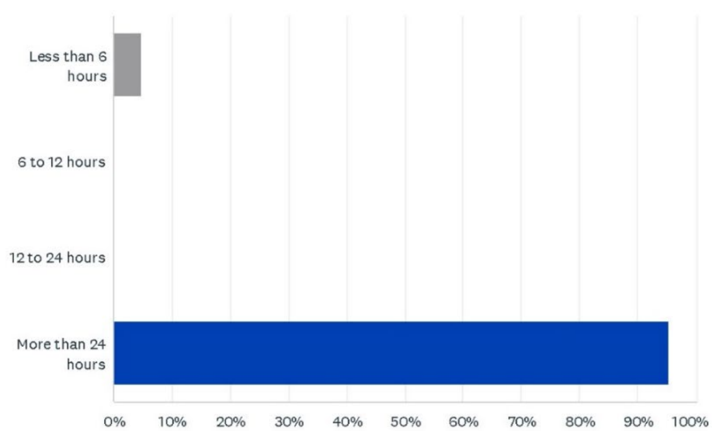
Answered: 21 Skipped: 9



ANSWER CHOICES	RESPONSES	
Highly likely	19.05%	4
Likely	47.62%	10
Possible	23.81%	5
Unlikely	9.52%	2
TOTAL		21

Q112 What is the probable duration of a Public Health Risk?

Answered: 21 Skipped: 9

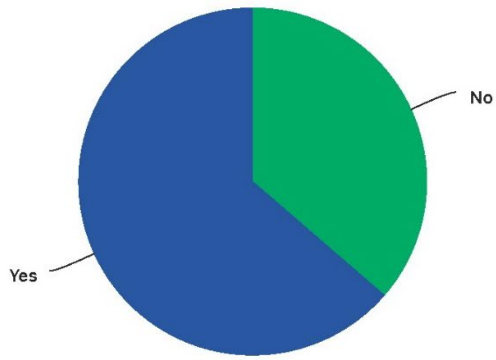


ANSWER CHOICES	RESPONSES	
Less than 6 hours	4.76%	1
6 to 12 hours	0.00%	0
12 to 24 hours	0.00%	0
More than 24 hours	95.24%	20
TOTAL		21

2024 Standard State Mitigation Plan Update SurveyMonkey

Q113 Has a Public Health Risk impacted your program or ability to serve your function?

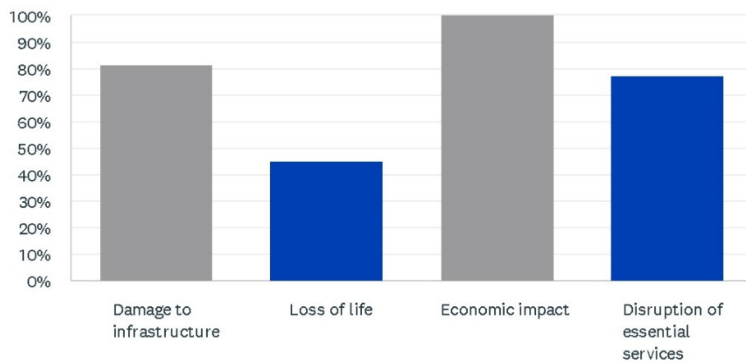
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	36.36%	8
Yes	63.64%	14
TOTAL		22

Q114 What will be affected by Climate Change (select all that apply)?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Damage to infrastructure	81.82%	18
Loss of life	45.45%	10
Economic impact	100.00%	22
Disruption of essential services	77.27%	17
Total Respondents: 22		

2024 Standard State Mitigation Plan Update SurveyMonkey

Q115 Are there specific areas in the community that are particularly vulnerable to Climate Change? (Describe locations using street intersections or landmarks)

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	The community at large.	3/17/2024 8:36 PM
2	the whole island	2/22/2024 2:01 PM
3	The entire CNMI.	2/13/2024 7:57 PM
4	The west side stretch of the island of Saipan. Some beach areas from San Jose to Fishing Base and parts of Micro Beach no longer have beach sand land. Erosion is fast occurring.	2/12/2024 8:11 PM
5	Coastal and low lying areas along Beach Road	2/12/2024 8:10 PM
6	The whole community	2/12/2024 7:37 PM
7	Entire CNMI	2/12/2024 6:27 PM
8	All of CNMI	2/12/2024 4:26 PM
9	Island wide	2/12/2024 4:16 PM
10	Northern Mariana Islands	2/12/2024 3:45 PM
11	Alamagan 17°36'45.3"N 145°49'18.0"E Pagan 18°07'20.2"N 145°45'37.7"E Agrihan 18°44'12.7"N 145°39'09.7"E	2/12/2024 1:35 PM
12	islandwide	2/8/2024 7:23 PM
13	Anatahan, Alamagan, Pagan and Agrigan	2/7/2024 2:38 PM
14	Coastal areas	2/7/2024 12:32 PM
15	Cnmi	2/5/2024 6:36 PM
16	Not that I know of.	2/5/2024 4:12 PM
17	Coastal areas	2/5/2024 1:42 PM
18	The entire island of Saipan including the entire Commonwealth of the Northern Mariana Islands	2/4/2024 8:54 PM
19	Island wide	2/4/2024 6:02 PM
20	Dependent on the climate change impact, it would good to consider the full extent of the islands as vulnerable to climate change so that we can continue to prioritize it in our planning, management, and policy for hazard mitigation.	2/4/2024 3:40 PM
21	all islands, those who rely on fishing and farming for income	2/4/2024 3:00 PM
22	cnmi	2/4/2024 1:29 PM

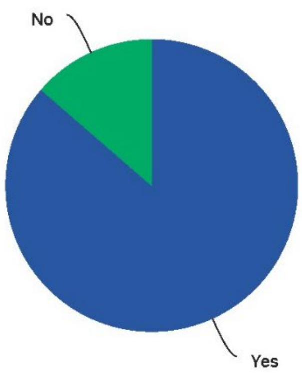
Q116 How many people are in those areas/locations?

Answered: 22 Skipped: 8

#	RESPONSES	DATE
1	~48,000	3/18/2024 4:36 PM
2	entire population including animals	2/23/2024 10:01 AM
3	The entire CNMI.	2/14/2024 3:57 PM
4	Approximately 1/10 of the population	2/13/2024 4:11 PM
5	Many	2/13/2024 4:10 PM
6	Everyone	2/13/2024 3:37 PM
7	Above 40k	2/13/2024 2:27 PM
8	Everyone	2/13/2024 12:26 PM
9	100%	2/13/2024 12:16 PM
10	Not sure	2/13/2024 11:45 AM
11	2020 Census Data: Agrihan Village-4; Alamagan Village-1; Pagan Village-2 Note: number of visitors that stay more than a day varies thru out the year	2/13/2024 9:35 AM
12	islandwide	2/9/2024 3:23 PM
13	600	2/8/2024 10:38 AM
14	Appr. 5,000	2/8/2024 8:32 AM
15	60,000	2/6/2024 2:36 PM
16	N/A	2/6/2024 12:12 PM
17	+/- 20,000	2/6/2024 9:42 AM
18	40,000 people	2/5/2024 4:54 PM
19	All residents of Saipan	2/5/2024 2:02 PM
20	All of the residential population including tourists	2/5/2024 11:40 AM
21	10k?	2/5/2024 11:00 AM
22	60,000-80,000	2/5/2024 9:29 AM

Q117 Is there critical infrastructure in the area/location?

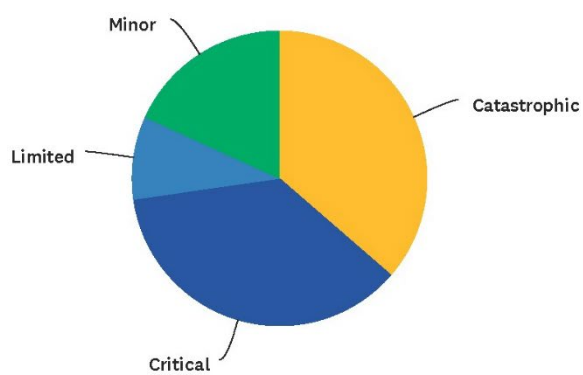
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	86.36%	19
No	13.64%	3
TOTAL		22

Q118 What is the potential magnitude or severity of Climate Change?

Answered: 22 Skipped: 8

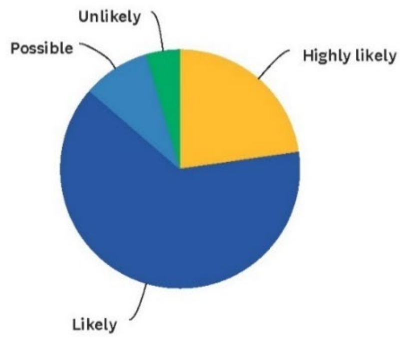


ANSWER CHOICES	RESPONSES	
Catastrophic	36.36%	8
Critical	36.36%	8
Limited	9.09%	2
Minor	18.18%	4
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q119 Based on past occurrences, what is the expected frequency of future occurrences of Climate Change?

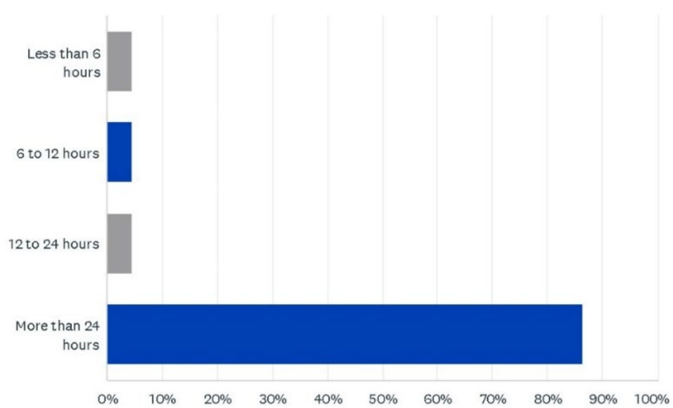
Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
Highly likely	22.73%	5
Likely	63.64%	14
Possible	9.09%	2
Unlikely	4.55%	1
TOTAL		22

Q120 What is the probable duration of Climate Change?

Answered: 22 Skipped: 8

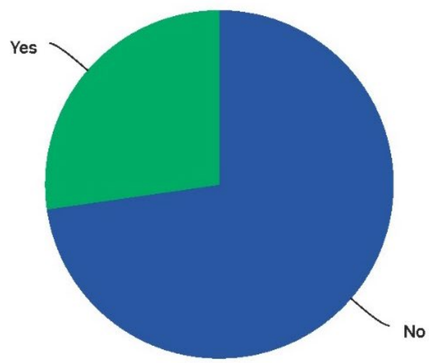


ANSWER CHOICES	RESPONSES	
Less than 6 hours	4.55%	1
6 to 12 hours	4.55%	1
12 to 24 hours	4.55%	1
More than 24 hours	86.36%	19
TOTAL		22

2024 Standard State Mitigation Plan Update SurveyMonkey

Q121 Has Climate Change impacted your program or ability to serve your function?

Answered: 22 Skipped: 8



ANSWER CHOICES	RESPONSES	
No	72.73%	16
Yes	27.27%	6
TOTAL		22

A.4 Meeting Attendees and Materials

A.4.1 Government Stakeholder Meetings


Figure A.4-1. Photo of Tinian stakeholder meeting participants.

As part of the planning process, individual government agency stakeholders met with the planning team between January and February 2024 to review the Facilities Asset Matrix, risk assessments, and risk priorities identified in the 2018 SSMP update (Figure A.4-1). Table A.4-1 is a list of government agencies who were consulted during the planning process. Figure A.4-2 is a summary of agency meeting dates, times, and locations. Government agency meeting sign in sheets are found in Figure A.4-3 through Figure A.4-13. Agency SMEs provided important data and expertise on known hazards and agency mitigation priorities.

Table A.4-1. Government agency stakeholders involved in the planning process.

Agency	Sector/Area of Expertise
Office of the Mayor Northern Islands	Emergency Management
Office of the Mayor of Rota	Emergency Management
Office of the Mayor Saipan	Emergency Management
Office of the Mayor Tinian & Aguiguan	Emergency Management
Bureau of Environmental & Coastal Quality	Land Use and Development
Coastal Resource Management	Natural Resources; Coastal Hazards; Climate Change
Commonwealth Healthcare Corporation	Health and Social Service
Commonwealth Ports Authority	Infrastructure
Commonwealth Utilities Corporation	Infrastructure
Department of Public Lands	Land Use and Development
Department of Community & Cultural Affairs	Health and Social Service; Housing
Historic Preservation Office	Cultural Resources
Division of Disabilities	Health and Social Services
Dept. of Fire & Emergency Medical Services	Emergency Management
Dept. of Land & Natural Resources	Natural and Cultural Resources
Division of Fish & Wildlife	Natural Resources
Department of Public Safety	Infrastructure
Department of Public Works	Infrastructure; Floodplain Administration & Land Use
Homeland Security & Emergency Management	Emergency Management
Marianas Alliance of Non-Governmental Organizations	Social Services
Marianas Visitors Authority	Economic Development
Northern Marianas College	Economic Development
Northern Marianas Housing Corporation	Housing
Office of Planning and Development	Land Use and Development
Public School System	Health and Social Services; Emergency Management
Pacific Coastal Research and Planning	Natural Resources; Climate Change
Pacific Rist Management ‘Ohana (PRiMO)	Risk management
Planning and Development Advisory Council	Economic Development

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS | OFFICE OF THE GOVERNOR

HAZARD MITIGATION GRANT PROGRAM

JUAN A. SABLAN BUILDING | CALLER BOX 10007 | SAIPAN, MP 96950 | 670.664.2410 | INFO@HM.GOV.MP

Nimbus Environmental Services
Scheduled Meetings with Government Agencies

Monday, January 29, 2024:

HMGP, Edwin Tmarsel, Naomi Tagabuel and Joey Dela Cruz; ***confirmed***
Time: 9:00 AM
Location: Governor's Conference Room, Capitol Hill
Google map link: https://maps.app.goo.gl/n5QS6qBfc8kUHwuWA

Tuesday, January, 30, 2024:

Commonwealth Utilities Corporation (CUC)
Name: Betty G. Terlaje, Acting Director (off-island); Kevin Watson and team ***confirmed***
POC: Betty Diaz, (670) 664-4282, ext., 353
Time: 10:00 AM
Location: CUC Conference Room, Joeten Dandan Building
Google map link: https://maps.app.goo.gl/SDfMYiyG6yD4sA3b6

Department of Public Works (DPW)
Name: Peter Camacho, Acting Secretary (Ray N. Yumul, Secretary will be off-island); ***confirmed***
POCC: Reeda Tarope or Winnie Taitano, (670) 235-9570
Time: 1:00 PM
Location: DPW Technical Services Division Conference room, Oleai, FHB Building
Google map link: https://maps.app.goo.gl/2x67A1SJtZhR9WoU6

Wednesday, January, 31, 2024:

CNMI Public School System; ***confirmed***
Name: Dr. Lawrence F. Camacho, Commissioner of Education
POC: Kimberly M. Camacho, (670) 237-3061 or (670) 789-8576
Time: 9:00 AM
Location: COE Office, Building #1211, Capitol Hill
Google map link: https://maps.app.goo.gl/rxJ1JqVUg9WTMav57

CNMI Department of Public Safety (DPS); ; ***confirmed***
Name: Acting Commissioner Anthony Macaranas
POC: Gerrilyn Dela Cruz, Chief Joaquin Camacho (670) 664-9000
Time: 1:00 PM
Location: DPS Office, Susupe
Google map link: https://maps.app.goo.gl/JJwekWCw5N4AkGam6

Nimbus – Scheduled Meetings with Government Agencies
Page 2 of 2

Thursday, February 1, 2024
Department of Fire and Emergency Medical Services; ***confirmed***
Name: Commissioner Juan A. Pua
POC(s): Jayendran Jairam, Steve Mesngon, and Manny Cabrea, (670) 664-9136
Time: 10:00 AM
Location: DFEMS Office, Building #1342, Capitol Hill
Google map link: https://maps.app.goo.gl/4HNqMRdmXrAi2Lq4A

Commonwealth Ports Authority (CPA); ***confirmed***
Name: Leo B. Tudela, Executive Director, Wendi Prater, Acting Executive Director
POC: Jadene Villagomez, (670) 237-6508
Time: 1:00 PM
Location: CPA Conference Room, Saipan International Airport
Google map link: https://maps.app.goo.gl/Wt4av3FNoXRf28gf8

CNMI Council on Developmental Disabilities; ***confirmed***
Name: Pamela C. Sablan, Executive Director
POC: Ruth Pangelinan, (670) 664-7000
Time: 3:30 PM
Location: CDD Office, Building #1310, Capitol Hill
Google map link: https://maps.app.goo.gl/Aq8SfiizPxkSXWEx8

Friday, February 2, 2024

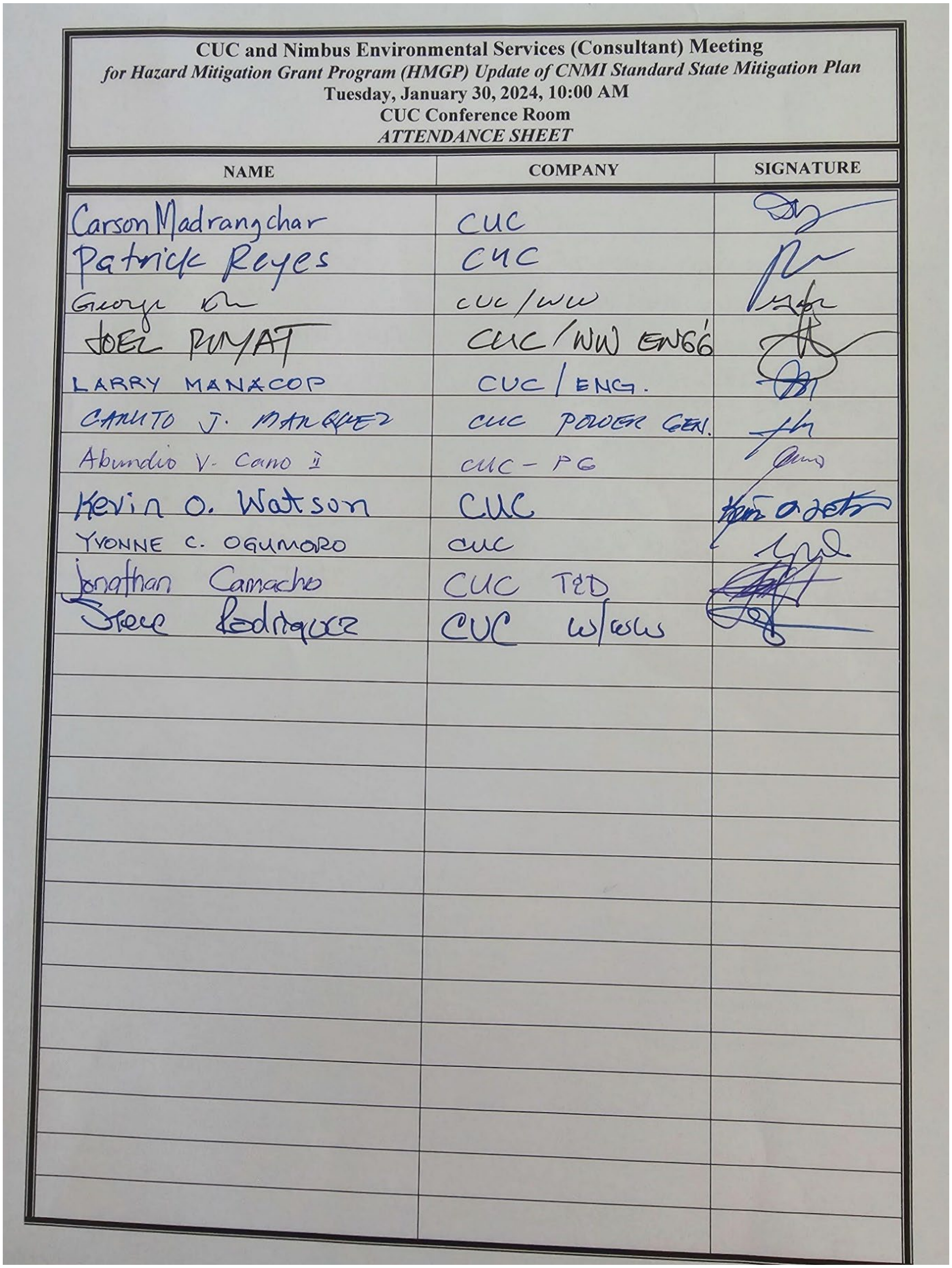
Commonwealth Healthcare Corporation (CHCC); ***confirmed***
Name: Dr. Esther L. Muna, CEO
POC: Janet Guerrero, (670) 234-8950 or (670) 236-8201
Time: 1:00 PM
Location: CHCC, Conference Room #3
Google map link: https://maps.app.goo.gl/mKCLa8Xc9qT4BWJJ6

Department of Community & Cultural Affairs; ***confirmed***
Name: Mr. Frank Rabauliman, Secretary, and Ms. Vivian Sablan, Ramona Camacho, Martha Ytheg
POC: Ramona Camacho (670) 664-2587 or (670) 664-2588
Time: 9:00 AM
Location: DCCA, Building #1231, Capitol Hill
Google map link: https://maps.app.goo.gl/S1sXkbqw493otJFN6

Tuesday, February 13, 2024

Nimbus with the Department of Lands and Natural Resources; ***confirmed***
Name: Sylvan O. Igisomar, Secretary
POC: JoAnn T. Sablan, (670) 322-9834
Time: 9:00 AM
Location: Division of Fish and Wildlife (DFW) Conference Room, Lower Base
Google map link: https://maps.app.goo.gl/aEs76Uz56a2Mdt8s7

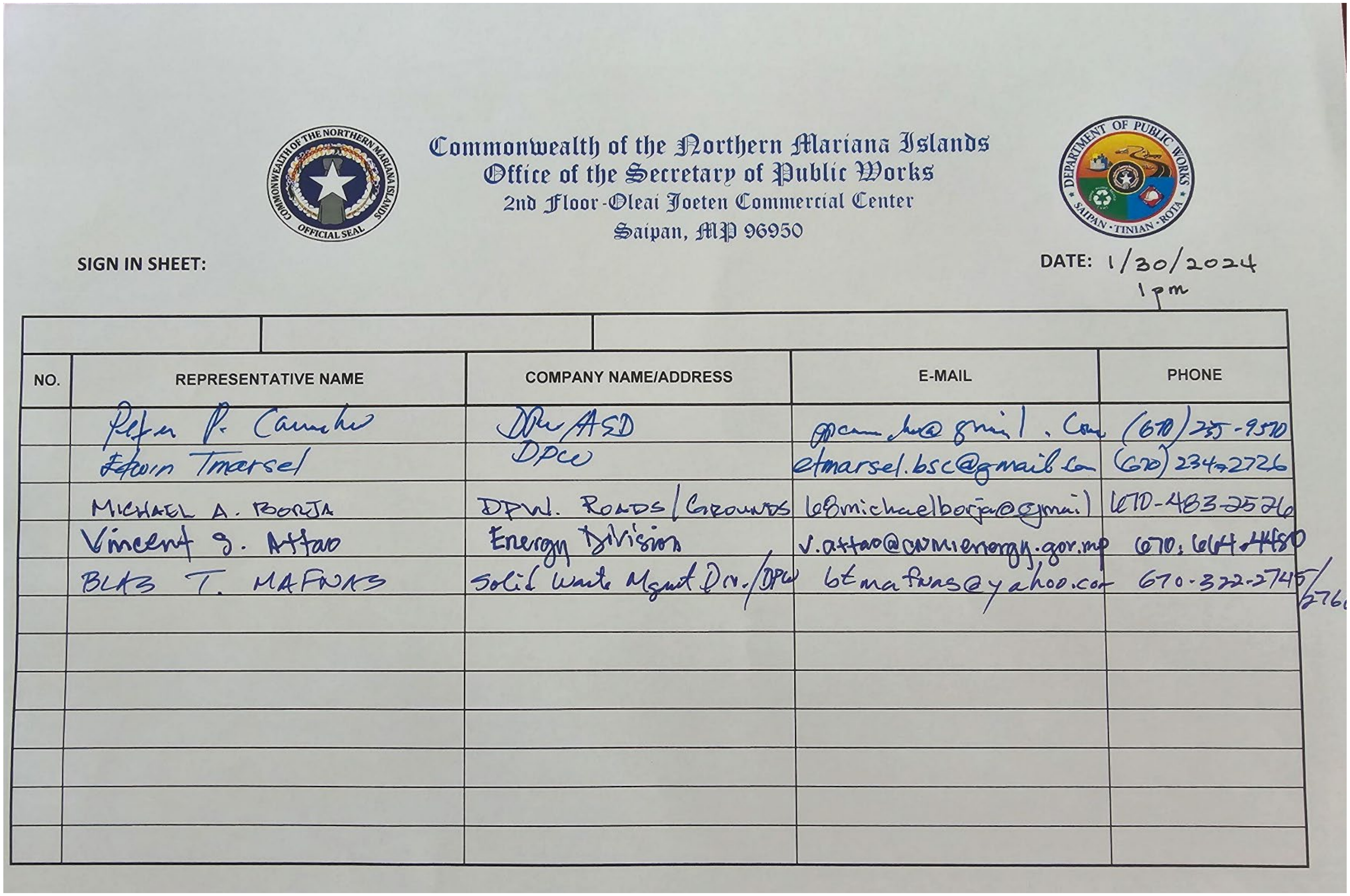
Figure A.4-2. Individual government agency stakeholder meetings.



CUC and Nimbus Environmental Services (Consultant) Meeting
for Hazard Mitigation Grant Program (HMGP) Update of CNMI Standard State Mitigation Plan
Tuesday, January 30, 2024, 10:00 AM
CUC Conference Room
ATTENDANCE SHEET

NAME	COMPANY	SIGNATURE
Carson Madrangchar	CUC	
Patrick Reyes	CUC	
George [illegible]	CUC/WW	
JOEL RUYAT	CUC/WW ENGG	
LARRY MANACOP	CUC/ENG.	
CARLITO J. MARQUEZ	CUC POWER GEN.	
Abundio V. Cano II	CUC-PG	
Kevin O. Watson	CUC	
YVONNE C. OGUMORO	CUC	
Jonathan Camacho	CUC T&D	
Steve Rodriquez	CUC W/WW	

Figure A.4-3. Commonwealth Utilities Corporation meeting sign in sheet.



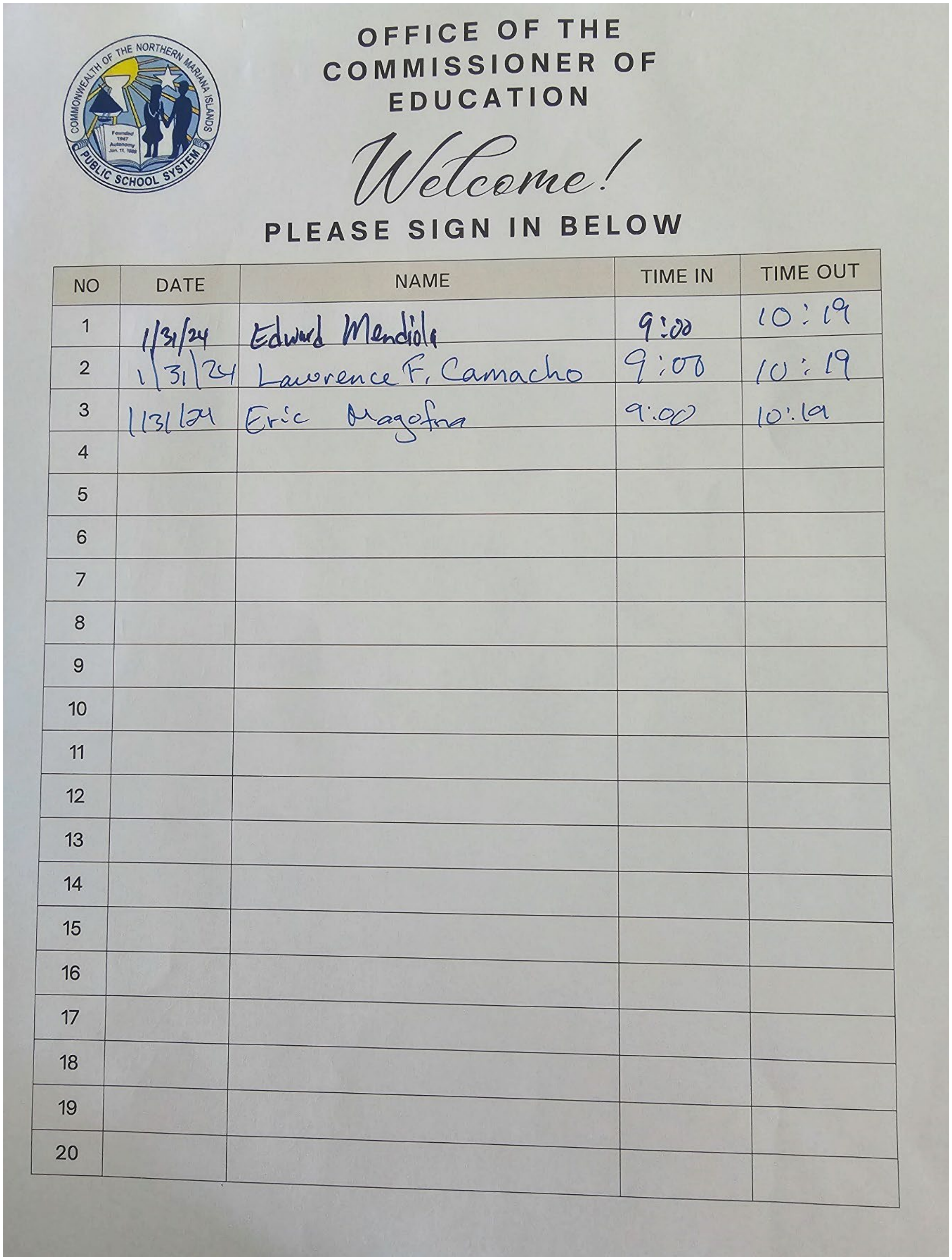
Commonwealth of the Northern Mariana Islands
Office of the Secretary of Public Works
2nd Floor-Oleai Joeten Commercial Center
Saipan, MP 96950

SIGN IN SHEET:

DATE: 1/30/2024
1pm

NO.	REPRESENTATIVE NAME	COMPANY NAME/ADDRESS	E-MAIL	PHONE
	Peter P. Camacho	DPW ASD	pcamacho@gmail.com	(670) 235-9570
	Edwin Tmarsel	DPCO	etmarsel.bsc@gmail.com	(670) 234-2726
	MICHAEL A. BORJA	DPW. ROADS/GROUNDS	68michaelborja@gmail	670-483-2526
	Vincent G. Attao	Energy Division	v.attao@cnmienergy.gov.mp	670.664.4480
	BLAS T. MAFNAS	Solid Waste Mgmt Div./DPW	btmafnas@yahoo.com	670-322-2745/276[illegible]

Figure A.4-4. Department of Public Works meeting sign in sheet.



OFFICE OF THE COMMISSIONER OF EDUCATION

Welcome!

PLEASE SIGN IN BELOW

NO	DATE	NAME	TIME IN	TIME OUT
1	1/31/24	Edward Mendiola	9:00	10:19
2	1/31/24	Lawrence F. Camacho	9:00	10:19
3	1/31/24	Eric Magofna	9:00	10:19
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Figure A.4-5. Public School System meeting sign in sheet.

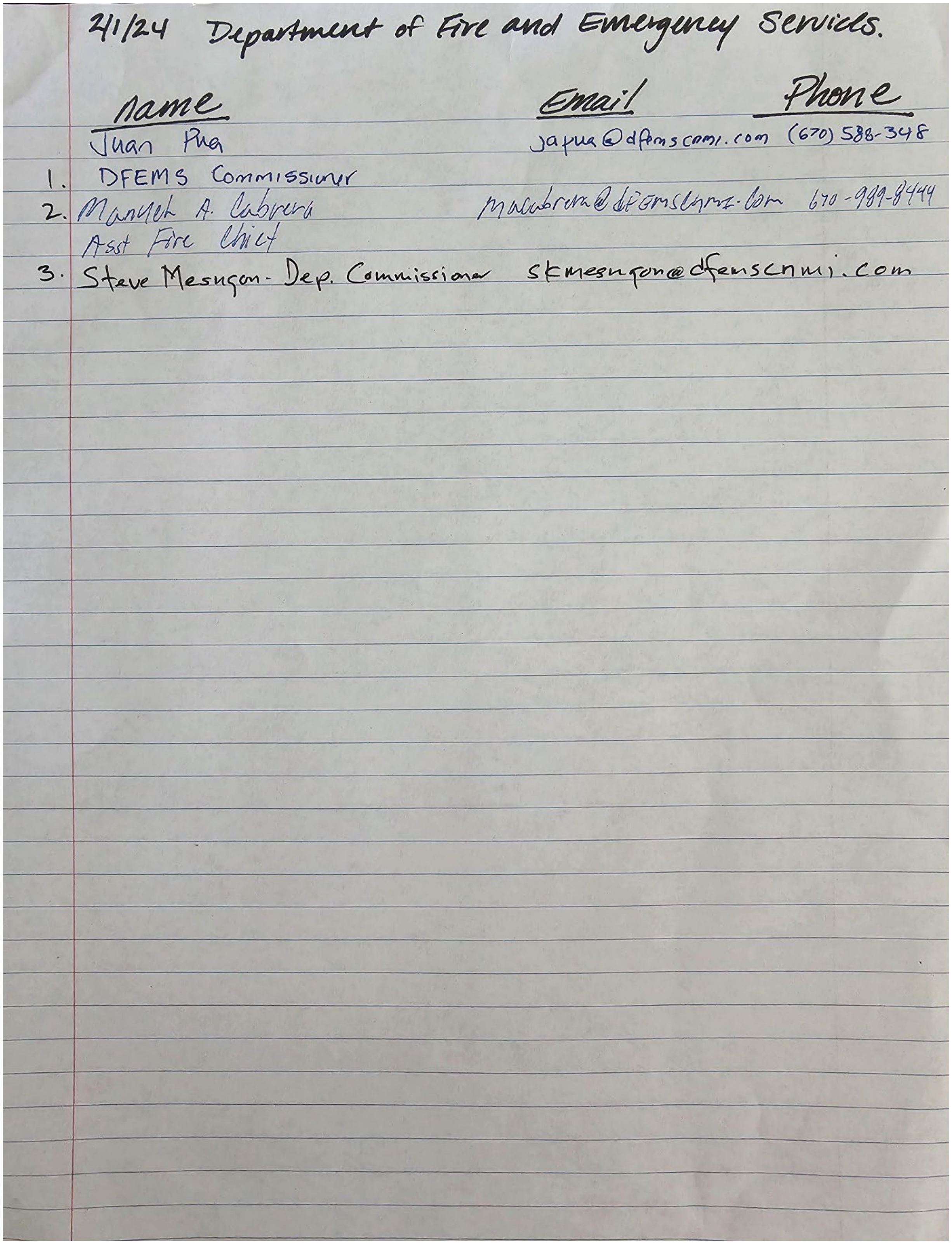
1/31/2024
1pm

Dept. of Public Safety

GERRILYN DELA CRUZ
FEDERAL PROGRAM COORDINATOR
gerrilyn.delaCruz@dps.gov.mp
670-286-0861

JOAQUIN CAMACHO
ASSISTANT CHIEF
jcamacho@dps.gov.mp
670-287-3893

Figure A.4-6. Department of Public Safety meeting sign in sheet.



2/1/24 Department of Fire and Emergency Services.

	Name	Email	Phone
1.	Juan Pua DFEMS Commissioner	japua@dfemscnmi.com	(670) 588-348
2.	Manuel A. Cabrera Asst Fire Chief	macabrera@dfemscnmi.com	670-989-8444
3.	Steve Mesngon - Dep. Commissioner	skmesngon@dfemscnmi.com	

Figure A.4-7. Department of Fire and Emergency Services meeting sign in sheet.

COMMONWEALTH PORTS AUTHORITY

Nimbus Environmental Services Meeting
2024 CNMI Standard Mitigation Plan

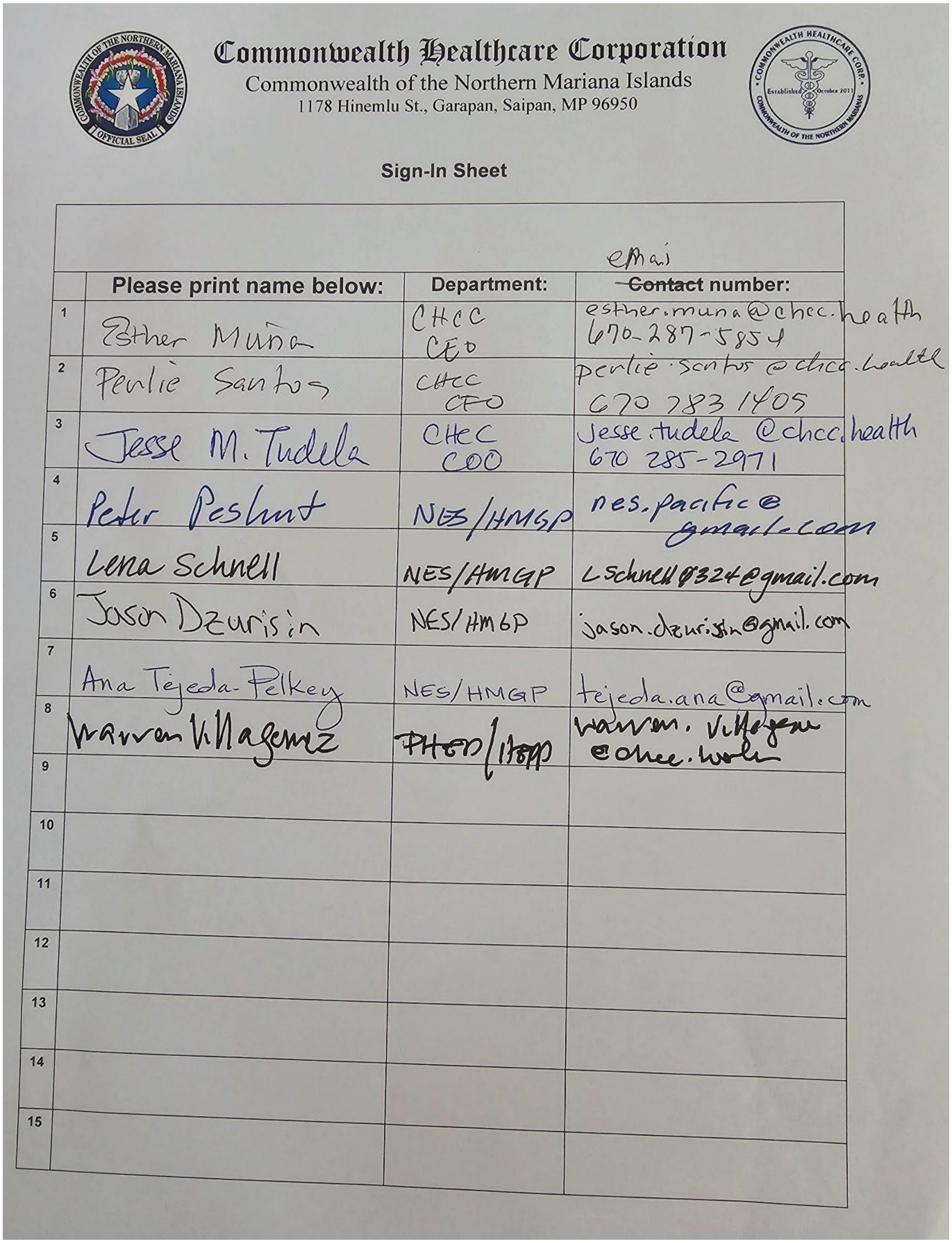
1:00 p.m., February 1, 2024 – CPA Airport Conference Room

ATTENDANCE SHEET

No.	NAME	COMPANY	CONTACT INFORMATION	
			TELEPHONE	EMAIL
1	Billy Joe Songao	CPA	237-6535	bjsongao@cnmiports.com
2	Joy DLG. Tenorio	CPA	237-6587	joy.tenorio@cnmiports.com
3	Ana Tejeda-Pelkey	Nimbus Envir. Svc.	213.631.5911	tejeda.ana@gmail.com
4	Lena Schnell	Nimbus Env. Services	(808) 315-0300	lschnell0324@gmail.com
5	Jason Dzurisin	Nimbus Env. Services	(574) 709-6345	jason.dzurisin@gmail.com
6	Peter Peshut	NES	~~(670)~~ (808) 961-6029	nes.pacific@gmail.com
7	Tanner Kenty	CPA	237-6500	tanner.kenty@cnmiports.com
8	Wendi Prater	CPA	237 6519	wprater@cnmiports.com
9	Dennis Cruz	CPA	483-4516	maintenance@cnmiports.com
10	Jerra Cing	CPA Saipan Seaport	664-3550	jerra.cing@cnmiports.com
11	Antonio Borja	CPA Tinian	433-9294	alborja@cnmiports.com
12	Albert Taitano	CPA Rota	532 9497	albert.taitano@cnmiports.com
13				

Figure A.4-8. Commonwealth Ports Authority meeting sign in sheet.

Figure A.4-9. Council on Developmental Disabilities meeting attendees.



Commonwealth Healthcare Corporation
Commonwealth of the Northern Mariana Islands
1178 Hinemlu St., Garapan, Saipan, MP 96950

Sign-In Sheet

	Please print name below:	Department:	~~Contact~~ eMail number:
1	Esther Muña	CHCC CEO	esther.muna@chcc.health 670-287-5854
2	Perlie Santos	CHCC CFO	perlie.santos@chcc.health 670 783 1405
3	Jesse M. Tudela	CHCC COO	jesse.tudela@chcc.health 670 285-2971
4	Peter Peshut	NES/HMGP	nes.pacific@gmail.com
5	Lena Schnell	NES/HMGP	Lschnell0324@gmail.com
6	Jason Dzurisin	NES/HMGP	jason.dzurisin@gmail.com
7	Ana Tejeda-Pelkey	NES/HMGP	tejeda.ana@gmail.com
8	Warren Villagomez	PHEP/HPP	warren.villagomez@chcc.health
9			
10			
11			
12			
13			
14			
15			

Figure A.4-10. Commonwealth Healthcare Corporation meeting sign in sheet.

Commonwealth of the Northern Mariana Islands
Department of Community and Cultural Affairs
Caller Box 10007
Saipan, Mariana Islands 96950
Tel. (670) 664-2587 Fax (670) 664-2571

Date: February 2, 2024

Time: 9:00 a.m.

Meeting: HM-24-0057-Meeting (Updating the Facilities Assessment Matrix with Nimbus Environmental Services for 2024 CNMI Standard State Mitigation Plan

Venue: DCCA Office of the Secretary

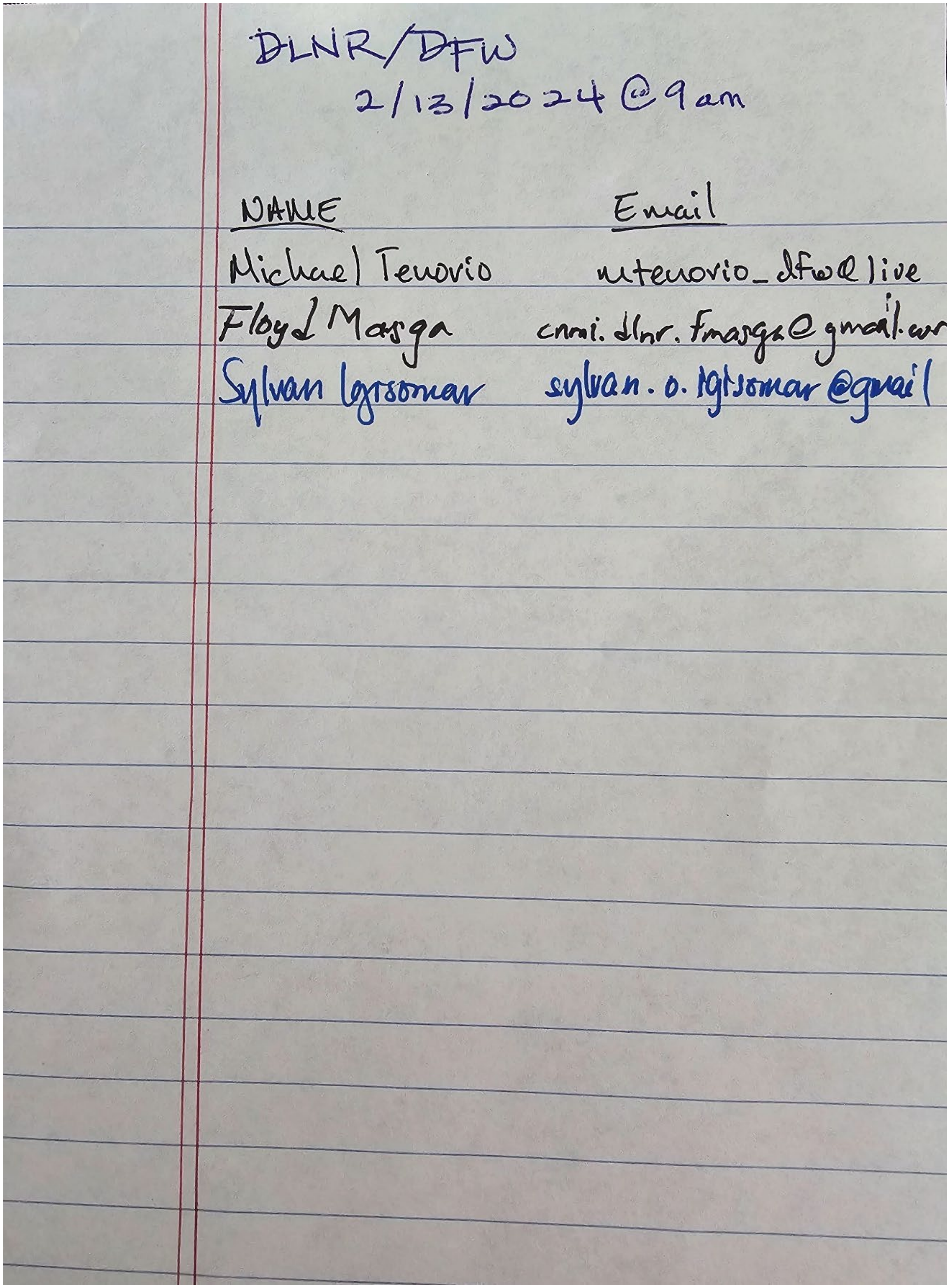
Attendees

Name	Title
Francisco M. Rabauliman	DCCA Acting Secretary
Vivian T. Sablan	DCCA DYS Administrator
Martha S. Yiftheg	DCCA HPO Historian
Ana Tejeda-Pelkey	Nimbus Environmental
Lena Shnell	Nimbus Environmental
Jason Dzurisin	Nimbus Environmental
Peter J. Peshut	Nimbus Environmental

Meeting Adjournment: 9:45 a.m.

1

Figure A.4-11. Department of Community and Cultural Affairs meeting sign in sheet.



DLNR/DFW
2/13/2024 @ 9am

NAME	Email
Michael Tenorio	mtenorio_dfw@live
Floyd Masga	cnmi.dlnr.fmasga@gmail.com
Sylvan Igisomar	sylvan.o.igisomar@gmail

Figure A.4-12. Department of Land and Natural Resources meeting sign in sheet.

Re: Meeting Attendance List - 2024 SSMP Update

Mark Rabauliman. NIMO <mrabauliman.nimo@gmail.com>
Tue 2/27/2024 4:38 PM
To:Ana Tejeda <tejeda.ana@gmail.com>

Tirow Ana
For the NIMO attendees:

1. Vicente C. Santos Jr - Program Manager
2. Paul C. Santos - Project Manager
3. Jeromy R. Topulei - Community Development Specialist
4. Valentino Taisacan Jr. - Mayor
5. Mark Rabauliman- Special Assistant

And I will be getting back into the survey next week.
Thank you

On Sat, Feb 24, 2024, 5:59 AM Ana Tejeda <tejeda.ana@gmail.com> wrote:

> Hafa Adai, Mark.
>
> I hope this email finds you well. I am writing to request a list of attendees from our meeting on February 15th at 8am. We seem to have walked away without everyone's information!
>
> Additionally, I want to follow up on the *Government Agency Stakeholder* survey. Were you able to resubmit your survey answers? I updated the survey protocols to allow for more than one submittal from the same IP address.
>
> Thank you for your time and assistance. I look forward to hearing from you.
>
> Ana Tejeda-Pelkey

Figure A.4-13. Northern Island Mayor's Office meeting attendees.

DPL 2/20/24

Patricia Rasa   Dir. Planning Div.

Velma Reyes   Admin. Officer   vreyes@dpl.gov.

Jovano Taitano   DPL Grant Writer
jovano.taitano@dpl.gov.mp

Terry. Santos(6)   Secretary, DPL   teresita.santos@dpl.gov.mp

Irene Torres   Dir. Homestead Div.   itorres@dpl.gov.

Department of Public Lands
meeting w/ Nimbus Env. Services
for 2024 SSMP update
2/20/24

NES: Lena Schnell

Figure A.4-14. Department of Public Lands meeting attendees.

A.4.2 Agency and Community Stakeholder Meetings

Agency and community stakeholders were invited to six public hybrid meetings in February 2024. The 2024 SHMP meeting presentations for Tinian, Rota, and Saipan are included in chronological order in Section A.4.2 through Section A.4.4. Audio and visual recordings of the public meetings are available upon request. Select photographs from the public meetings are also included. Public hybrid meeting sign-in sheets and list of virtual attendees are available in Figure A.4-15 through Figure A.4-20.

During the 2024 SHMP planning process update, SMEs were publicly engaged during the 2024 Pacific Risk Management ‘Ohana (PRiMO) Resilience in Action Conference. The conference proceedings can be found at PRiMO Conference - Pacific Risk Management 'Ohana (noaa.gov) and the presentation is available in Section A.4.5. The PDAC presentation is available in Section A.4.6. The stakeholder mitigation action plan prioritization presentation is available in Section A.4.7.

A.4.3 Tinian Stakeholder Presentation

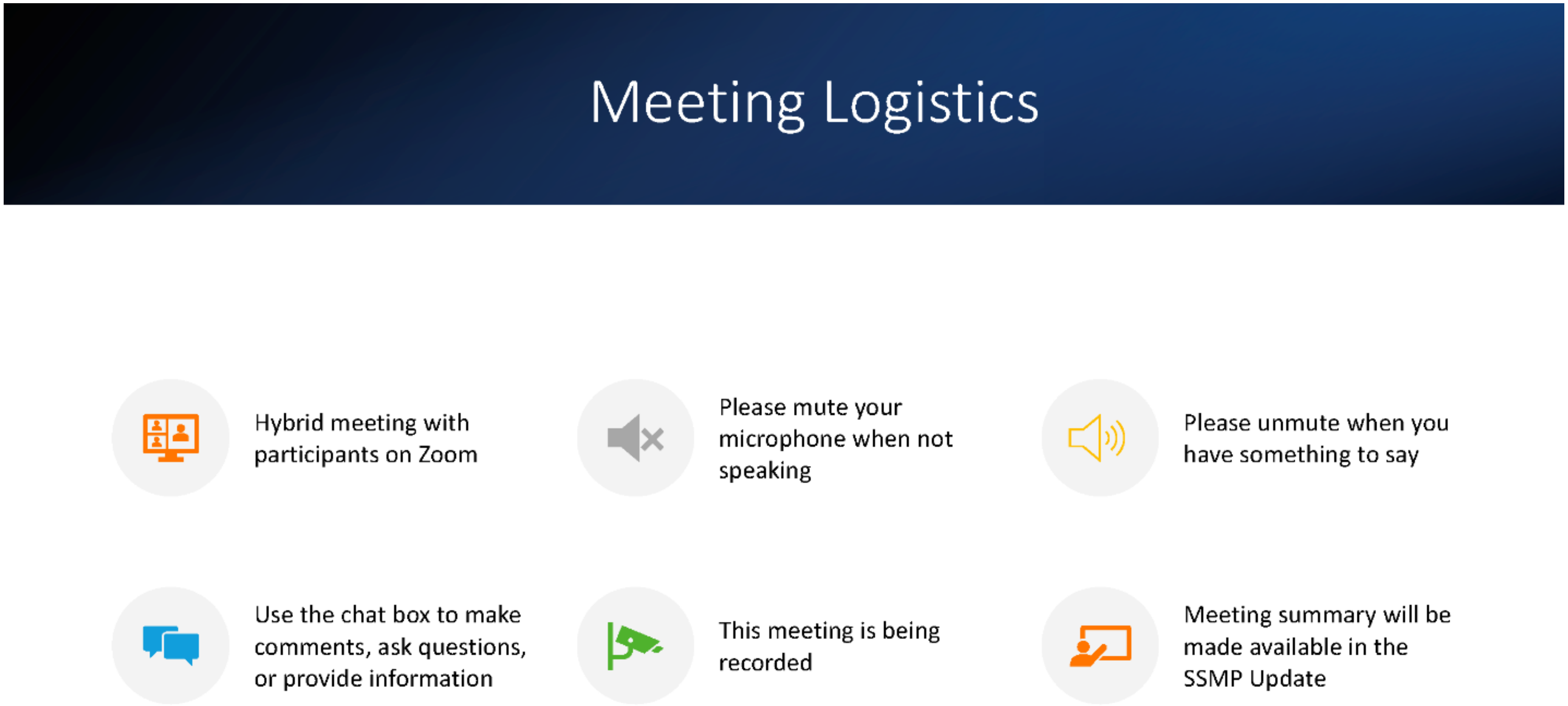
Standard State Mitigation Plan Update 2024

Hazard Mitigation Grant Program
Office of the Governor

Stakeholders Meeting
Tinian
February 6, 2024

Agenda

- Introductions
- What is the Standard State Hazard Mitigation Plan?
- 2018 Standard State Hazard Mitigation Plan Update
- Hazard Mitigation Planning Process & Requirements
- Agency & Community Stakeholders Survey
- FEMA Risk Map
- Questions


Meeting Logistics
Hybrid meeting with participants on Zoom
Please mute your microphone when not speaking
Please unmute when you have something to say
Use the chat box to make comments, ask questions, or provide information
This meeting is being recorded
Meeting summary will be made available in the SSMP Update

Introductions

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS | OFFICE OF THE GOVERNOR

HAZARD MITIGATION GRANT PROGRAM

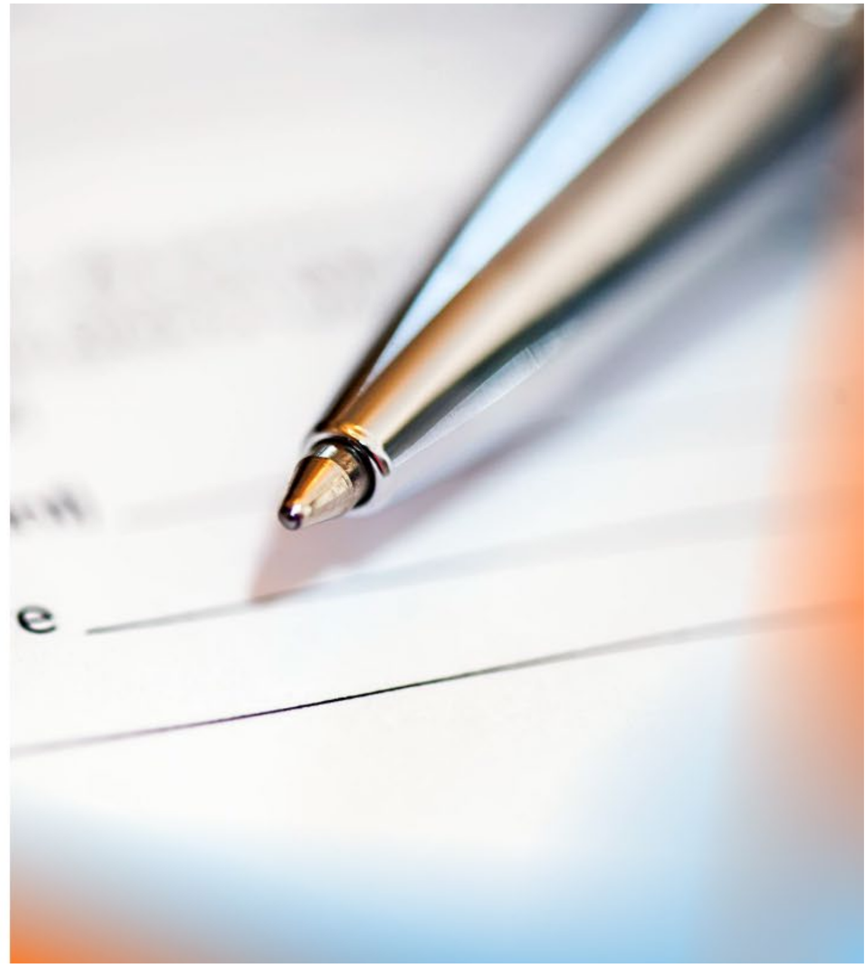
JUAN A. SABLAN BUILDING | CALLER BOX 10007 | SAIPAN, MP 96950 | 670.664.2410 | INFO@HM.GOV.MP

Nimbus Environmental Services

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

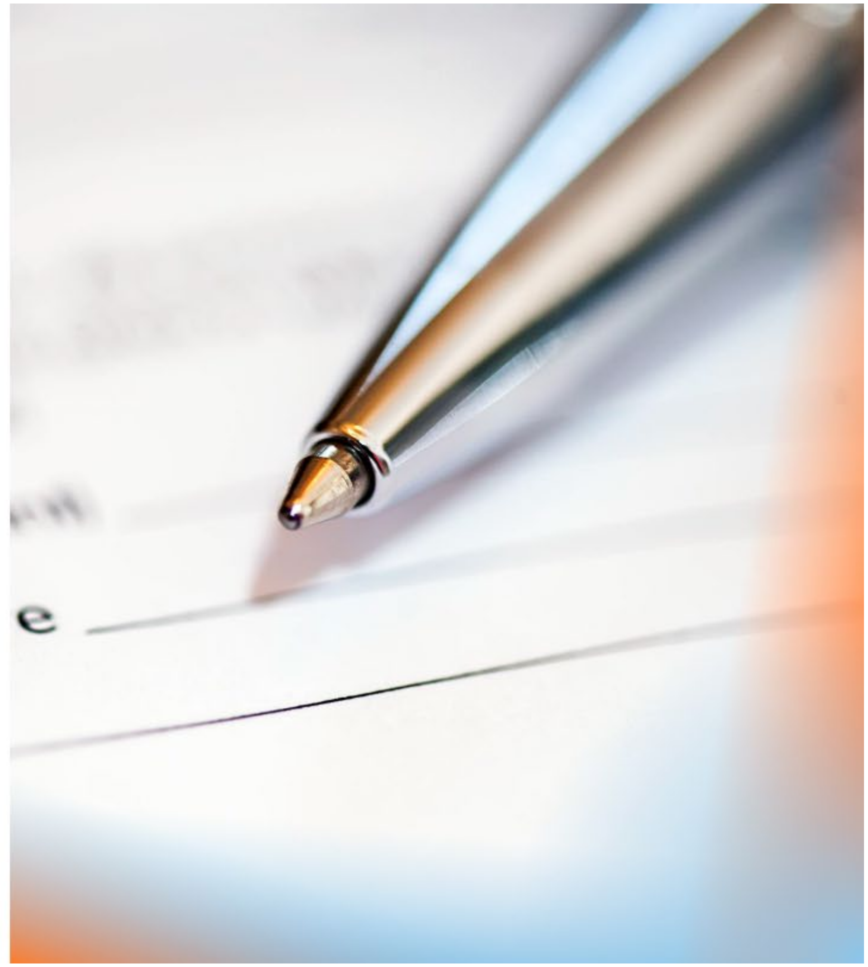
Open until March 31, 2024



General Community Stakeholders Survey

https://acesse.one/SSMPpublic

Open until March 31, 2024



Overview of Standard State Hazard Mitigation Plan

What is the purpose of the Standard State Hazard Mitigation Plan?

- Provides a range of natural hazards likely to occur in CNMI
- Assesses risks and vulnerabilities to the community
- Develops strategies to mitigate those risks and vulnerabilities
- Proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters

Hazard Mitigation Planning

- Collaborative process between the Hazard Mitigation Grant Program, under the Office of the Governor, Government Agencies and Community Stakeholders
- Encourages participants to take part in the hazard mitigation process by sharing information
- Raise awareness of the range of hazards and their affects on the community
- Opportunity to integrate hazard mitigation planning with other community plans
- Strengthen community resilience to natural hazards through preparedness, response, and recovery through good planning

Hazard Mitigation Planning

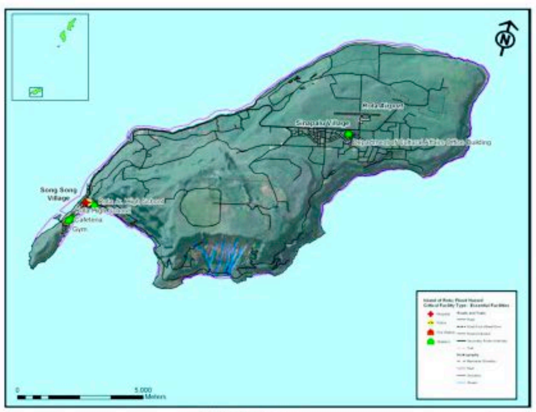
Commonwealth of the
Northern Mariana Islands

Standard State Mitigation Plan
August 2018

2018 Standard State Mitigation Plan Update is available on the Office of Planning and Development website at:

https://encr.pw/ssmp2018

Standard Site Mitigation Plan Map Updates



Title: Rota Flood Hazards
Project: 2010 SSMP
Figure: N-14

Title: Saipan Flood Hazards
Project: 2010 SSMP
Figure: N-1

Title: Tinian Flood Hazards
Project: 2010 SSMP
Figure: N-8

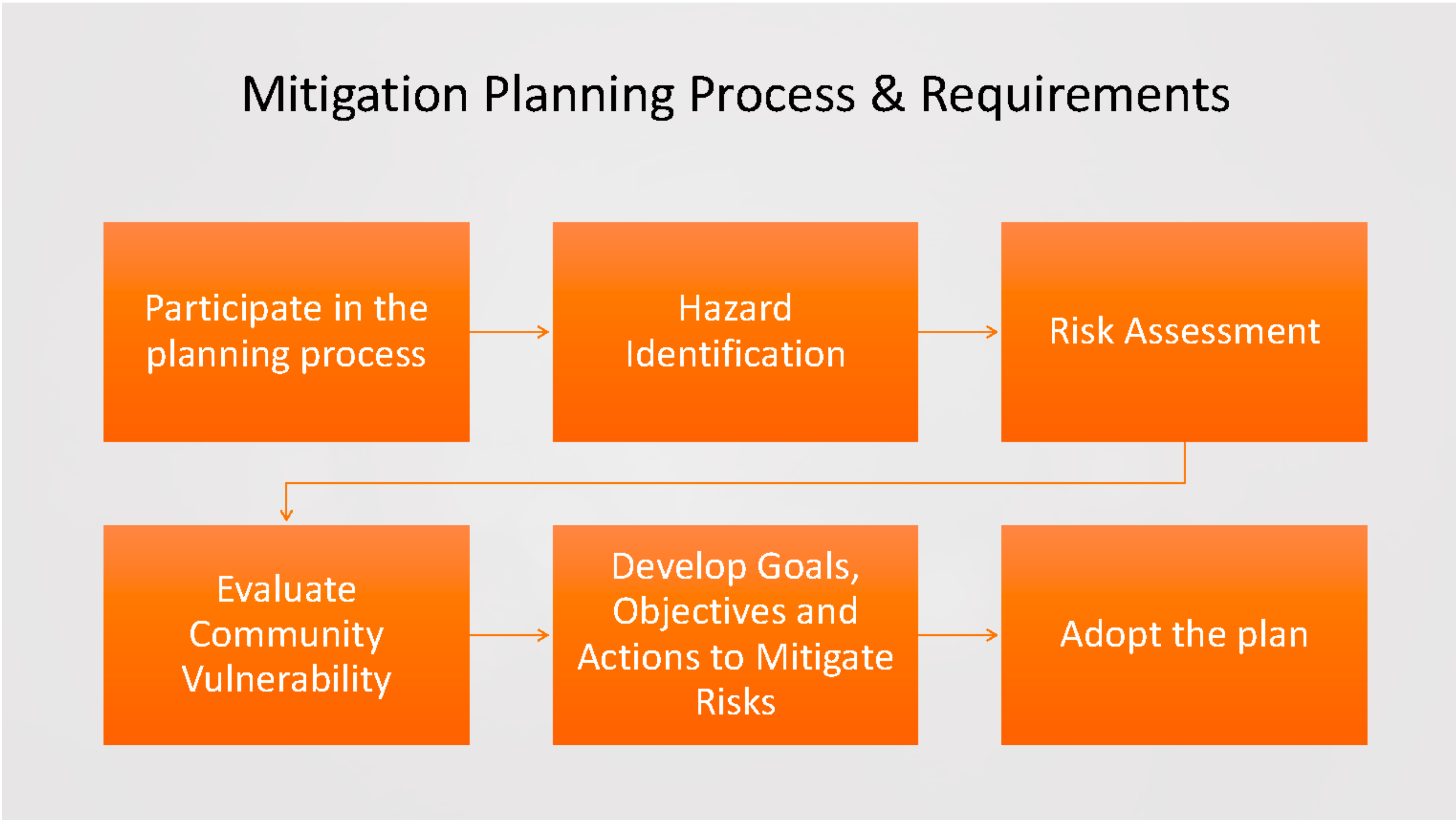
Hazard Mitigation Planning

Approved Standard State Mitigation Plan creates eligibility for FEMA's Hazard Mitigation Assistance grant programs

- Pre-Disaster Mitigation
- Flood Mitigation Assistance (National Flood Insurance Program)
- Hazard Grant Mitigation Program

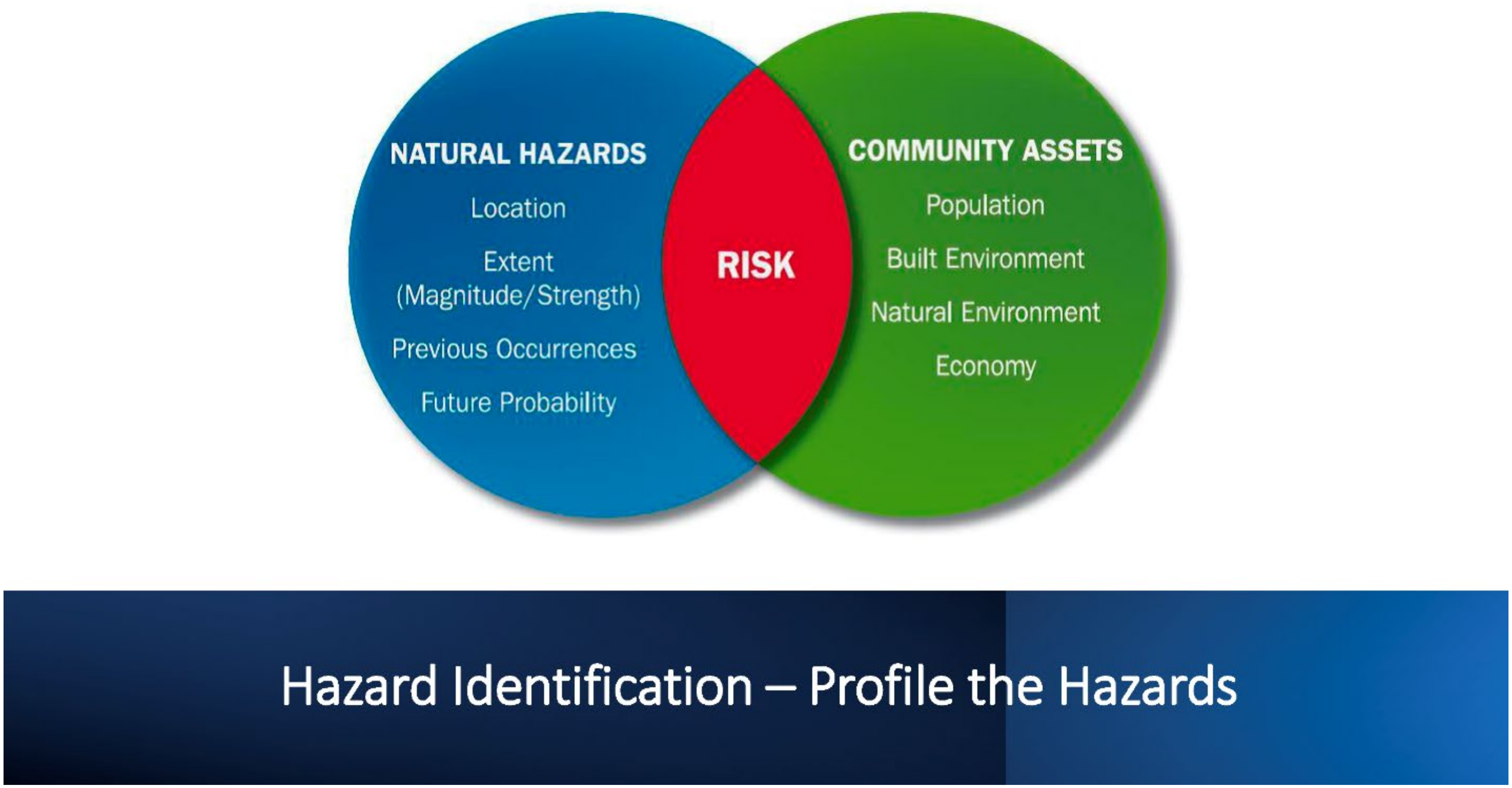

Mitigation Planning Process &
Requirements


How does the Hazard Mitigation Plan Work?
Adopt and Implement the Plan
Organize the Planning Process and Resources
Assess Risks
Develop a Mitigation Strategy


Mitigation Planning Process & Requirements
Participate in the planning process
Hazard Identification
Risk Assessment
Evaluate Community Vulnerability
Develop Goals, Objectives and Actions to Mitigate Risks
Adopt the plan

Hazard Mitigation Projects

Project	Municipality	Agency	Award
Water System Mitigation Project – Phase I	Saipan	Commonwealth Utilities Corp.	$4,596,513
Kannat Talba Flood Control & Drainage System	Saipan	Dept. of Public Works	$2,123,650
Storm Readiness Project	Saipan	Northern Marianas Housing Corp.	$132,595
Susupe Office Building Shutters	Tinian	Dept. of Public Safety	$37,223
Tinian Aging Center Storm Shutters	Tinian	Dept. of Community & Cultural Affairs	$33,270
Fire Station 1 & 5 Concrete Roof – Phase I	Saipan	Dept. of Fire & Emergency Medical Services	$212,500
Concrete Power Poles – Phase I	Rota	Commonwealth Utilities Corp.	$166,800


NATURAL HAZARDS
Location
Extent (Magnitude/Strength)
Previous Occurrences
Future Probability
RISK
COMMUNITY ASSETS
Population
Built Environment
Natural Environment
Economy
Hazard Identification – Profile the Hazards

Hazard Identification and Risk Assessment

HAZARD IDENTIFICATION - WHAT CAN HAPPEN HERE?

VULNERABILITY ASSESSMENT - WHAT WILL BE AFFECTED?

A lifeline enables the continuous operations of <u>critical governmental and business functions</u> and is <u>essential to human health and safety and economic security</u>.

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

Community Stakeholders Survey

https://acesse.one/SSMPpublic

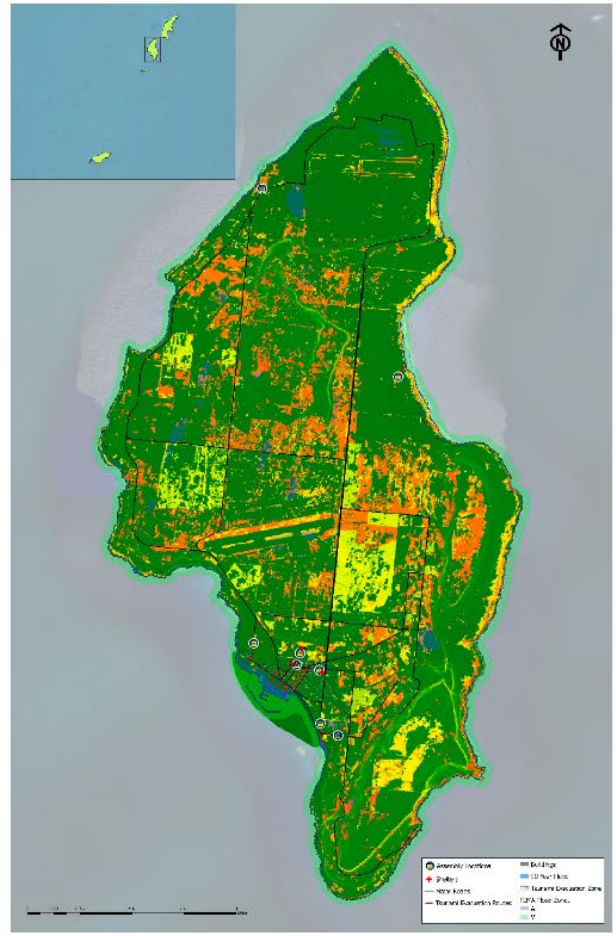
Climate Change

Natural hazard events will intensify the frequency, duration, and severity of future events.

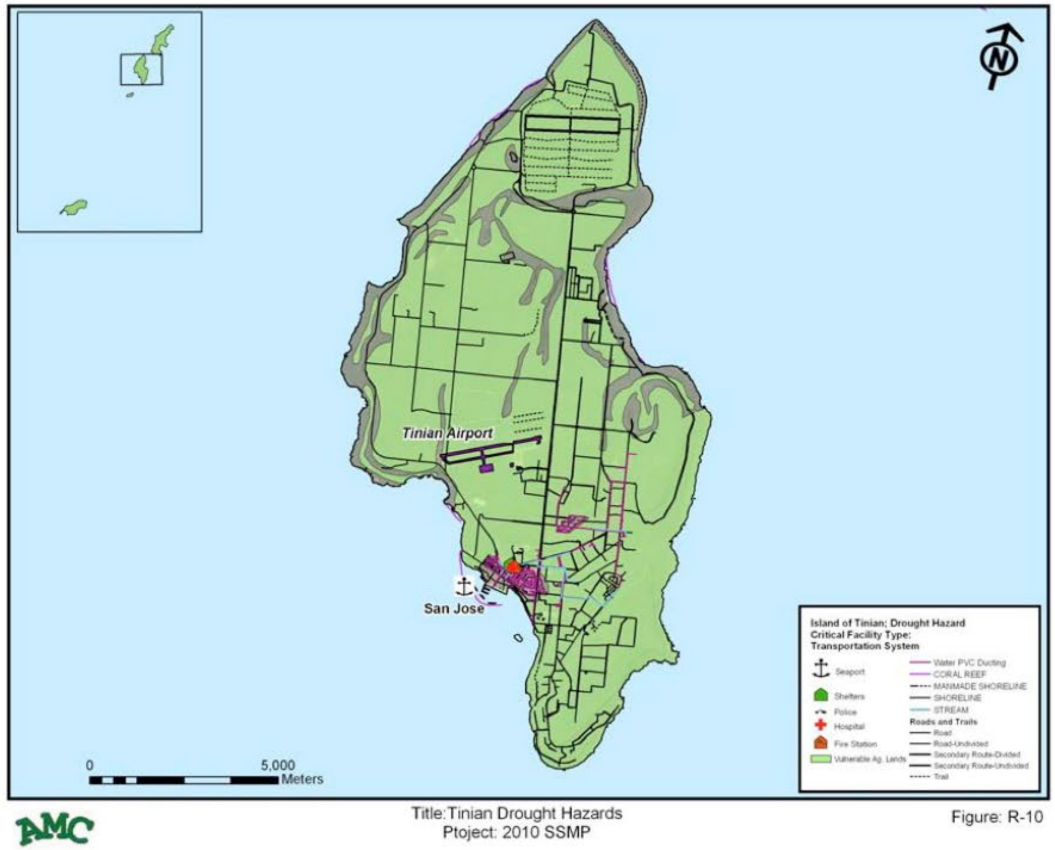
(Keener et al. 2018)

Typhoon, Tropical Storms, Tsunami & Coastal Flooding Hazards for Tinian

Wildfire Hazard for Tinian



Drought Hazard for Tinian



FEMA Risk Map

Table 3. Community Mitigation Needs

ISLAND	HAZARD	MITIGATION NEED
1. ALL ISLANDS	MULTI-HAZARDS	Train workforce for enforcement of 2018 International Building Code
2. ALL ISLANDS	MULTI-HAZARDS	Gain access to technical assistance or training on FEMA programs, including Environmental and Historic Preservation and the NFIP.
3. ALL ISLANDS	MULTI-HAZARDS	Improve resources for disaster-resilient building, like an update to the Homeowner's Guide or expanding on the CNMI Bureau of Environmental and Coastal Quality - Division of Coastal Resources Management's Better Building guidebook on stormwater and typhoon risks.
4. ALL ISLANDS	MULTI-HAZARDS	Engage with multiple agencies and local governments to identify mitigation strategies and update the Standard State Hazard Mitigation Plan.
5. ALL ISLANDS	FLOOD	Increase flood insurance options and policies.
6. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling for all islands to understand risks to flooding and to develop new Flood Insurance Rate Maps for Saipan, Tinian and Rota.
7. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling that includes hazards presented by wave run-up and sea level rise to be used in planning, development and identifying flood mitigation actions.
8. ROTA	MULTI-HAZARDS	Identify mitigation strategies to be included in the Standard State Mitigation Plan.
9. SAIPAN	MULTI- HAZARDS	Improve living conditions and safe housing for vulnerable residents and residents still recovering from or displaced by Hurricane Yutu.
10. SAIPAN	COASTAL EROSION	Mitigate or adapt to erosion of Micro Beach. Coordinate across agencies to look at existing engineering studies or proposed nature-based solutions and determine next steps.
11. SAIPAN	FLOOD	Secure Lower Base Power Plant and access road from flooding.
12. SAIPAN	FLOOD	Ensure continued functionality of and access to Commonwealth Health Ceter during flood.
13. SAIPAN	FLOOD	Improve drainage of Garapan District.
14. SAIPAN	FLOOD	Protect/stabilize Beach Road from coastal flooding and sea level rise.
15. SAIPAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce flooding from runoff. Stormwater improvements for Garapan and Tinian industrial area.
16. SAIPAN	FLOOD, SEA LEVEL RISE	Protect coral reefs and protective functions, given consideration to expected sea level rise.
17. SAIPAN	TYPHOON	Remediate debris, derelict, or abandoned buildings that could act as projectiles and exacerbate damages from strong winds.
18. TINIAN	MULTI-HAZARDS	Identify mitigation strategies to be included in the SSMP.
19. TINIAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce fooding from runoff.

FEMA Risk Mapping, Assessment, and Planning Program (MAP) (2021)

Questions

HAZARD MITIGATION PLANNING; GOVERNMENT AGENCY STAKEHOLDERS MEETING

PROJECT:	2024 Standard State Mitigation Plan Update (SSMP 2024)	**MEETING DATE:**	February 6, 2024 1:30-3:30 pm
FACILITATOR:	HMGP/Nimbus Environmental Services	**LOCATION:**	Northern Marianas College Tinian Campus, Room D

FIRST NAME	LAST NAME	EMAIL
Emerito	Lumba	emerito.lumbacnmipss.org
REMEDIO	PANGELINAN	rlpangelinan@omb.gov.mp
Marian May	Guerrero	marianmguerrero@omb.gov.mp
Peter	Palacios Jr	peter.palaciosjr@gmail.com
Juan	Santos Jr.	JESANTOS_TINIAN@gmail.com
* KeShaun Nabors		nabors99@gmail.com
Maria Agu	Aguon	maria.aguon@marianas.edu
Estevan	Cabrera	cabreraep72@gmail.com
Jose	Villagomez	josevillagomez1670@gmail.com
Carl	Espinosa	cgeespinosa@gmail.com
Kaia	Lazaro	kaialazaro02@gmail.com
Dolores	Cabrera	doris.cabrera@cucgov.org
DavidM Evangelista	Evangelista	670-433-0182
Jennilyn	Cruz	jcruz@nmpasi.org
Gilbert Borja	Borja	Tinian HPO @ gmail.com
Esteven S. King	King	tiacommerce.abtcnmi@gmail
Atalig	Jose	2MOT.externalaffairs@gmail.com

Figure A.4-15. Tinian government agency stakeholder meeting sign-in sheet.

A.4.4 Rota Stakeholder Presentation

Standard State Mitigation Plan Update 2024

Hazard Mitigation Grant Program
Office of the Governor

Stakeholders Meeting

Rota

February 8, 2024

Agenda

- Introductions
- What is the Standard State Hazard Mitigation Plan?
- 2018 Standard State Hazard Mitigation Plan Update
- Hazard Mitigation Planning Process & Requirements
- Agency & Community Stakeholders Survey
- FEMA Risk Map
- Questions

Meeting Logistics

- Hybrid meeting with participants on Zoom
- Please mute your microphone when not speaking
- Please unmute when you have something to say
- Use the chat box to make comments, ask questions, or provide information
- This meeting is being recorded
- Meeting summary will be made available in the SSMP Update

Introductions

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS | OFFICE OF THE GOVERNOR

HAZARD MITIGATION GRANT PROGRAM

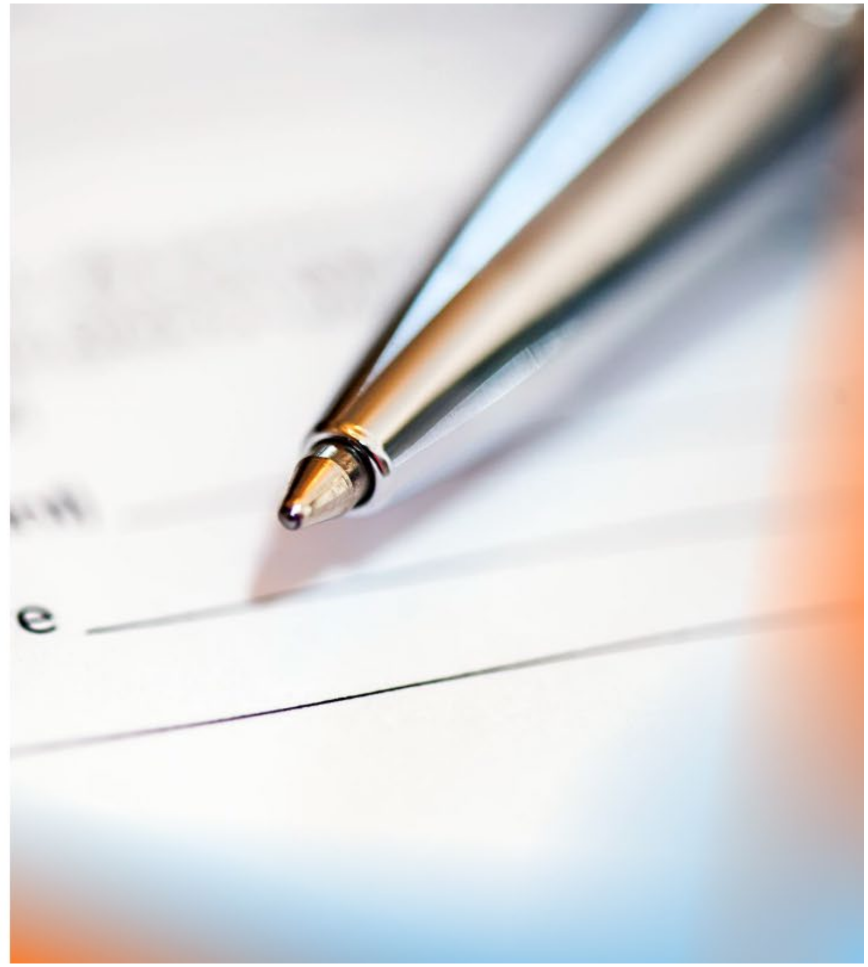
JUAN A. SABLAN BUILDING | CALLER BOX 10007 | SAIPAN, MP 96950 | 670.664.2410 | INFO@HM.GOV.MP

Nimbus Environmental Services

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

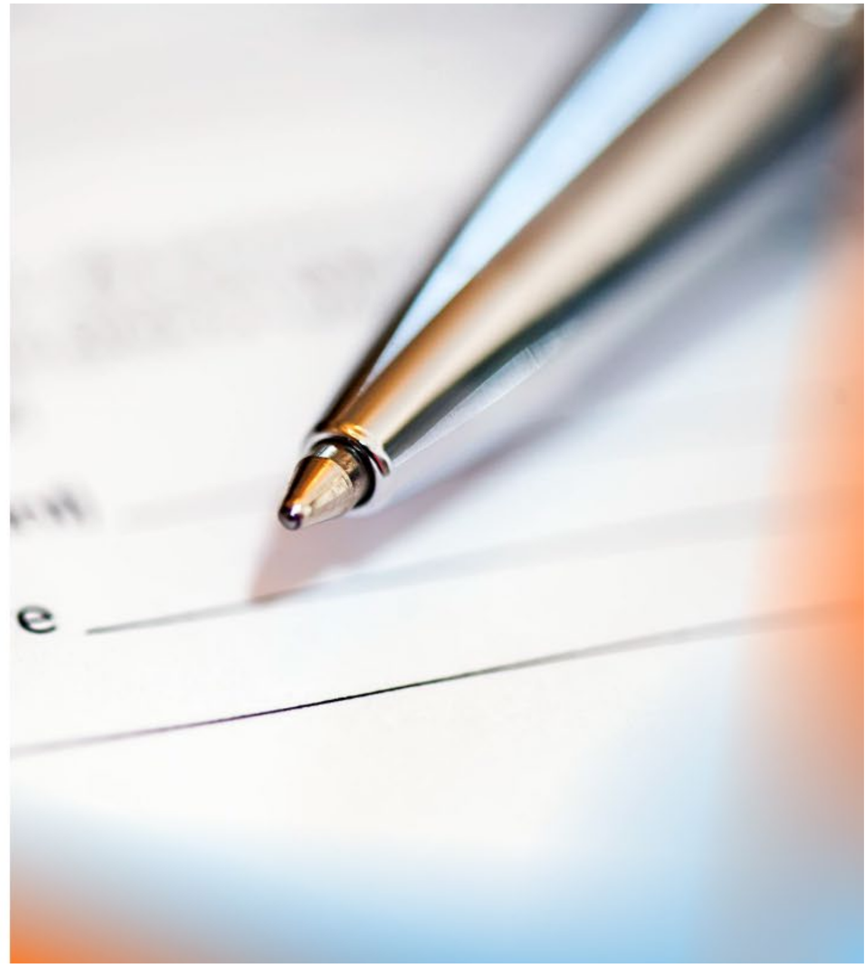
Open until March 31, 2024



General Community Stakeholders Survey

https://acesse.one/SSMPpublic

Open until March 31, 2024



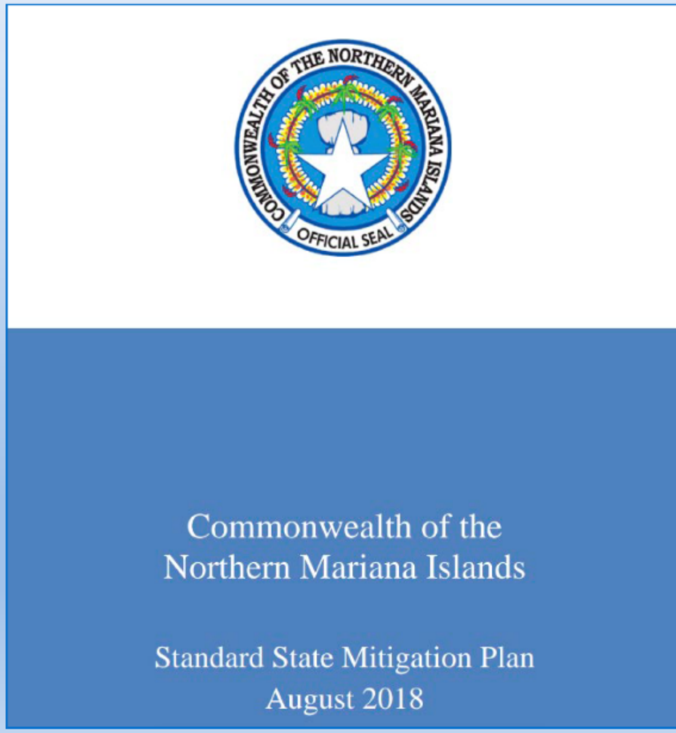
Overview of Standard State Hazard Mitigation Plan

What is the purpose of the Standard State Hazard Mitigation Plan?

- Provides a range of natural hazards likely to occur in CNMI
- Assesses risks and vulnerabilities to the community
- Develops strategies to mitigate those risks and vulnerabilities
- Proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters


Hazard Mitigation Planning
Collaborative process between the Hazard Mitigation Grant Program, under the Office of the Governor, Government Agencies and Community Stakeholders
Encourages participants to take part in the hazard mitigation process by sharing information
Raise awareness of the range of hazards and their affects on the community
Opportunity to integrate hazard mitigation planning with other community plans
Strengthen community resilience to natural hazards through preparedness, response, and recovery through good planning

Hazard Mitigation Planning

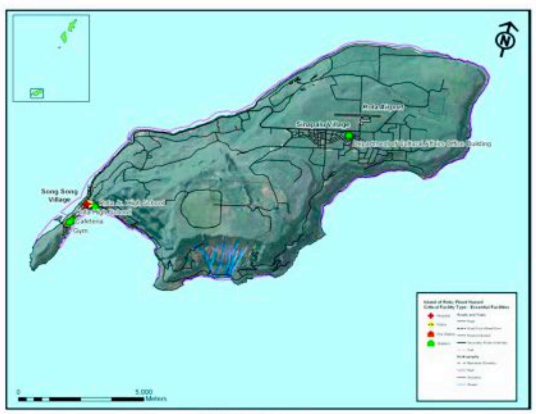

Commonwealth of the
Northern Mariana Islands

Standard State Mitigation Plan
August 2018

2018 Standard State Mitigation Plan Update is available on the Office of Planning and Development website at:

https://encr.pw/ssmp2018

Standard Site Mitigation Plan Map Updates



Title: Rota Flood Hazards
Project: 2010 SSMP
Figure: N-14

Title: Saipan Flood Hazards
Project: 2010 SSMP
Figure: N-1

Title: Tinian Flood Hazards
Project: 2010 SSMP
Figure: N-8

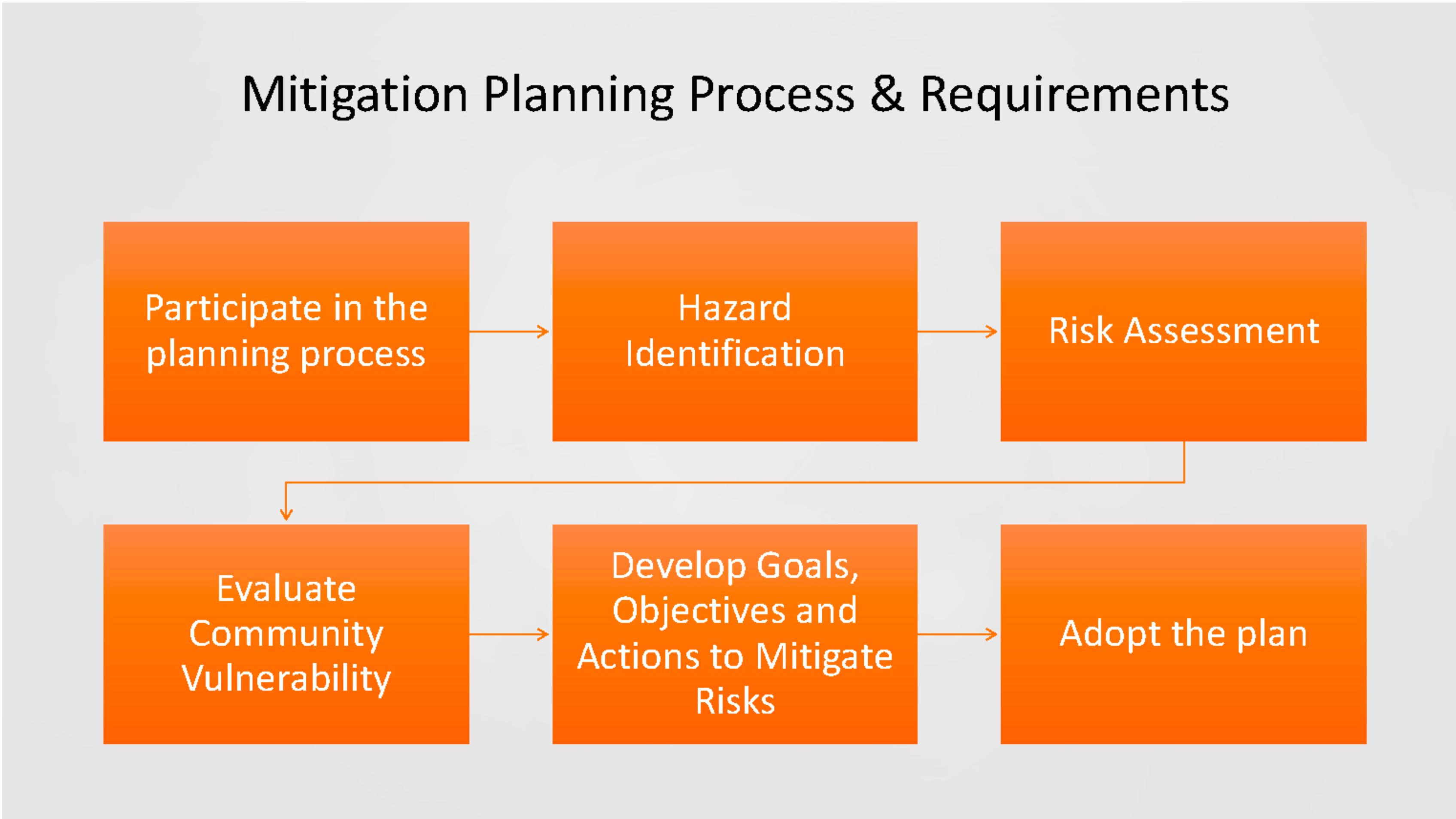
Hazard Mitigation Planning

Approved Standard State Mitigation Plan creates eligibility for FEMA's Hazard Mitigation Assistance grant programs

- Pre-Disaster Mitigation
- Flood Mitigation Assistance (National Flood Insurance Program)
- Hazard Grant Mitigation Program

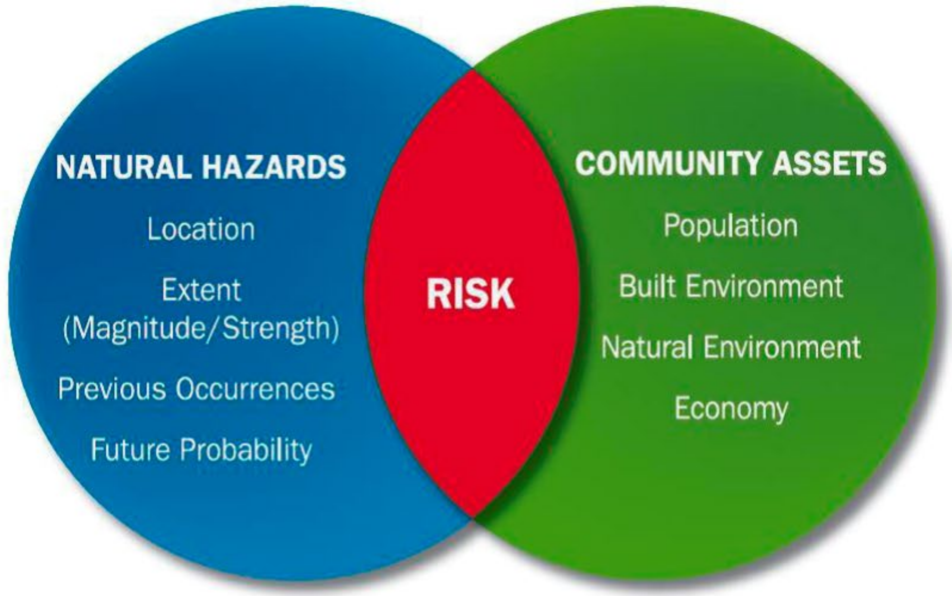

Mitigation Planning Process &
Requirements


How does the Hazard Mitigation Plan Work?
Organize the Planning Process and Resources
Assess Risks
Develop a Mitigation Strategy
Adopt and Implement the Plan


Mitigation Planning Process & Requirements
Participate in the planning process
Hazard Identification
Risk Assessment
Evaluate Community Vulnerability
Develop Goals, Objectives and Actions to Mitigate Risks
Adopt the plan

Hazard Mitigation Projects

Project	Municipality	Agency	Award
Water System Mitigation Project – Phase I	Saipan	Commonwealth Utilities Corp.	$4,596,513
Kannat Talba Flood Control & Drainage System	Saipan	Dept. of Public Works	$2,123,650
Storm Readiness Project	Saipan	Northern Marianas Housing Corp.	$132,595
Susupe Office Building Shutters	Tinian	Dept. of Public Safety	$37,223
Tinian Aging Center Storm Shutters	Tinian	Dept. of Community & Cultural Affairs	$33,270
Fire Station 1 & 5 Concrete Roof – Phase I	Saipan	Dept. of Fire & Emergency Medical Services	$212,500
Concrete Power Poles – Phase I	Rota	Commonwealth Utilities Corp.	$166,800



Hazard Identification – Profile the Hazards

Hazard Identification and Risk Assessment

HAZARD IDENTIFICATION - WHAT CAN HAPPEN HERE?

VULNERABILITY ASSESSMENT - WHAT WILL BE AFFECTED?

A lifeline enables the continuous operations of <u>critical governmental and business functions</u> and is <u>essential to human health and safety and economic security</u>.

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

Community Stakeholders Survey

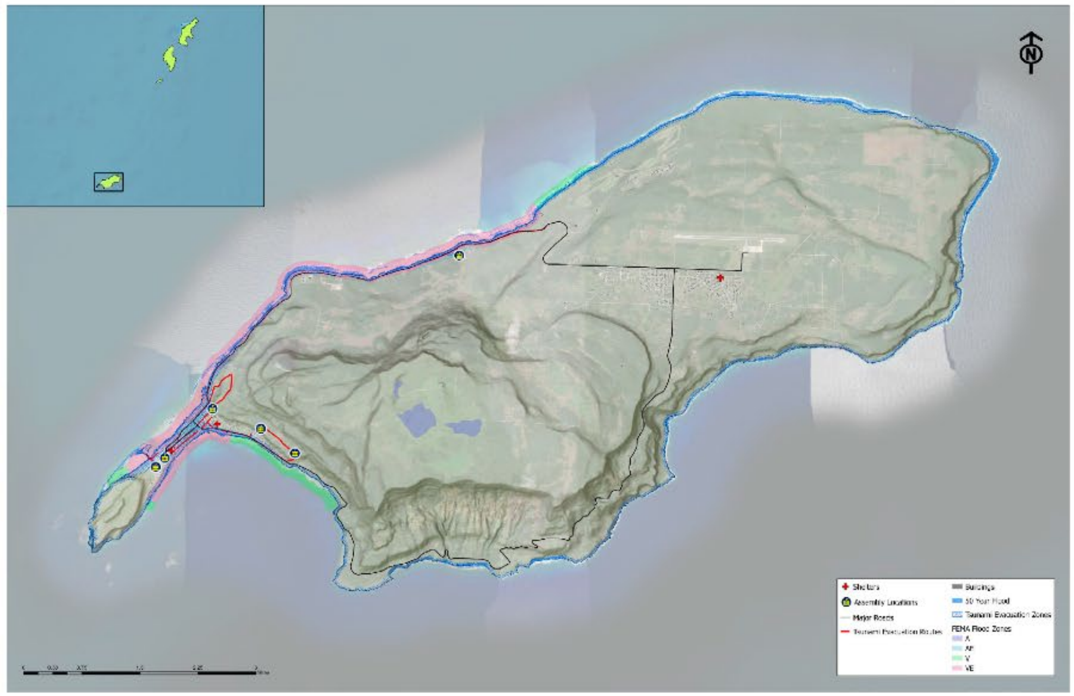
https://acesse.one/SSMPpublic

Climate Change

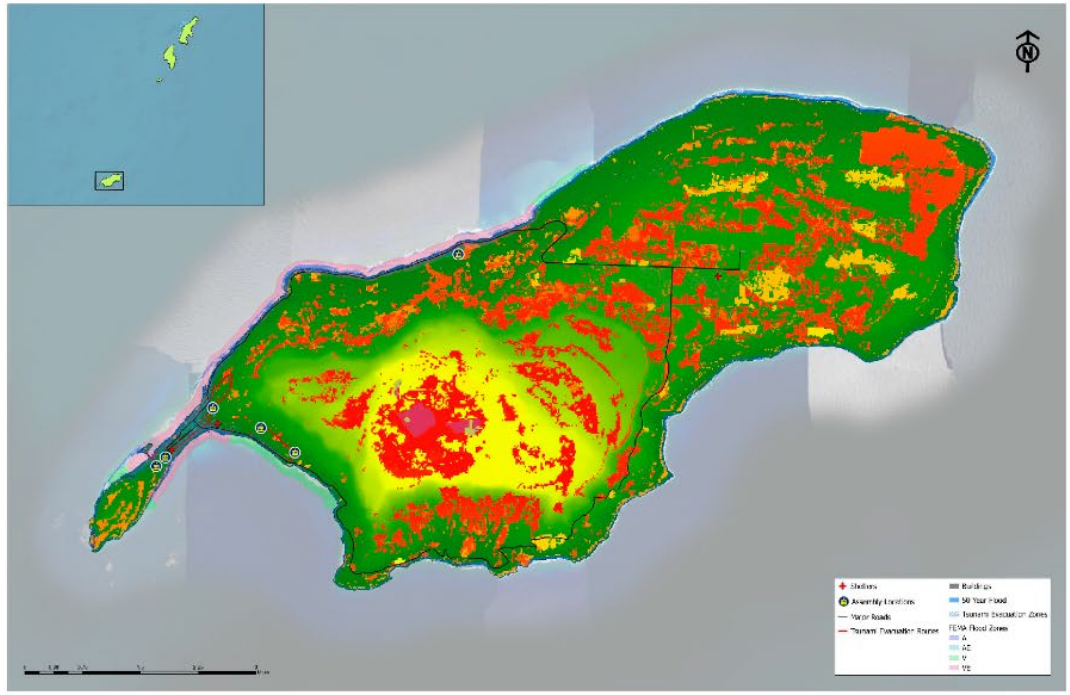
Natural hazard events will intensify the frequency, duration, and severity of future events.

(Keener et al. 2018)

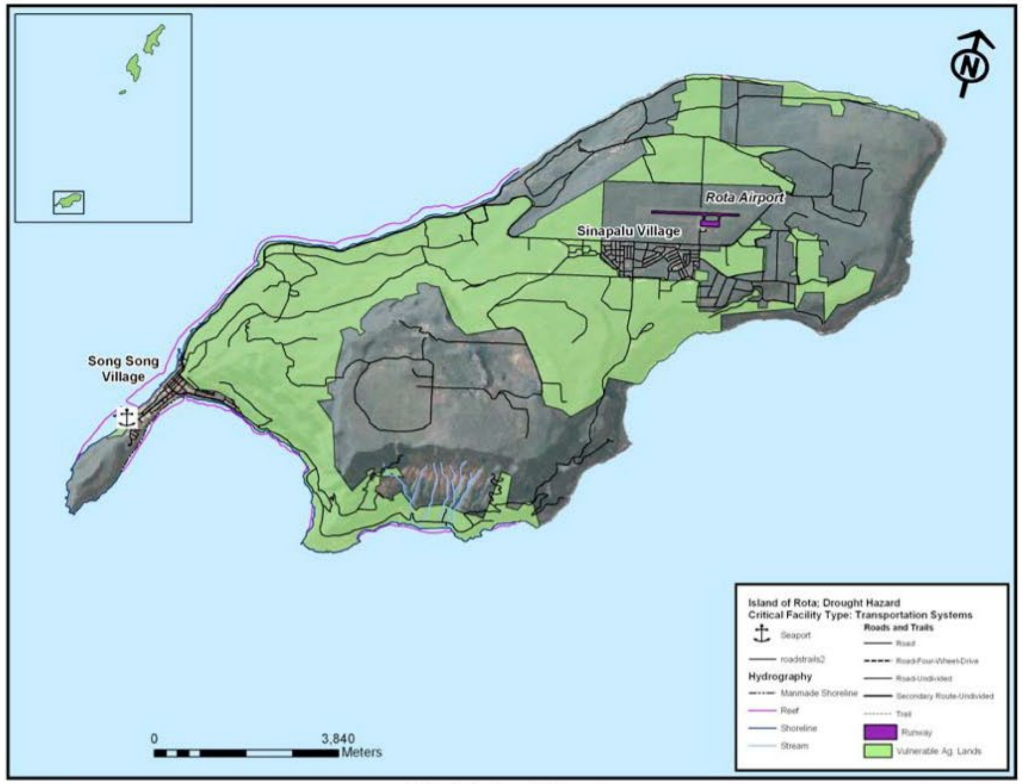
Typhoon, Tropical Storms, Tsunami & Coastal Flooding Hazards for Rota



Wildfire Hazard for Rota



Drought Hazard for Rota



Title: Rota Drought Hazards
Project 2010 SSMP

Figure: R-16

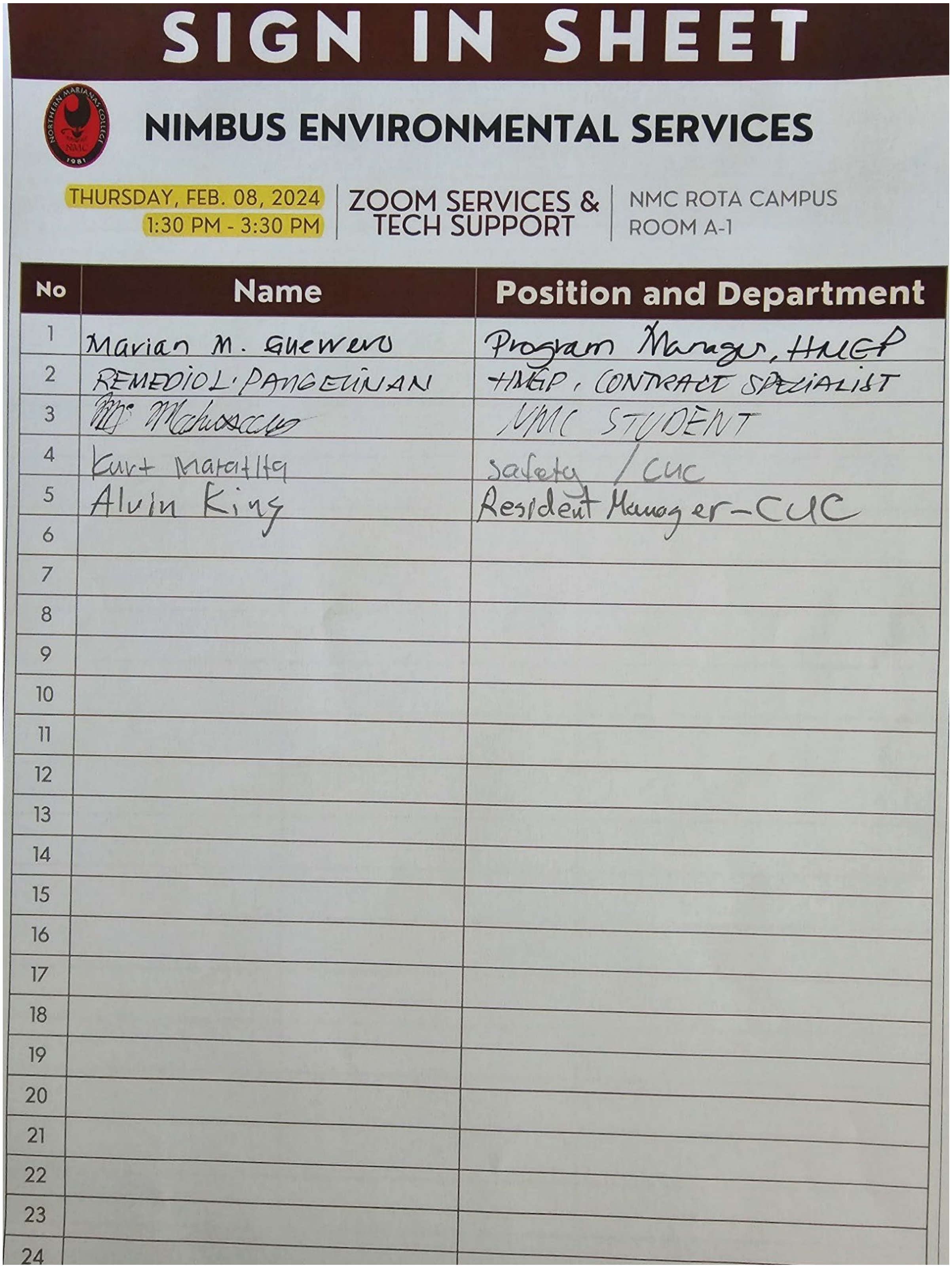
FEMA Risk Map

Table 3. Community Mitigation Needs

ISLAND	HAZARD	MITIGATION NEED
1. ALL ISLANDS	MULTI-HAZARDS	Train workforce for enforcement of 2018 International Building Code
2. ALL ISLANDS	MULTI-HAZARDS	Gain access to technical assistance or training on FEMA programs, including Environmental and Historic Preservation and the NFIP.
3. ALL ISLANDS	MULTI-HAZARDS	Improve resources for disaster-resilient building, like an update to the Homeowner's Guide or expanding on the CNMI Bureau of Environmental and Coastal Quality - Division of Coastal Resources Management's Better Building guidebook on stormwater and typhoon risks.
4. ALL ISLANDS	MULTI-HAZARDS	Engage with multiple agencies and local governments to identify mitigation strategies and update the Standard State Hazard Mitigation Plan.
5. ALL ISLANDS	FLOOD	Increase flood insurance options and policies.
6. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling for all islands to understand risks to flooding and to develop new Flood Insurance Rate Maps for Saipan, Tinian and Rota.
7. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling that includes hazards presented by wave run-up and sea level rise to be used in planning, development and identifying flood mitigation actions.
8. ROTA	MULTI-HAZARDS	Identify mitigation strategies to be included in the Standard State Mitigation Plan.
9. SAIPAN	MULTI-HAZARDS	Improve living conditions and safe housing for vulnerable residents and residents still recovering from or displaced by Hurricane Yutu.
10. SAIPAN	COASTAL EROSION	Mitigate or adapt to erosion of Micro Beach. Coordinate across agencies to look at existing engineering studies or proposed nature-based solutions and determine next steps.
11. SAIPAN	FLOOD	Secure Lower Base Power Plant and access road from flooding.
12. SAIPAN	FLOOD	Ensure continued functionality of and access to Commonwealth Health Ceter during flood.
13. SAIPAN	FLOOD	Improve drainage of Garapan District.
14. SAIPAN	FLOOD	Protect/stabilize Beach Road from coastal flooding and sea level rise.
15. SAIPAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce flooding from runoff. Stormwater improvements for Garapan and Tinian industrial area.
16. SAIPAN	FLOOD, SEA LEVEL RISE	Protect coral reefs and protective functions, given consideration to expected sea level rise.
17. SAIPAN	TYPHOON	Remediate debris, derelict, or abandoned buildings that could act as projectiles and exacerbate damages from strong winds.
18. TINIAN	MULTI-HAZARDS	Identify mitigation strategies to be included in the SSMP.
19. TINIAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce fooding from runoff.

FEMA Risk Mapping, Assessment, and Planning Program (MAP) (2021)

Questions



SIGN IN SHEET

NORTHERN MARIANAS COLLEGE NMC 1981

NIMBUS ENVIRONMENTAL SERVICES

THURSDAY, FEB. 08, 2024
1:30 PM - 3:30 PM

ZOOM SERVICES & TECH SUPPORT

NMC ROTA CAMPUS
ROOM A-1

No	Name	Position and Department
1	Marian M. Guerrero	Program Manager, HMGP
2	REMEDIO L. PANGELINAN	HMGP, CONTRACT SPECIALIST
3	[illegible]	NMC STUDENT
4	Kurt Maratita	Safety / CUC
5	Alvin King	Resident Manager – CUC
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

Figure A.4-16. Rota government agency stakeholder meeting sign-in sheet.

HAZARD MITIGATION PLANNING; GENERAL PUBLIC STAKEHOLDERS MEETING

PROJECT:	2024 Standard State Mitigation Plan Update (SSMP 2024)	**MEETING DATE:**	February 8, 2024 6:30-8:30 pm
FACILITATOR:	HMGP/Nimbus Environmental Services	**LOCATION:**	Northern Marianas College Rota Campus, Room A1

FIRST NAME	LAST NAME	EMAIL
Jerry (670) 287-0015	Barcinas	Jerry.barcinas@marianas.edu

Figure A.4-17. Rota community stakeholder meeting sign-in sheet.

A.4.5 Saipan and Northern Islands Stakeholder Presentation

Standard State Mitigation Plan Update 2024

Hazard Mitigation Grant Program
Office of the Governor

Stakeholders Meeting
Saipan and Northern Islands
February 13, 2024

Agenda

- Introductions
- What is the Standard State Hazard Mitigation Plan?
- 2018 Standard State Hazard Mitigation Plan Update
- Hazard Mitigation Planning Process & Requirements
- Agency & Community Stakeholders Survey
- FEMA Risk Map
- Questions

Meeting Logistics

Hybrid meeting with participants on Zoom

Please mute your microphone when not speaking

Please unmute when you have something to say

Use the chat box to make comments, ask questions, or provide information

This meeting is being recorded

Meeting summary will be made available in the SSMP Update

Introductions

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS | OFFICE OF THE GOVERNOR

HAZARD MITIGATION GRANT PROGRAM

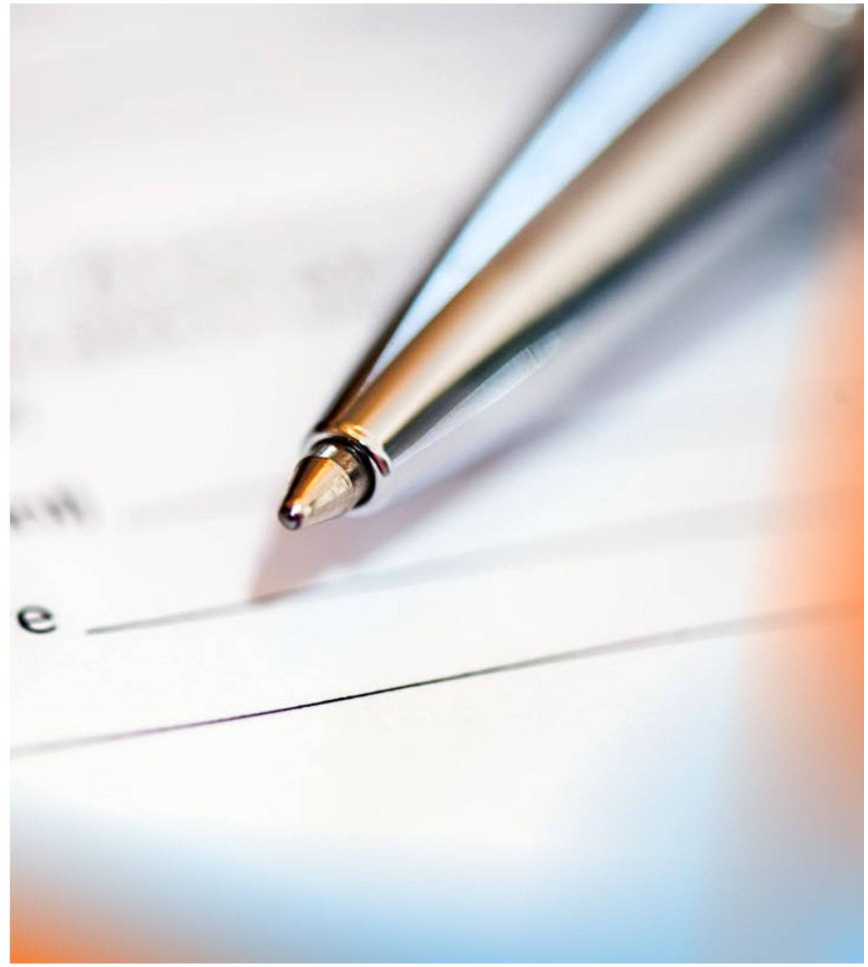
JUAN A. SABLAN BUILDING | CALLER BOX 10007 | SAIPAN, MP 96950 | 670.664.2410 | INFO@HM.GOV.MP

Nimbus Environmental Services

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

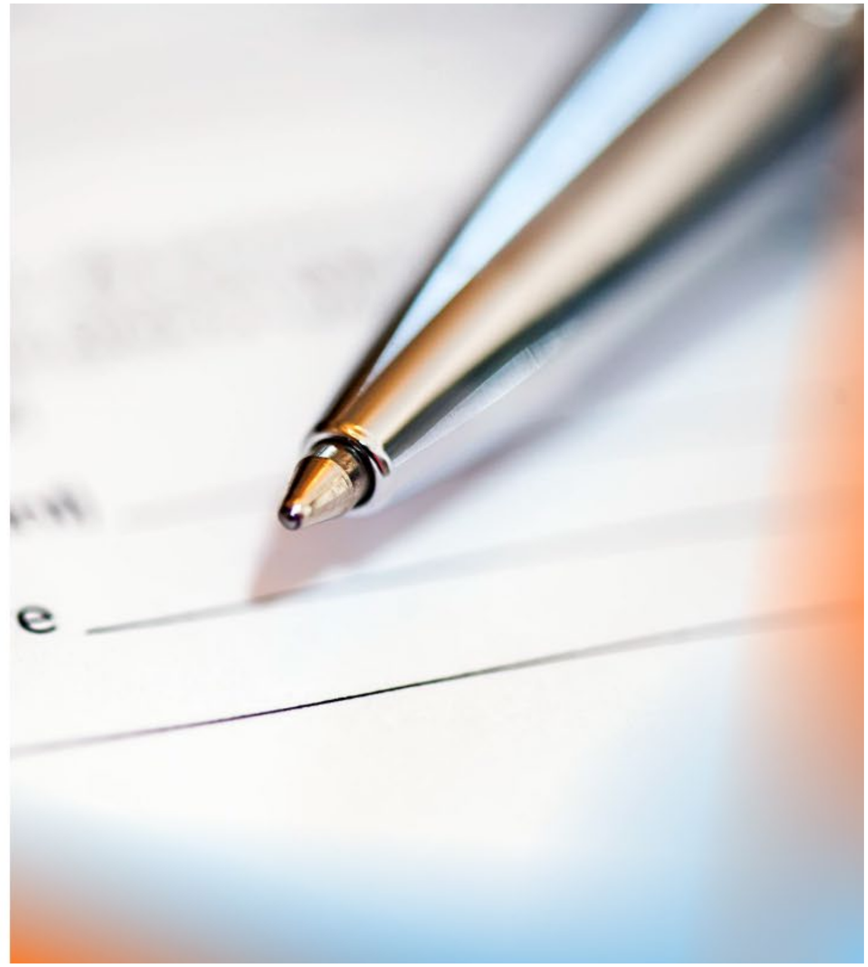
Open until March 31, 2024



General Community Stakeholders Survey

https://acesse.one/SSMPpublic

Open until March 31, 2024



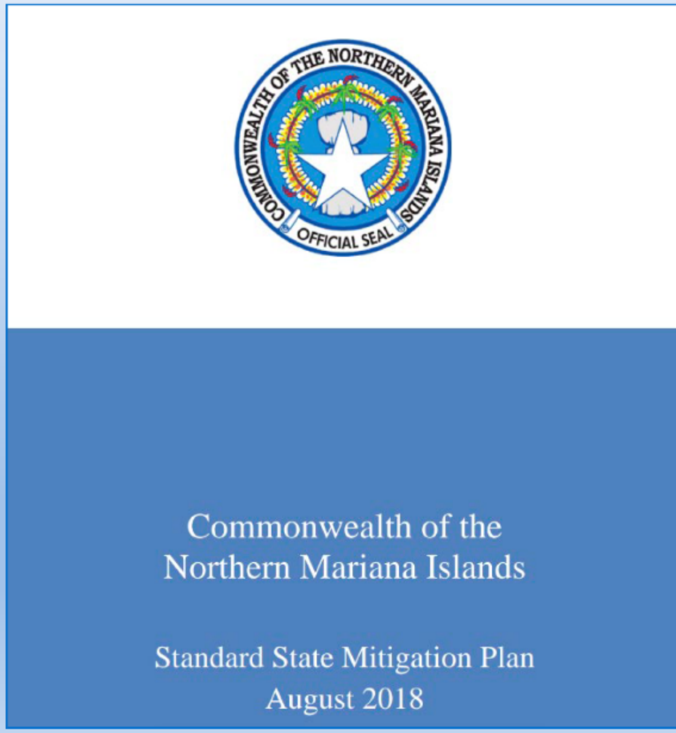
Overview of Standard State Hazard Mitigation Plan

What is the purpose of the Standard State Hazard Mitigation Plan?

- Provides a range of natural hazards likely to occur in CNMI
- Assesses risks and vulnerabilities to the community
- Develops strategies to mitigate those risks and vulnerabilities
- Proposes actions to reduce loss of life, property damage, and environmental impacts from natural disasters


Hazard Mitigation Planning
Collaborative process between the Hazard Mitigation Grant Program, under the Office of the Governor, Government Agencies and Community Stakeholders
Encourages participants to take part in the hazard mitigation process by sharing information
Raise awareness of the range of hazards and their affects on the community
Opportunity to integrate hazard mitigation planning with other community plans
Strengthen community resilience to natural hazards through preparedness, response, and recovery through good planning

Hazard Mitigation Planning


Commonwealth of the Northern Mariana Islands

Standard State Mitigation Plan
August 2018

2018 Standard State Mitigation Plan Update is available on the Office of Planning and Development website at:

https://encr.pw/ssmp2018

Standard Site Mitigation Plan Map Updates

Title: Rota Flood Hazards
Project: 2010 SSMP
Figure: N-14

Title: Saipan Flood Hazards
Project: 2010 SSMP

Title: Tinian Flood Hazards
Project: 2010 SSMP
Figure: N-8

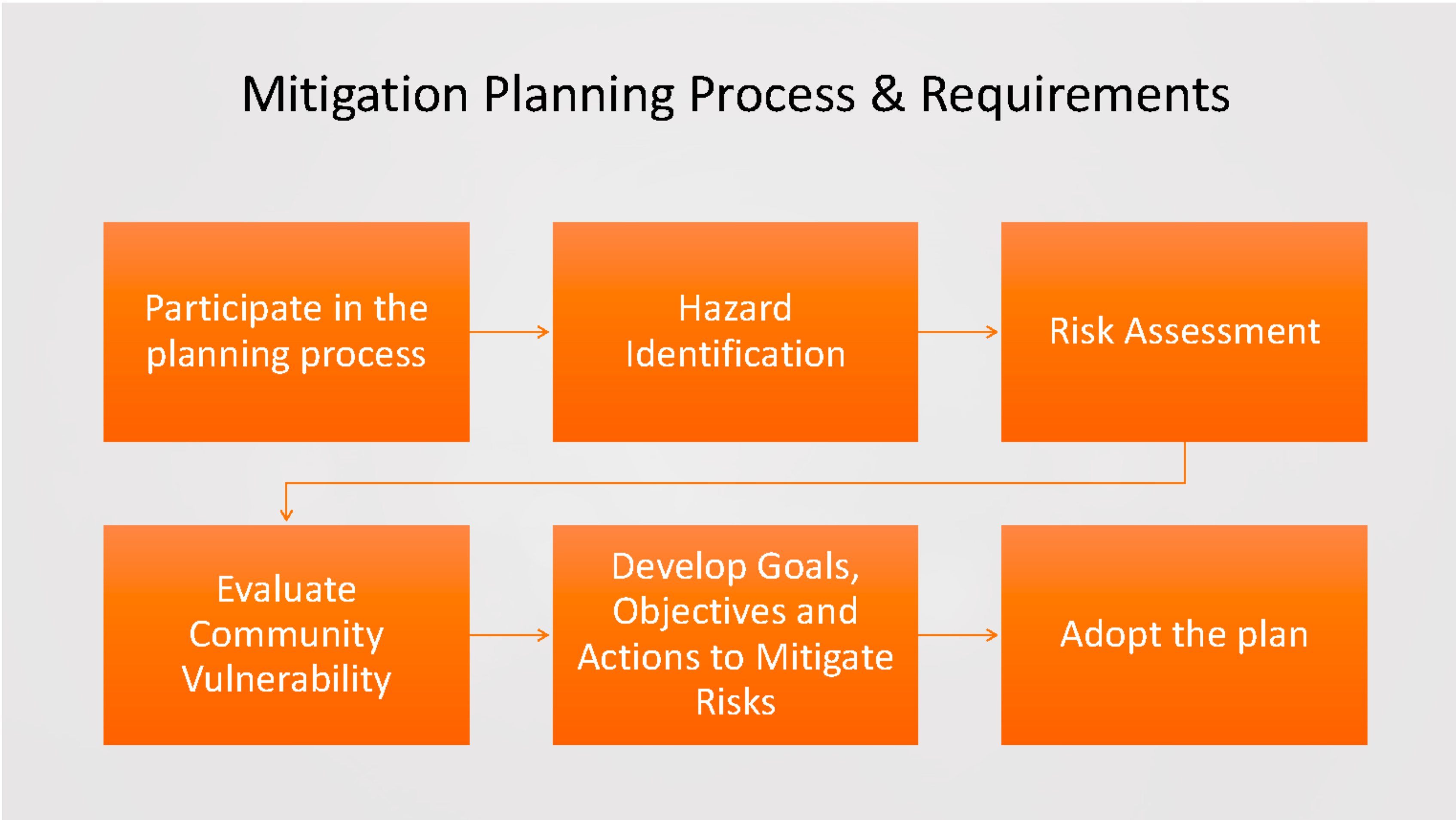
Hazard Mitigation Planning

Approved Standard State Mitigation Plan creates eligibility for FEMA's Hazard Mitigation Assistance grant programs

- Pre-Disaster Mitigation
- Flood Mitigation Assistance (National Flood Insurance Program)
- Hazard Grant Mitigation Program

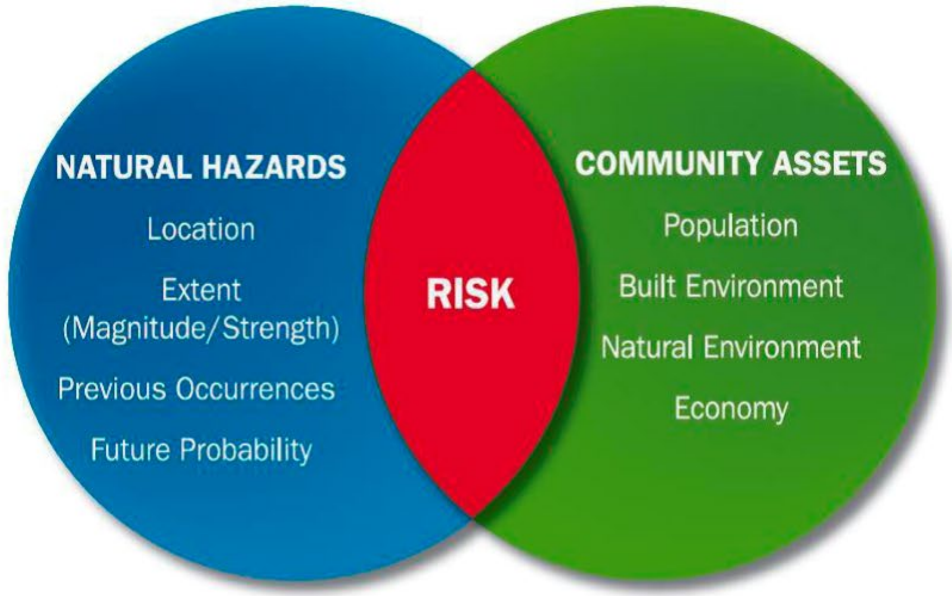

Mitigation Planning Process &
Requirements


How does the Hazard Mitigation Plan Work?
Adopt and Implement the Plan
Organize the Planning Process and Resources
Assess Risks
Develop a Mitigation Strategy


Mitigation Planning Process & Requirements
Participate in the planning process
Hazard Identification
Risk Assessment
Evaluate Community Vulnerability
Develop Goals, Objectives and Actions to Mitigate Risks
Adopt the plan

Hazard Mitigation Projects

Project	Municipality	Agency	Award
Water System Mitigation Project – Phase I	Saipan	Commonwealth Utilities Corp.	$4,596,513
Kannat Talba Flood Control & Drainage System	Saipan	Dept. of Public Works	$2,123,650
Storm Readiness Project	Saipan	Northern Marianas Housing Corp.	$132,595
Susupe Office Building Shutters	Tinian	Dept. of Public Safety	$37,223
Tinian Aging Center Storm Shutters	Tinian	Dept. of Community & Cultural Affairs	$33,270
Fire Station 1 & 5 Concrete Roof – Phase I	Saipan	Dept. of Fire & Emergency Medical Services	$212,500
Concrete Power Poles – Phase I	Rota	Commonwealth Utilities Corp.	$166,800



Hazard Identification – Profile the Hazards

Hazard Identification and Risk Assessment

HAZARD IDENTIFICATION - WHAT CAN HAPPEN HERE?

VULNERABILITY ASSESSMENT - WHAT WILL BE AFFECTED?

A lifeline enables the continuous operations of <u>critical governmental and business functions</u> and is <u>essential to human health and safety and economic security</u>.

Government Agency Stakeholders Survey

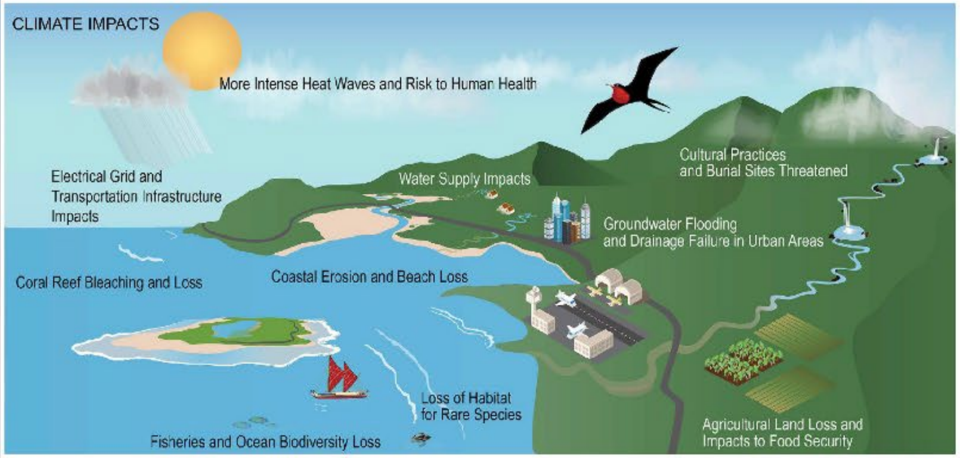
https://acesse.one/SSMPAgency

Community Stakeholders Survey

https://acesse.one/SSMPpublic

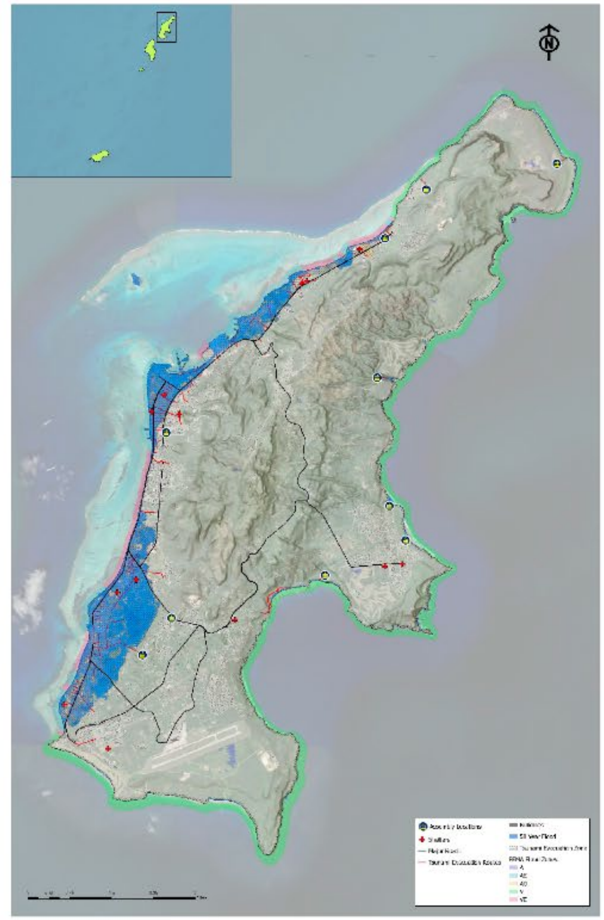
Climate Change

Natural hazard events will intensify the frequency, duration, and severity of future events.

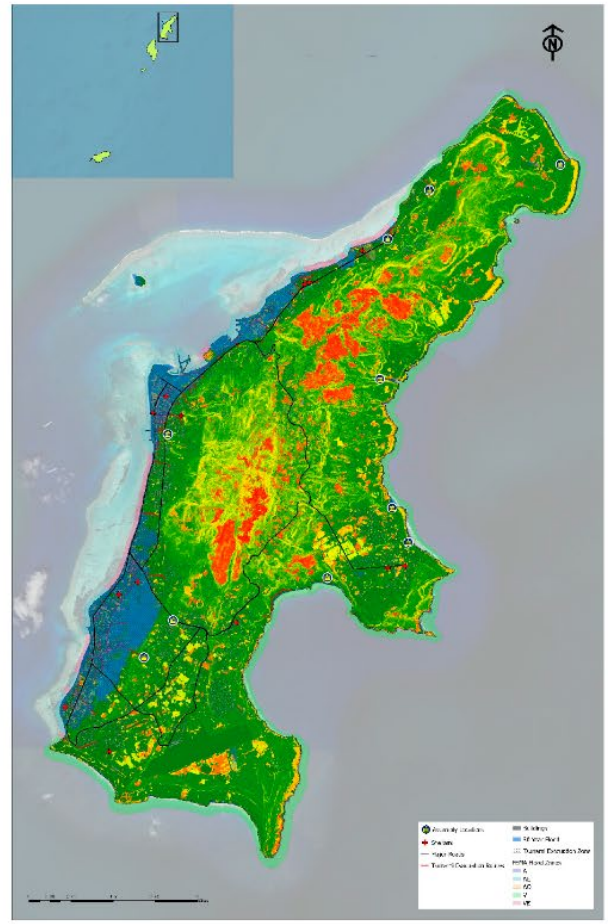


(Keener et al. 2018)

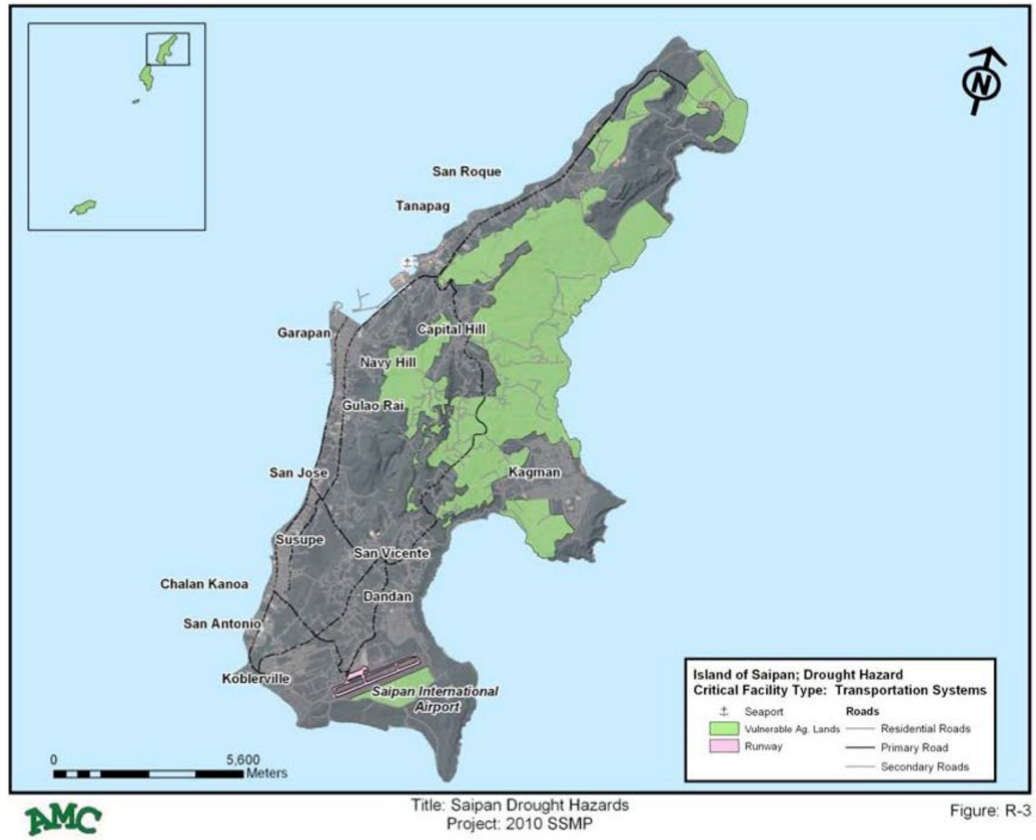
Typhoon, Tropical Storms, Tsunami & Coastal Flooding Hazards for Saipan



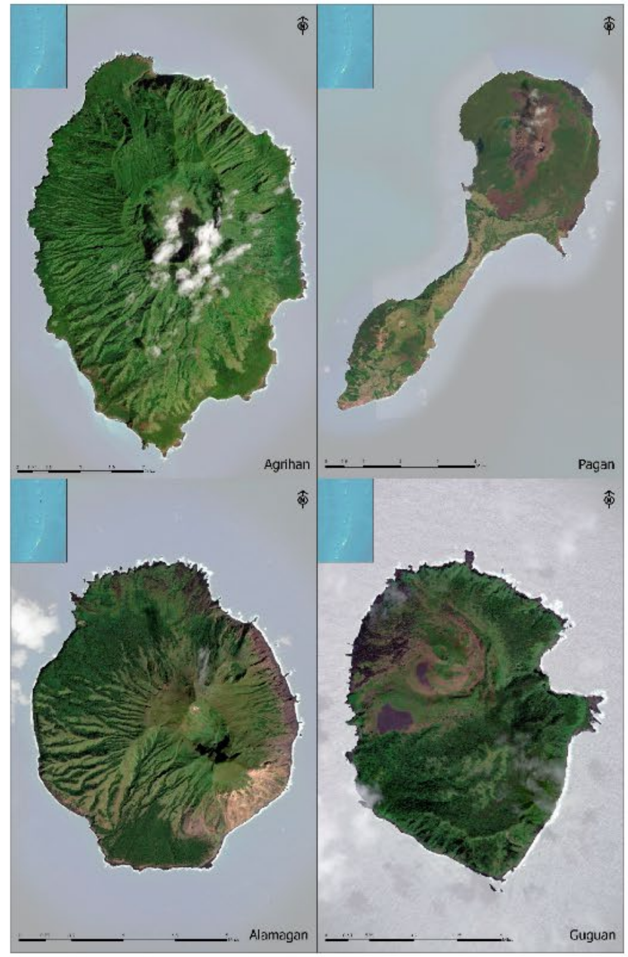
Wildfire Hazard for Saipan



Drought Hazard for Saipan



Northern Islands



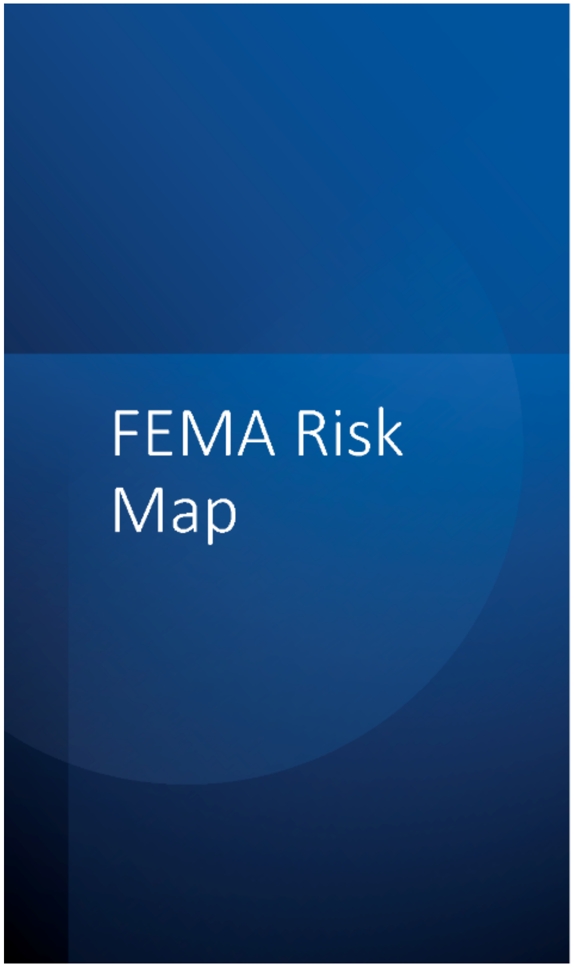
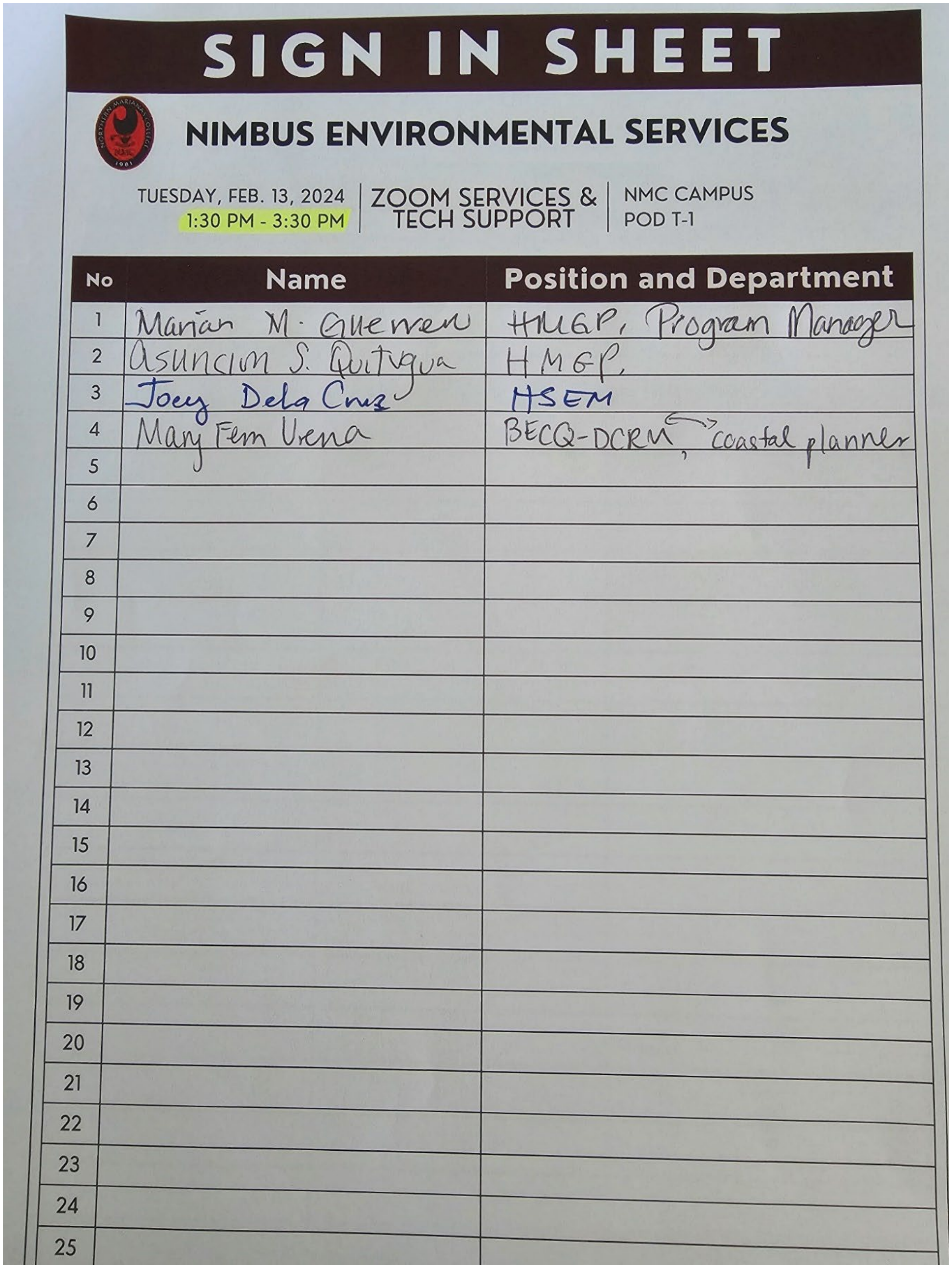


Table 3. Community Mitigation Needs

ISLAND	HAZARD	MITIGATION NEED
1. ALL ISLANDS	MULTI-HAZARDS	Train workforce for enforcement of 2018 International Building Code
2. ALL ISLANDS	MULTI-HAZARDS	Gain access to technical assistance or training on FEMA programs, including Environmental and Historic Preservation and the NFIP.
3. ALL ISLANDS	MULTI-HAZARDS	Improve resources for disaster-resilient building, like an update to the Homeowner's Guide or expanding on the CNMI Bureau of Environmental and Coastal Quality - Division of Coastal Resources Management's Better Building guidebook on stormwater and typhoon risks.
4. ALL ISLANDS	MULTI-HAZARDS	Engage with multiple agencies and local governments to identify mitigation strategies and update the Standard State Hazard Mitigation Plan.
5. ALL ISLANDS	FLOOD	Increase flood insurance options and policies.
6. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling for all islands to understand risks to flooding and to develop new Flood Insurance Rate Maps for Saipan, Tinian and Rota.
7. ALL ISLANDS	FLOOD	Improve coastal flood hazard data and modeling that includes hazards presented by wave run-up and sea level rise to be used in planning, development and identifying flood mitigation actions.
8. ROTA	MULTI-HAZARDS	Identify mitigation strategies to be included in the Standard State Mitigation Plan.
9. SAIPAN	MULTI- HAZARDS	Improve living conditions and safe housing for vulnerable residents and residents still recovering from or displaced by Hurricane Yutu.
10. SAIPAN	COASTAL EROSION	Mitigate or adapt to erosion of Micro Beach. Coordinate across agencies to look at existing engineering studies or proposed nature-based solutions and determine next steps.
11. SAIPAN	FLOOD	Secure Lower Base Power Plant and access road from flooding.
12. SAIPAN	FLOOD	Ensure continued functionality of and access to Commonwealth Health Ceter during flood.
13. SAIPAN	FLOOD	Improve drainage of Garapan District.
14. SAIPAN	FLOOD	Protect/stabilize Beach Road from coastal flooding and sea level rise.
15. SAIPAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce flooding from runoff. Stormwater improvements for Garapan and Tinian industrial area.
16. SAIPAN	FLOOD, SEA LEVEL RISE	Protect coral reefs and protective functions, given consideration to expected sea level rise.
17. SAIPAN	TYPHOON	Remediate debris, derelict, or abandoned buildings that could act as projectiles and exacerbate damages from strong winds.
18. TINIAN	MULTI-HAZARDS	Identify mitigation strategies to be included in the SSMP.
19. TINIAN	FLOOD, STORM-WATER	Improve building inspection and practices to reduce fooding from runoff.

FEMA Risk Mapping, Assessment, and Planning Program (MAP) (2021)


Questions



SIGN IN SHEET

NIMBUS ENVIRONMENTAL SERVICES

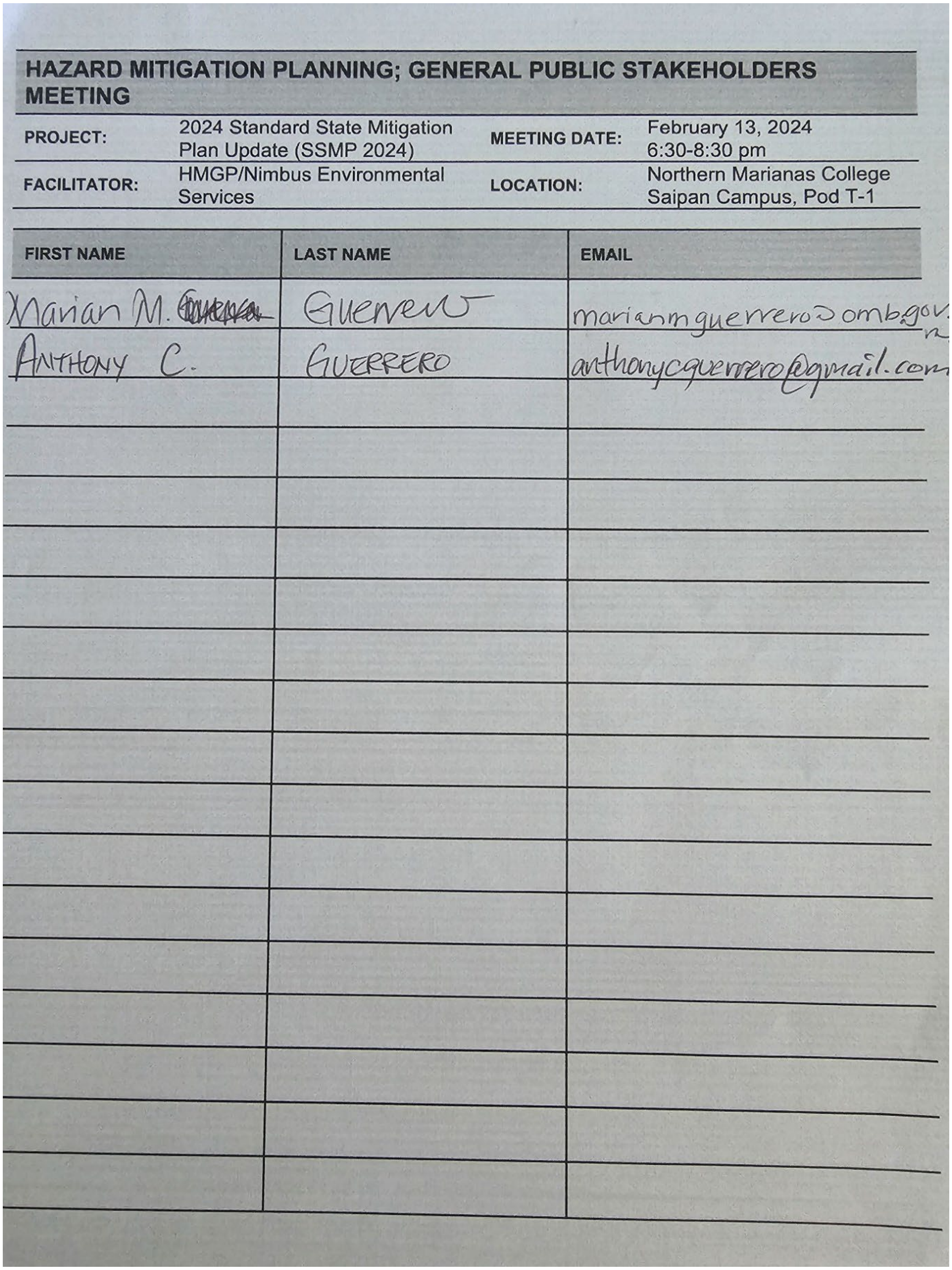
TUESDAY, FEB. 13, 2024
1:30 PM - 3:30 PM

ZOOM SERVICES & TECH SUPPORT

NMC CAMPUS
POD T-1

No	Name	Position and Department
1	Marian M. Guerrero	HMGP, Program Manager
2	Asuncion S. Quitugua	HMGP
3	Joey Dela Cruz	HSEM
4	Mary Fem Urena	BECQ-DCRM, coastal planner
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

Figure A.4-18. Saipan government agency stakeholder meeting sign-in sheet.



HAZARD MITIGATION PLANNING; GENERAL PUBLIC STAKEHOLDERS MEETING

PROJECT:	2024 Standard State Mitigation Plan Update (SSMP 2024)	**MEETING DATE:**	February 13, 2024 6:30-8:30 pm
FACILITATOR:	HMGP/Nimbus Environmental Services	**LOCATION:**	Northern Marianas College Saipan Campus, Pod T-1

FIRST NAME	LAST NAME	EMAIL
Marian M. ~~[illegible]~~	Guerrero	marianmguerrero@omb.gov.mp
ANTHONY C.	GUERRERO	anthonycguerrero@gmail.com

Figure A.4-19. Saipan community stakeholder meeting sign-in sheet.

2024 SSMP Update Mitigation Planning

Outreach Meetings

Zoom Participants

February 6, 2024 - Tinian

Government Agency Stakeholders
Ike Kiyoshi, Office of the Mayor
Joaluntalan
Felipe Aquino, Jr.
Zenie Mafnas, Northern Marianas Housing Corporation
Velma Reyes, Department of Public Lands
Sue - Tinian Center
Jennielyn Santos Cruz
Kenneth G. Cruz

Community Stakeholders
Edward Hofschneider
Maggie Palacios
Frances Diaz

February 8, 2024 - Rota
Government Agency Stakeholders
--

Community Stakeholders
--

February 13, 2024 – Saipan and Northern Islands

Government Agency Stakeholders
Dave
Jo
Jjairam
Colin Sablan
JP Sablan
DJaymarch Ong
Susan Satur, Center for Living Independently
Mark O. Rabauliman, Office of the May Northern Islands
C. Guerrero, 500 Sails
Jodina Attao, Northern Marianas Technical Institute
Jonathan Arriola, Northern Marianas Technical Institute
Manny Cabrera, Department of Fire & Emergency Services
Leona Deleon Guerrero, CNMI Office of the Governor- Hazard Mitigation Grant Program
Carlos Deleon Guerrero

1

Edwin Tmarsel, DPW
Jonathan Camacho, CUC Power Division
Raquel Aguon, Marianas Visitors Authority
Victor Cabrera
David Cabrera, Division of Coastal Resources Management
Arthur C., Division of Coastal Resources Management
Zarah Bermudes, CNMI Council on Developmental Disabilities
Jo Tudela, CNMI Assistive Technology Program
Jonathan Arriola, Northern Marianas Housing Corporation
Vivian Sablan, Department of Community & Cultural Affairs Youth Services

Community Stakeholders

Florita Cabanes
Charito Cristoria

2

Figure A.4-20. List of stakeholders from hybrid meetings.

A.4.6 2024 Pacific Risk Management ‘Ohana Conference Presentation

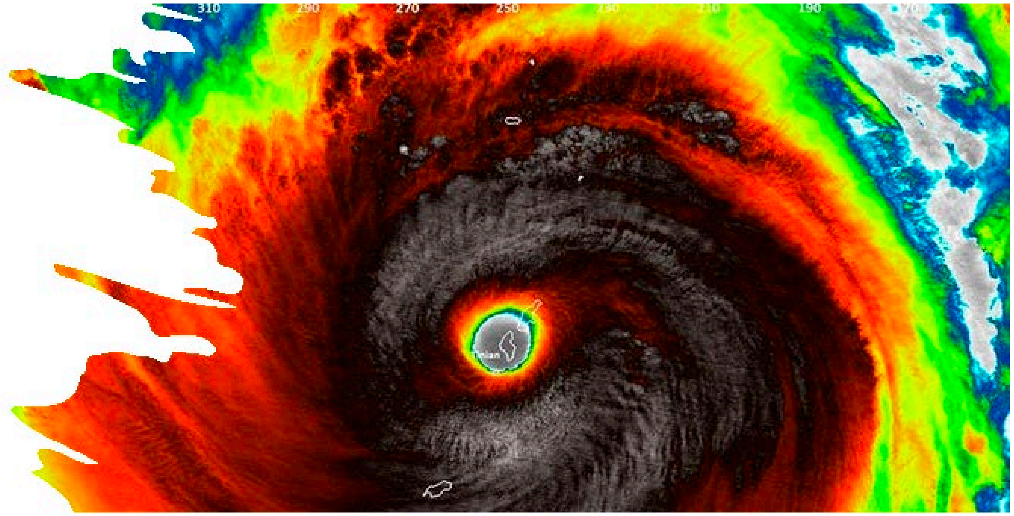
Standard State Mitigation Plan Update 2024

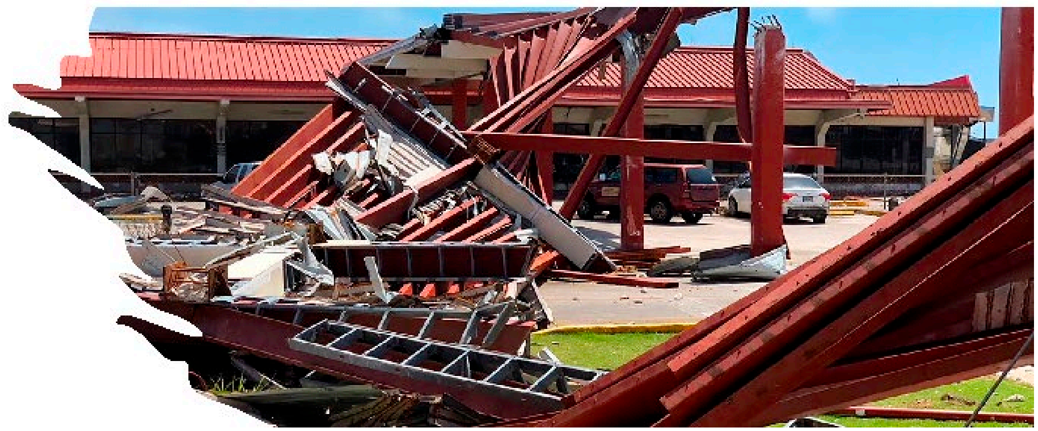
Hazard Mitigation Grant Program
Office of the Governor

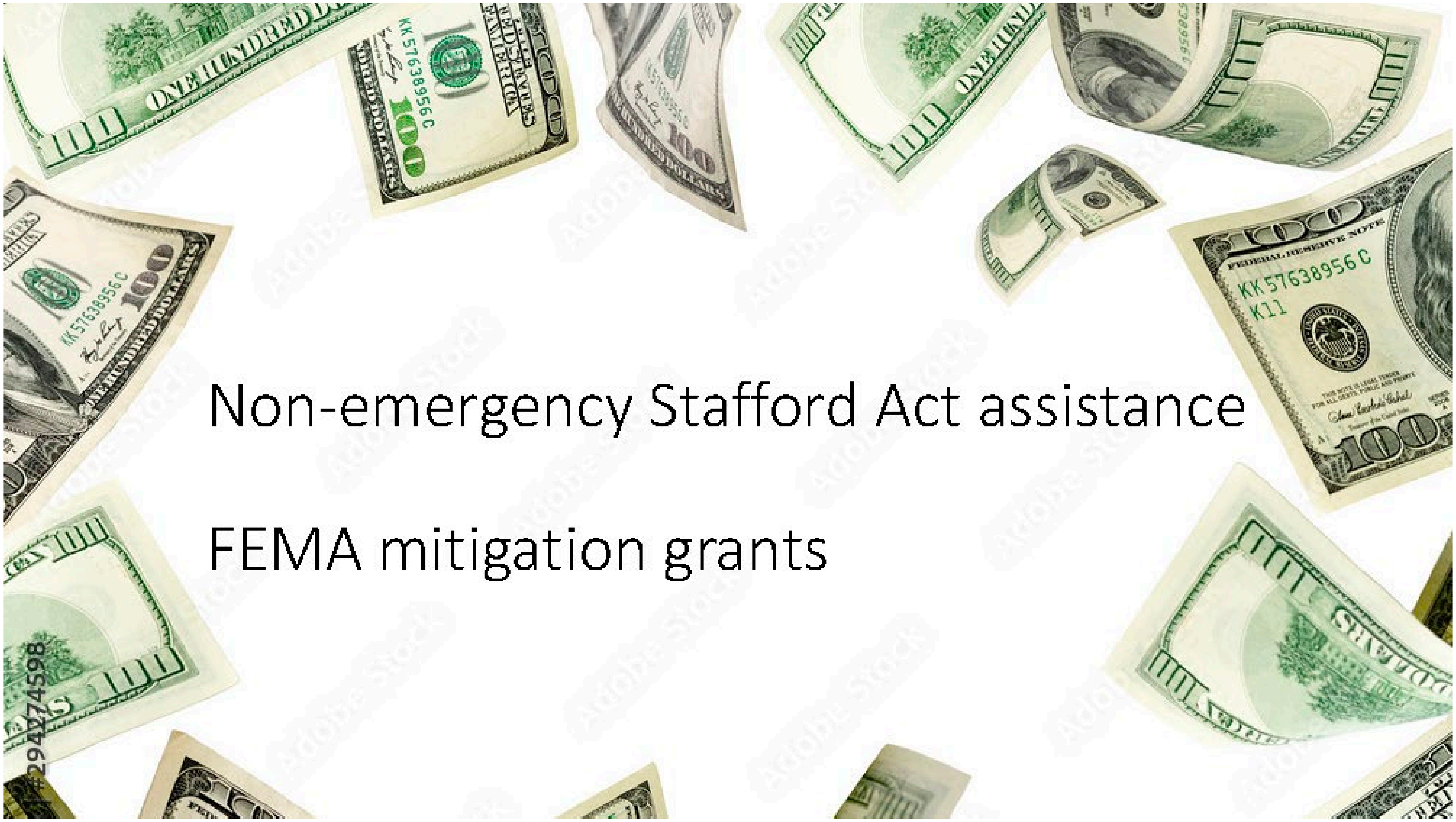
Pacific Risk Management ‘Ohana Conference
February 21-23, 2024

What is a State Standard Mitigation Plan?

- Stafford Act
- Commitment to reduce risks from natural hazards
- Guide resource commitment to reduce the effects of these hazards

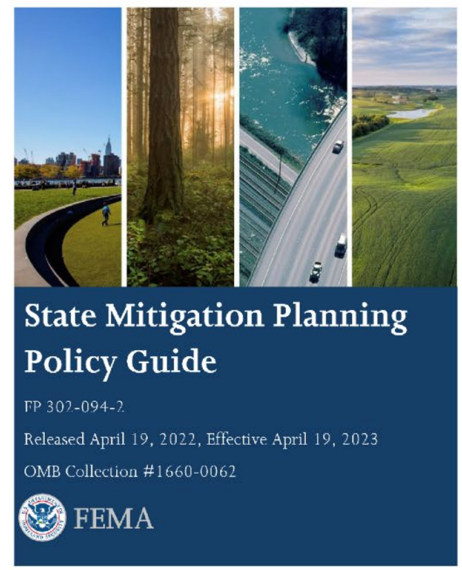





Non-emergency Stafford Act assistance
FEMA mitigation grants

2022 State Mitigation Planning Policy Guide

- Equity and climate change consideration
- Expanded participants in the planning process –
    - Community lifeline experts
    - Climate change experts
    - State agencies that support underserved communities
- Mitigation capabilities
    - Building codes
    - National Flood Insurance Program and flood risk mapping
- Consider current and future risks
- Reorganized requirements for ease of use

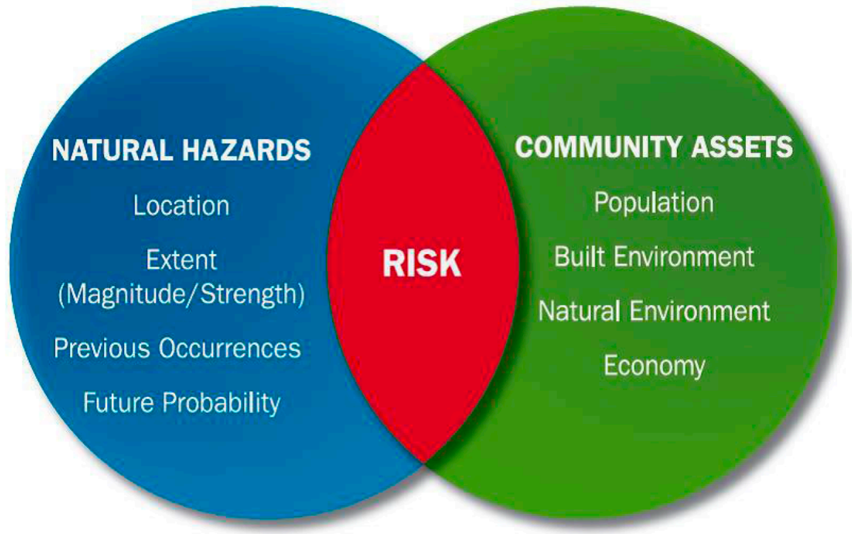


What to Expect in the 2024 CNMI SSMP Update Planning Process

- Agency meetings
  - 10 Agencies
- Outreach meetings
  - Tinian
  - Rota
  - Saipan
- Questionnaires

What to Expect in the 2024 CNMI SSMP Update Risk Assessment

- Hazard information & maps
- Assets
  - Geo-locate State infrastructure
  - Reorganize critical facilities by community lifeline
- Building replacement costs
- Community demographics / vulnerabilities



What to Expect in the 2024 CNMI SSMP Update Risk Assessment

- Hazard information & maps
- Assets
  - Geo-locate State infrastructure
  - Reorganize critical facilities by community lifeline
- Building replacement costs
- Community demographics / vulnerabilities

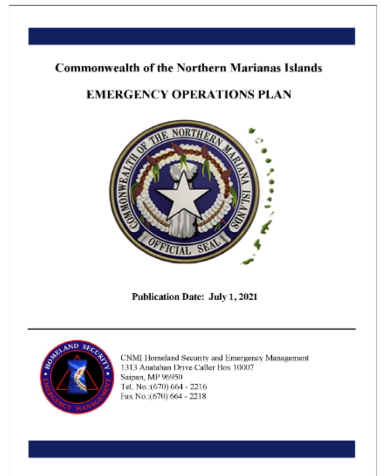
Climate Change

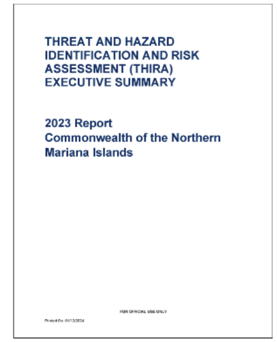
Natural hazard events will intensify the frequency, duration, and severity of future events.

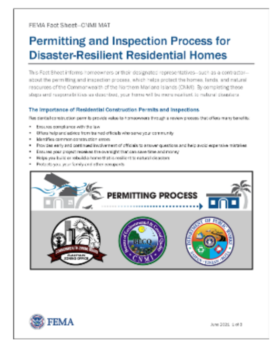
(Keener et al. 2018)

What to Expect in the 2024 CNMI SSMP Update Mitigation Capabilities

- Incorporate existing CNMI plans
  - All-Hazards Emergency Operations Plan (2021)
  - THIRA/SPR (2023 update)
- CNMI Laws and Regulation review
  - IBC/IRC adopted 2019
- National Flood Insurance Program Information / FEMA Risk MAP







What to Expect in the 2024 CNMI SSMP Update
Mitigation Strategies

- Build strategies on existing goals
- Report 5-year accomplishments

Project	Municipality	Agency	Award
Water System Mitigation Project – Phase I	Saipan	Commonwealth Utilities Corp.	$4,596,513
Kannat Talba Flood Control & Drainage System	Saipan	Dept. of Public Works	$2,123,650
Susupe Office Building Shutters	Tinian	Dept. of Public Safety	$37,223
Tinian Aging Center Storm Shutters	Tinian	Dept. of Community & Cultural Affairs	$33,270
Fire Station 1 & 5 Concrete Roof – Phase I	Saipan	Dept. of Fire & Emergency Medical Services	$212,500
Concrete Power Poles – Phase I	Rota	Commonwealth Utilities Corp.	$166,800

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

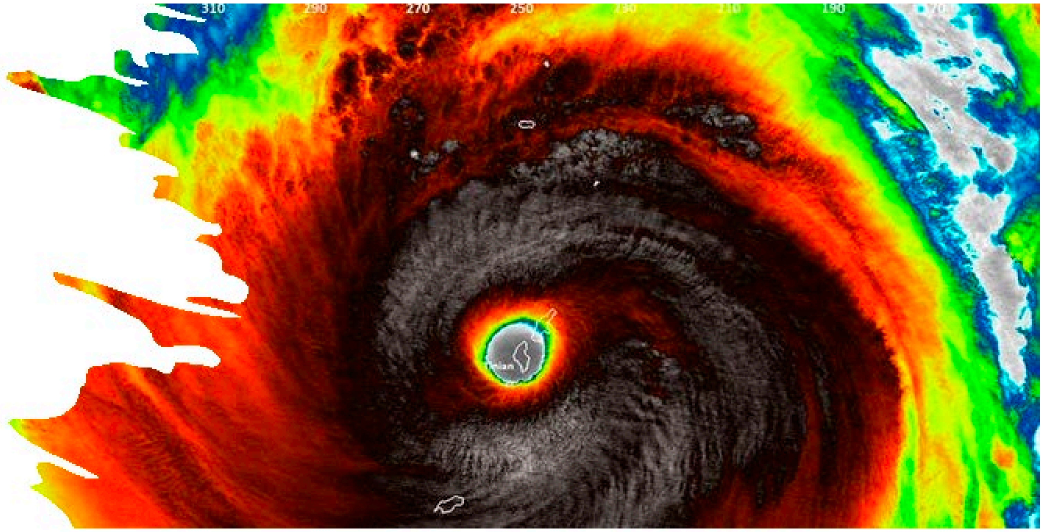
Community Stakeholders Survey

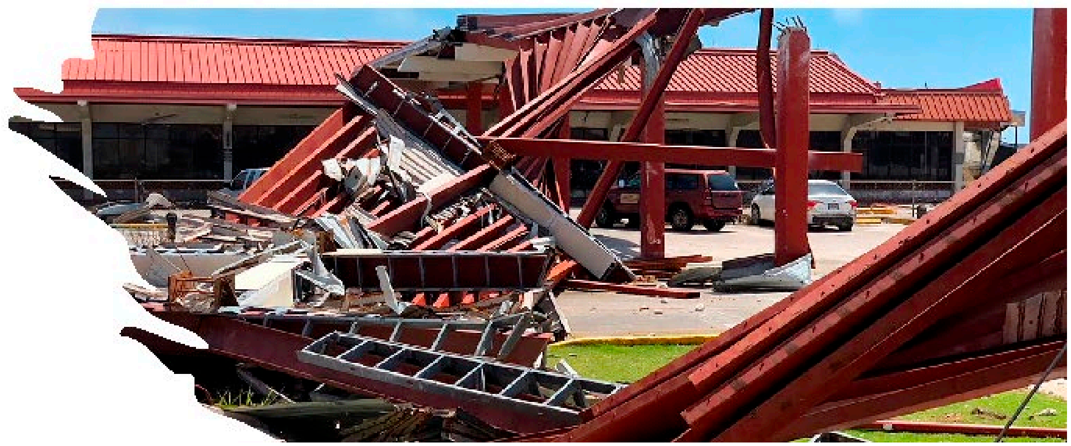
https://acesse.one/SSMPpublic

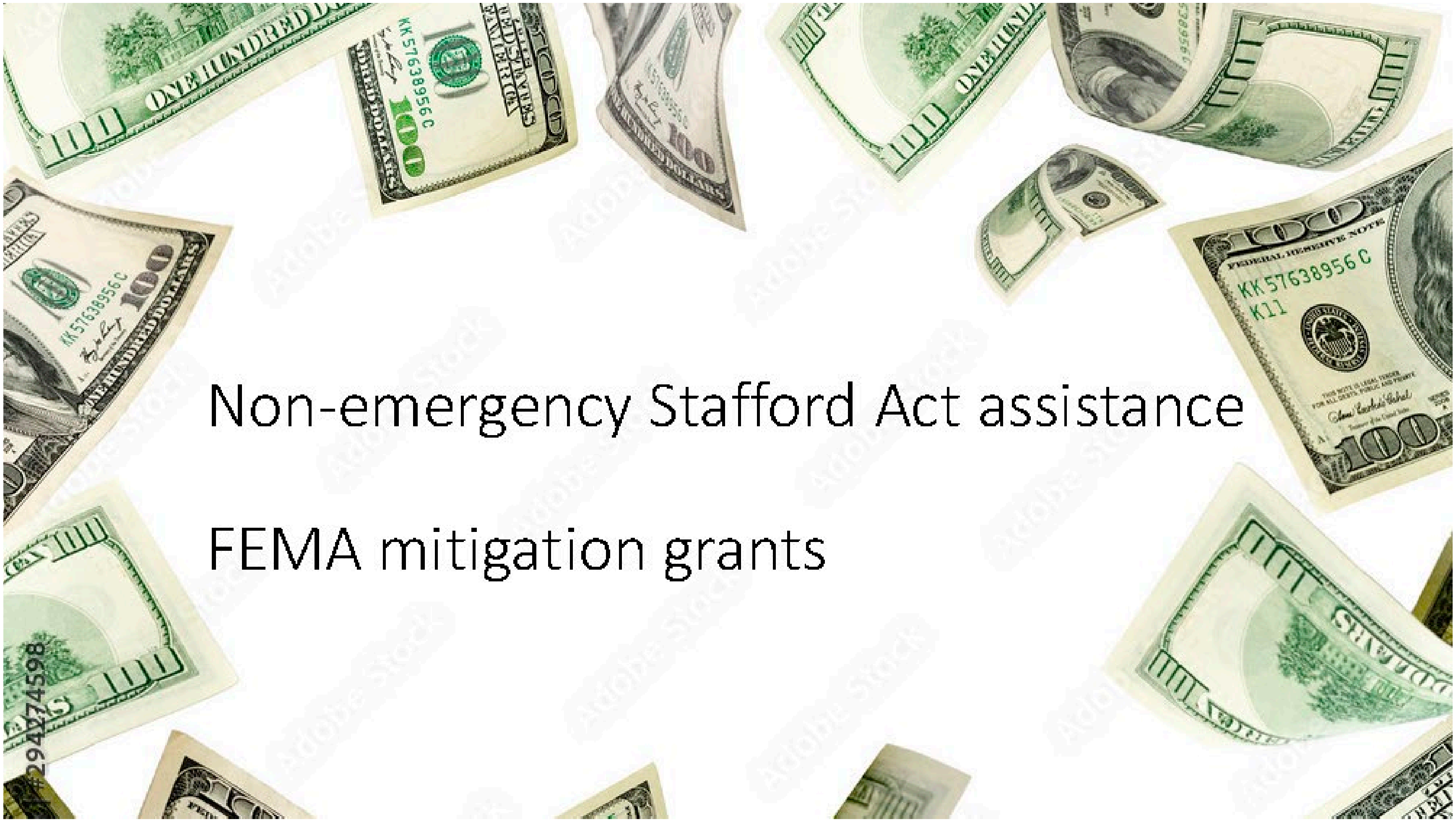
A.4.7 Presentation for Planning and Development Advisory Council

What is a State Standard Mitigation Plan?

- Stafford Act
- Commitment to reduce risks from natural hazards
- Guide resource commitment to reduce the effects of these hazards

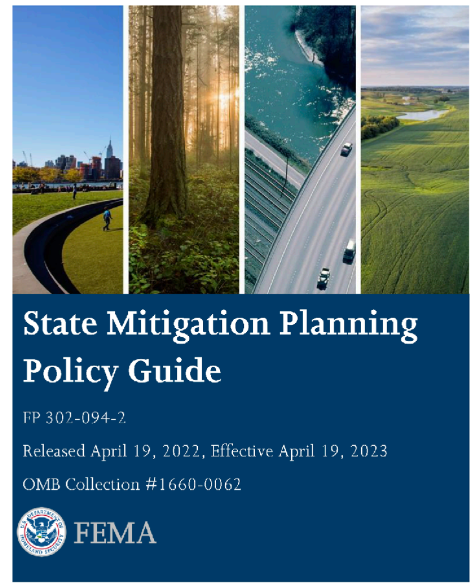





Non-emergency Stafford Act assistance
FEMA mitigation grants

2022 State Mitigation Planning Policy Guide

- Equity and climate change consideration
- Expanded participants in the planning process –
  - Community lifeline experts
  - Climate change experts
  - State agencies that support underserved communities
- Mitigation capabilities
  - Building codes
  - National Flood Insurance Program and flood risk mapping
- Consider current and future risks
- Reorganized requirements for ease of use



What to Expect in the 2024 CNMI SSMP Update Planning Process

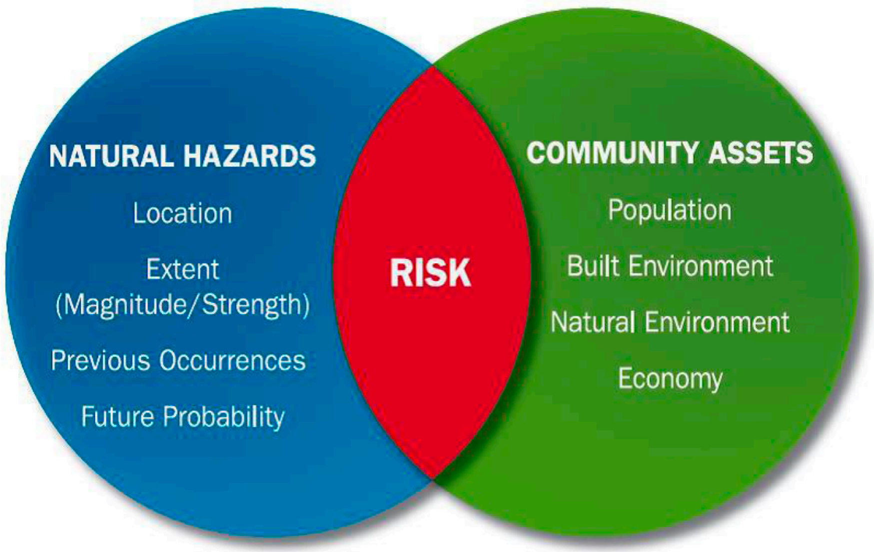
- New organization
  - Follows 2022 Planning Policy
  - Formatted for web hosting by chapter and hazard
  - Consolidated hazard information
    - Profile
    - Risk
    - Vulnerability assessment
    - Loss evaluation

2024 CNMI SSMP Update
Planning Process Progress

- Agency meetings
  - 10 Agencies
- Outreach meetings
  - Tinian
  - Rota
  - Saipan
- Questionnaires

2024 CNMI SSMP Update
Risk Assessment

- Hazard information & maps
- Assets
  - Geo-locate State infrastructure
  - Reorganize critical facilities by community lifeline
- Building replacement costs
- Community demographics / vulnerabilities



What to Expect in the 2024 CNMI SSMP Update
Risk Assessment

- Hazard information & maps
- Assets
  - Geo-locate State infrastructure
  - Reorganize critical facilities by community lifeline
- Building replacement costs
- Community demographics / vulnerabilities

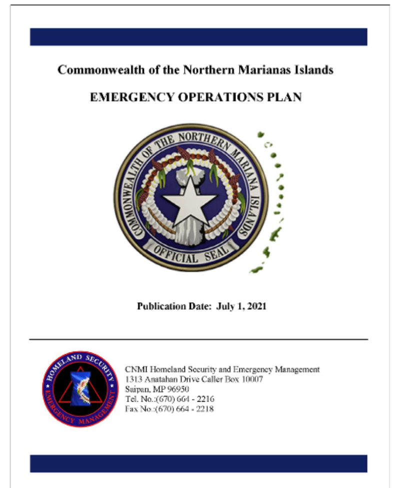
Climate Change

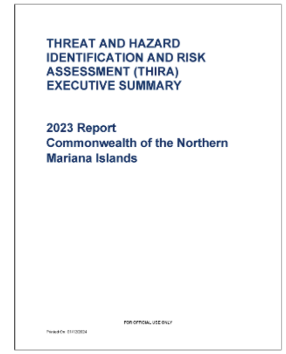
Natural hazard events will intensify the frequency, duration, and severity of future events.

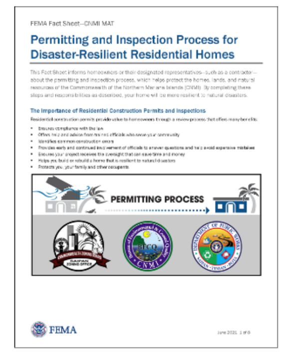
(Keener et al. 2018)

2024 CNMI SSMP Update Mitigation Capabilities

- Incorporate existing CNMI plans
  - All-Hazards Emergency Operations Plan (2021)
  - THIRA/SPR (2023 update)
- CNMI Laws and Regulation review
  - IBC/IRC adopted 2019
- National Flood Insurance Program Information / FEMA Risk MAP


Commonwealth of the Northern Marianas Islands
EMERGENCY OPERATIONS PLAN
Publication Date: July 1, 2021
CNMI Homeland Security and Emergency Management
1313 Anatahan Drive Caller Box 10007
Saipan, MP 96950
Tel. No.:(670) 664 - 2216
Fax No.:(670) 664 - 2218

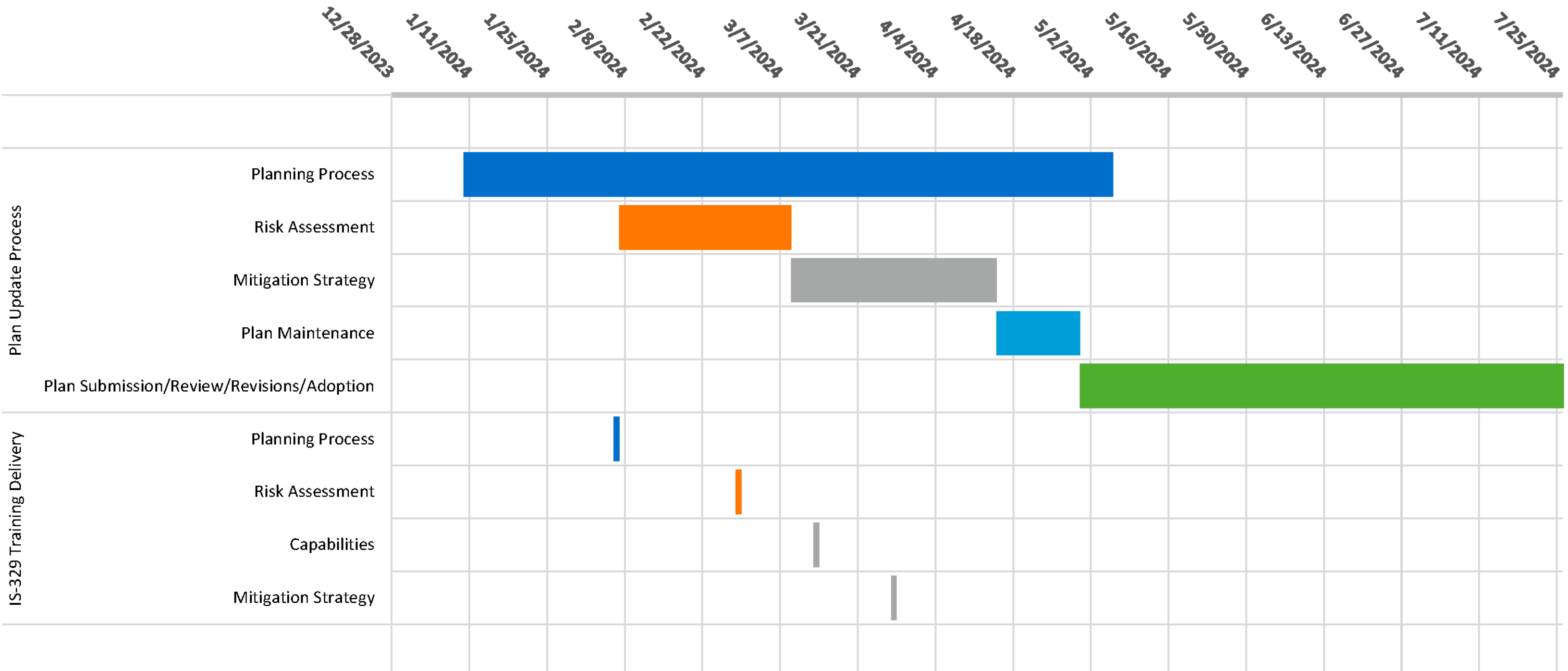

THREAT AND HAZARD IDENTIFICATION AND RISK ASSESSMENT (THIRA) EXECUTIVE SUMMARY
2023 Report
Commonwealth of the Northern Mariana Islands


Permitting and Inspection Process for Disaster-Resilient Residential Homes

2024 CNMI SSMP Update Mitigation Strategies

- Build strategies on existing goals from 2018 SSMP
- Align with Socio-economic / DDR planning task force & CNMI Recovery Administrator
- Integrate objectives/actions from existing plans – CSDP, CDBG-DR Action Plan, Public Land Use Plan
- Report Mitigation Accomplishments 2018-2024

2024 CNMI SSMP Update Timeline



2024 CNMI SSMP Update
Next Steps

- Vulnerability Assessments
- Draft Mitigation Capabilities Chapter
- Collaborate with stakeholders to develop Mitigation Strategies, Objectives and Actions
- Stakeholder engagement

Government Agency Stakeholders Survey

https://acesse.one/SSMPAgency

Community Stakeholders Survey

https://acesse.one/SSMPpublic

A.4.8 Presentation for Stakeholder Mitigation Action Plan Prioritization

Hazard Mitigation
Grant Program

Office of the Governor

State Hazard Mitigation Plan Update 2024

Mitigation Action Plan Prioritization Stakeholders Meeting

Governor’s Conference Room
Saipan

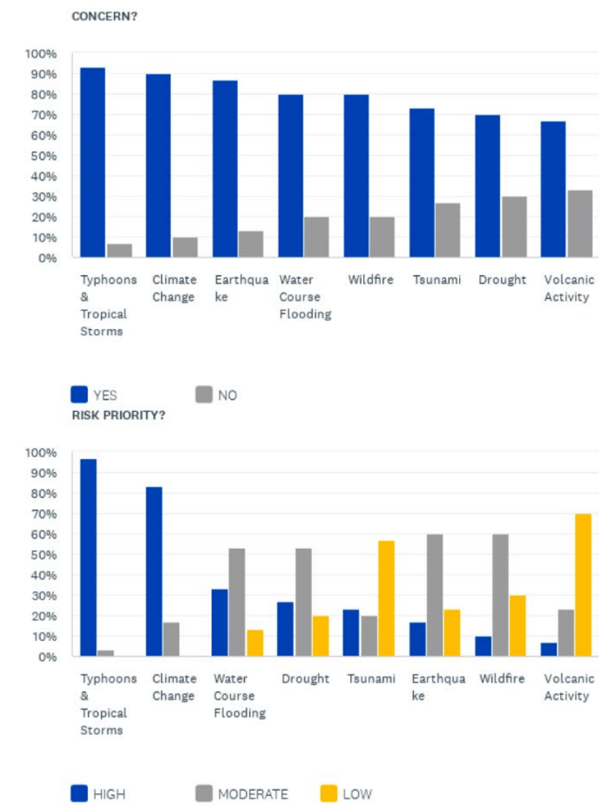
May 8, 2024

Agenda

- INTRODUCTIONS
- STAKEHOLDER HAZARD RANKINGS
- 2024 SHMP UPDATE HAZARD RISK ASSESSMENT & RANKING
- MITIGATION ACTIONS
- MITIGATION ACTIONS PRIORITIZATION
- MITIGATION ACTION PRIORITIZATION WORKSHEET
- QUESTIONS

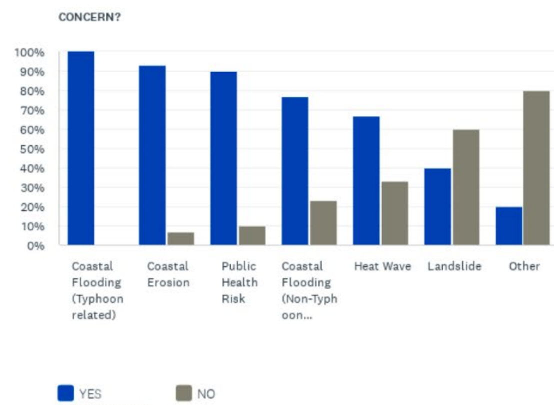
Agency Stakeholder Survey Results

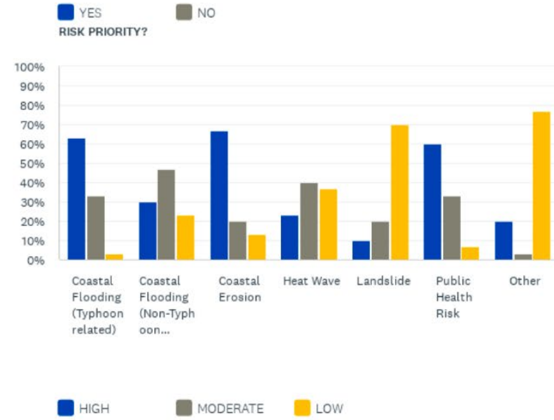
Q8 Are the following natural hazards still a concern to the community? Have risk priorities changed since the last SSMP update?



Agency Stakeholders Survey Results

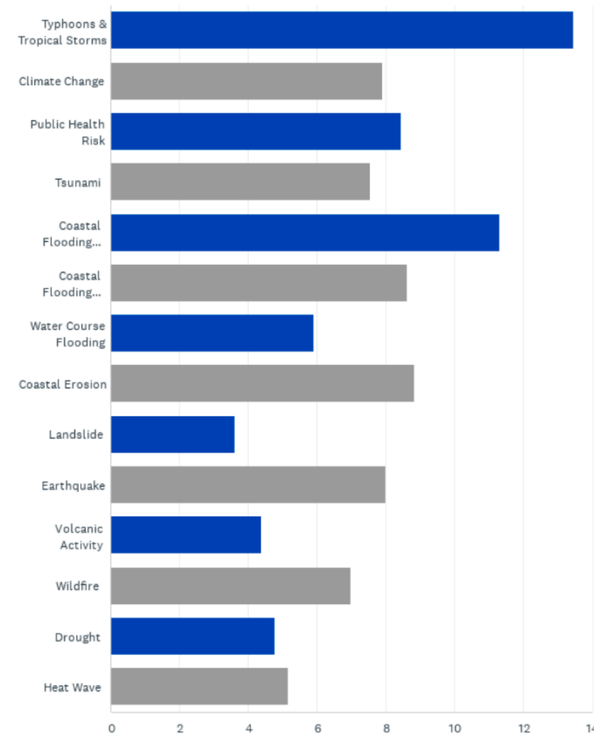
Q9 Are the following natural hazards a concern to the community? If so, please rate the risk to the community (high, moderate, low)? Is there another significant hazard that is a threat to the community that is not listed?





Community Stakeholders Survey Results

Q6 The Federal Emergency Management Agency (FEMA) has identified the following hazards in the National Risk Index (National Risk Index | FEMA.gov). Please rank the following natural hazards in order of the threat they pose to your community.



Natural Hazard Ranking

Table 4.11-1. 2024 SHMP update relative risk ranked results for the hazards of concern.

Hazard Rank	Hazard	Frequency	Population	Assets	Spatial Exent	Warning	Duration	Adaptive Capacity	Future Conditions	Relative Risk Factor
High	Typhoon, Wind	2	3	3	3	0	2	2	3	7.2
High	Typhoon, Storm surge	2	2	3	2	0	2	2	3	6.0
Medium	Tsunami	1	2	3	2	3	1	0	2	3.3
Medium	Drought	2	1	1	3	0	3	2	3	3.3
Medium	Flood, Event-based	1	2	2	2	0	1	2	3	2.9
Medium	Flood, Coastal Erosion	2	1	1	1	0	2	2	3	2.9
Medium	Health Risks	1	3	0	3	0	3	1	3	2.7
Low	Extreme Heat & Heat Wave	1	2	0	3	0	2	1	3	2.1
Low	Wildfire	1	1	1	1	3	2	2	3	2.0
Low	Earthquake	1	1	1	3	3	0	2	0	1.8
Low	Volcanic Activity	1	1	1	1	3	2	2	0	1.7
Low	Flood, Chronic Coastal	3	0	0	1	0	1	2	3	0.8

Department or Agency	Location	Existing or Future Development	Community Lifeline(s)	Potential Funding Source(s)	Timeline
1. Progress was made for the 2024 SHMP update to spatially geolocate commonwealth assets, including critical facilities, and general building stock. However, data are still incomplete or are generalized (i.e., building types). 2. Detailed 2020 Census data were available in February 2024; however, there was insufficient time during the 2024 SHMP update to use this information to update the Social Vulnerability Index maps for Saipan, Tinian, and Rota.					
Action: 1. Update the social vulnerability GIS information with detailed demographic data from the 2020 Census released in February 2024.					
Hazard: All					

Other funding sources and programs are detailed in Appendix F.

6.5.3 Mitigation Action Plan Prioritization

Element S12-b. Was the prioritization of mitigation action and activities updated based on the updated analysis of risks, capabilities, and progress?

Stakeholders prioritized identifying mitigation actions in the 2024 SHMP update based on hazards in the risk assessment, capabilities, and progress on previously identified actions. The prioritization schema for action implementation differs from the process and criteria used to rank planning and project proposals for FEMA mitigation grant funding. Each action in the 2024 SHMP update was ranked based on the following criteria:

- Will the action result in lifeline safety?
- Will the action result in property protection of vulnerable state assets?
- Will the action be cost-effective? (future benefits exceed cost)
- Is the action technically feasible?
- Will the action mitigate impacts from climate change?
- Does the state have the legal authority to implement?
- Is funding available for the action?
- Will the action have a positive impact on the natural environment?
- Does the action benefit socially vulnerable communities?
- Does the state have the administrative capability to execute the action?
- Will the action reduce risk to more than one hazard?

- Can the action be completed in less than 5 years?
- Is there an agency/department local champion for the action?
- Will the action support other local objectives (such as capital improvements, economic development, environmental quality, or open space preservation?) or policies of other plans and programs?

The answers to each of these questions are weighted as follows:

- Yes = 3 points
- Not sure, could be either yes or no, or question is difficult to quantify = 1 point
- No = 0 points

Following scoring of each action, priorities are assigned based on the following metrics:

- 31 or more = High Priority
- 15 to 30 = Medium Priority
- 0 to 14 = Low Priority

This prioritization process was applied to hazards identified by the risk assessment conducted for the 2024 SHMP update. It was also applied based on updates to the capabilities assessed in Chapter 5 (Capability Assessment) and Appendix E (Capability Assessment Supplement), as shown in the prioritization questions above. Table 6-2 shows the implementation priority for each action included in the 2024 SHMP update, based on the following characteristics of the action:

- **Mitigation Goals—**Goals are listed in detail in Section 6.2 (Mitigation Goals and Objectives)
- **Mitigation Objectives—**Objectives are listed in detail in Section 6.2 (Mitigation Goals and Objectives)
- **Action Type—**Mitigation actions are summarized into the following four types define by FEMA:
  - **Local Plans and Regulations—**Include government authorities, policies, or codes that encourage risk reduction, such as building codes and state planning regulations. This may also include planning studies.
  - **Structure & Infrastructure Projects—**Involve modifying existing structures and infrastructure or constructing new structures to reduce the impact of hazards.
  - **Natural Systems Protection—**Minimize losses while also preserving or restoring the function of natural systems.

2024 State Hazard Mitigation Plan Update
Mitigation Action Prioritization Worksheet

Name:

Organization:

Email:

Action No	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score
2018-01-01	Harden essential facilities.															
2018-01-02	Assess hardening and retrofit requirements for critical facilities that must remain operational.															
2018-01-03	Develop proposals to harden and retrofit facilities and seek funding.															
2018-01-04	Convert the overhead power distribution system to an underground system. Set policy governing requirements for new line installations.															
2018-01-05	Replace wood poles with concrete poles. Set policy governing requirements for new concrete pole installations.															

Mitigation Action Prioritization Worksheet

Mitigation Action Prioritization Worksheet Instructions

Step 1: For each mitigation action listed on the worksheet, please answer questions 1 to 14 below.

Step 2: Based on your answer, assign the following points to each question:
3 points = Yes
1 point = Not sure, could be either yes or no, the question is difficult to quantify
0 points = No

Step 3: Enter the points on the worksheet in the column that corresponds to the question

	Worksheet Column Heading	Question
1	Lifeline Safety	Will the action result in lifeline safety?
2	Property Protection	Will the action result in property protection of vulnerable state assets?
3	Cost-Effective	Will the action be cost-effective? (future benefits exceed cost)
4	Technically Feasible	Is the action technically feasible?
5	Climate Change	Will the action mitigate impacts from climate change?
6	Legal Authority	Does the CNMI have the legal authority to implement?
7	Funding	Is funding available for the action?
8	Env. Impact	Will the action have a positive impact on the natural environment?
9	Social Vulnerability	Does the action benefit socially vulnerable communities?
10	Administrative Capacity	Does the state have the administrative capability to execute the action?
11	Multi-hazard	Will the action reduce risk to more than one hazard?
12	Timeline	Can the action be completed in less than 5 years?
13	Local Champion	Is there an agency/department local champion for the action?
14	Other Objectives or Policies	Will the action support other local objectives (such as capital improvements, economic development, environmental quality, or open space preservation?) or policies of other plans and programs?

2024 SHMP Update
Mitigation Action Prioritization Worksheet

2024 State Hazard Mitigation Plan Update
Mitigation Action Prioritization Worksheet

Name:

Organization:

Email:

Action No	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score
2018-01-01	Harden essential facilities.															
2018-01-02	Assess hardening and retrofit requirements for critical facilities that must remain operational.															
2018-01-03	Develop proposals to harden and retrofit facilities and seek funding.															
2018-01-04	Convert the overhead power distribution system to an underground system. Set policy governing requirements for new line installations.															
2018-01-05	Replace wood poles with concrete poles. Set policy governing requirements for new concrete pole installations.															

Questions


Mitigation Action
Prioritization Worksheet
Due - May 24, 2024

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Appendix B Map Atlas

28 July 2024

Appendix B Map Atlas

Table of Contents

List of Figures

B.1 Introduction

The 2024 HMP update streamlined the information included in the State Profile (Chapter 2) and the Risk Assessment (Chapter 4.0). This appendix includes additional maps to support each section, as appropriate.

B.1.1 Planning Profile

Full-page figures from the *CNMI Comprehensive Public Use Land Use Plan Update GIS Map Book* (Pacific Engineering Group & Services and Chris Hart & Partners, Inc. 2019) prepared for the Department of Public Lands. Maps from Figure B.1 to Figure B.11 are reprinted from the GIS Map Book and are included here as supplemental information to Section 2.7 Land Use and Development Trends and in support of the risk assessments for each hazard in Chapter 4.0, specifically the analysis for future changes that may impact Commonwealth vulnerability

Reference

Pacific Engineering Group & Services, Chris Hart & Partners, Inc. 2019. Draft - Commonwealth of the Northern Mariana Islands Comprehensive Public Land Use Plan Update - GIS Map Book. Wailuku, HI: CNMI Department of Public Lands. https://www.dropbox.com/scl/fi/adekrl46nk83ng27ojzfu/GIS-BOOK_Full-PDF_2.20.2018-submittal.pdf?rlkey=npz25of4ycw9ikipu226zhps0&e=1&dl=0.

B.1.1.1 Land Use and Development Maps

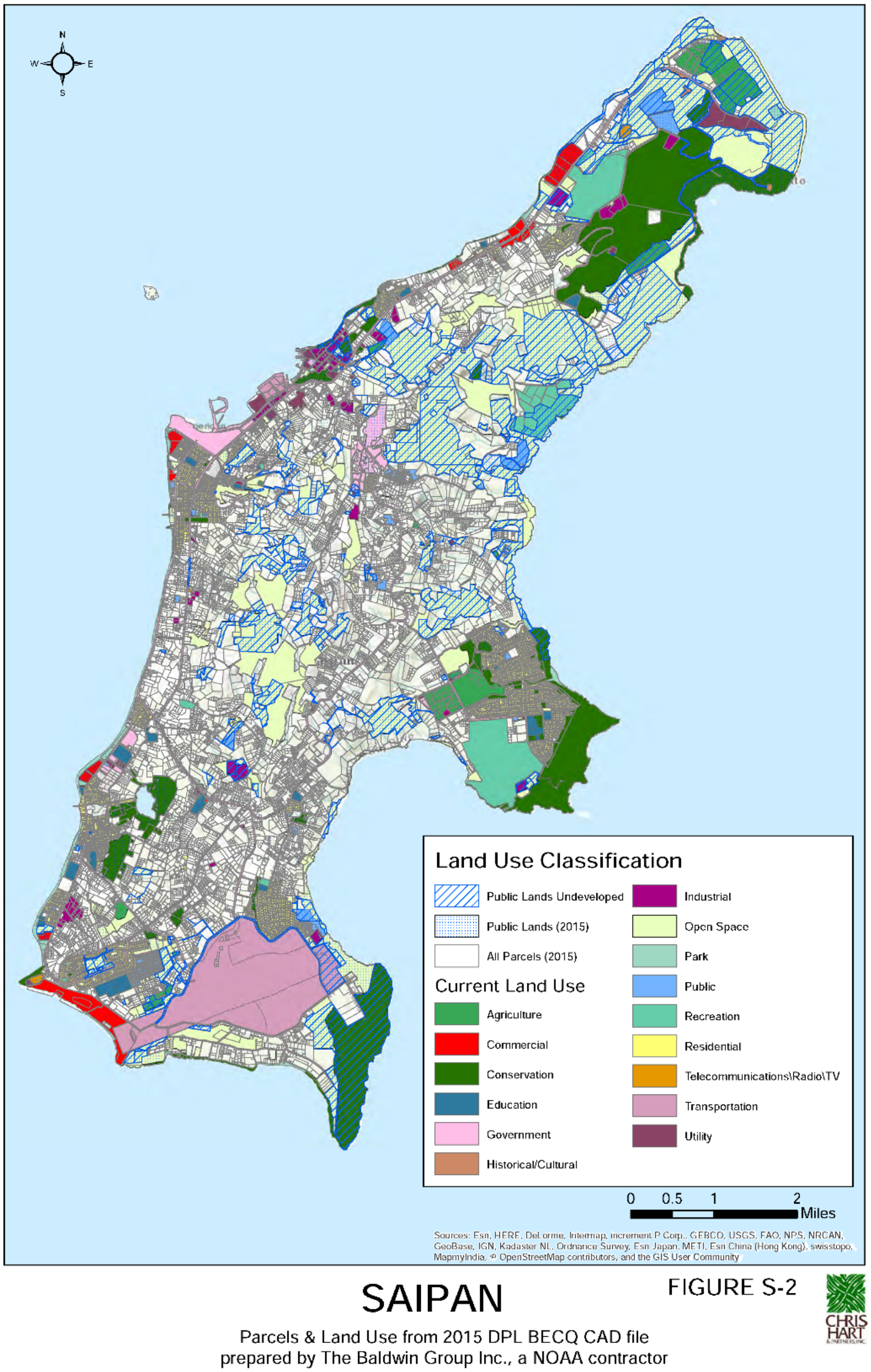
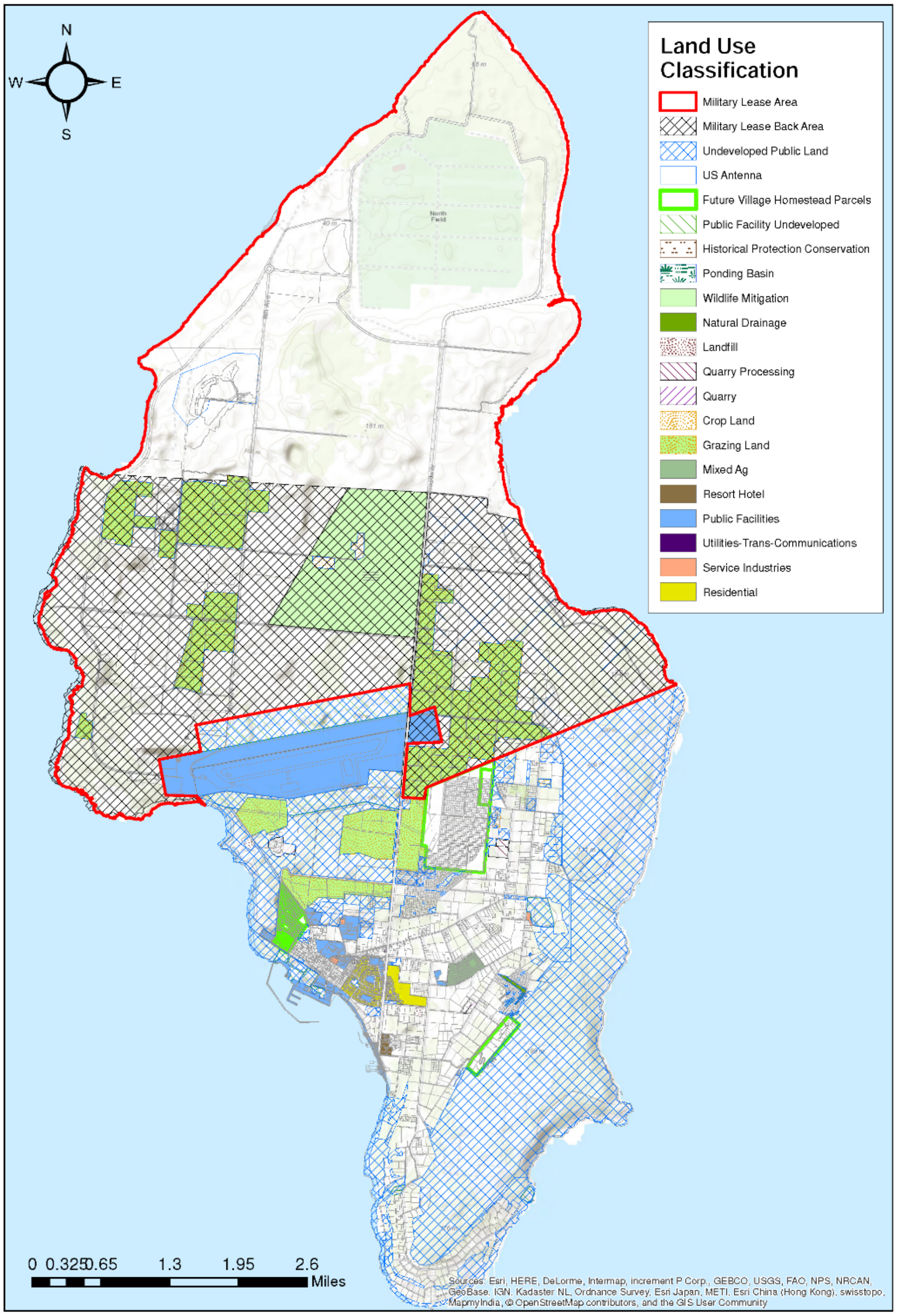


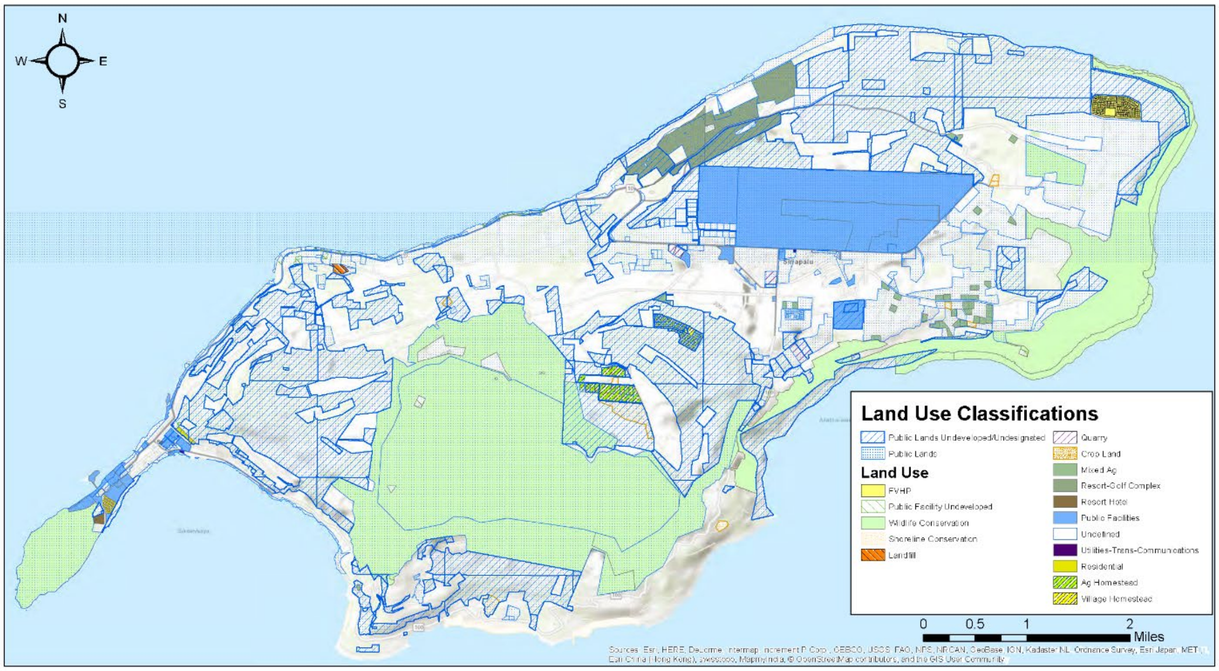
Figure B.1. Land use classification on Saipan.



TINIAN

FIGURE T-2

Figure B.2. Land use classification on Tinian.



ROTA

FIGURE R-2

Information by CNMI DPL

Figure B.3. Land use classification on Rota.

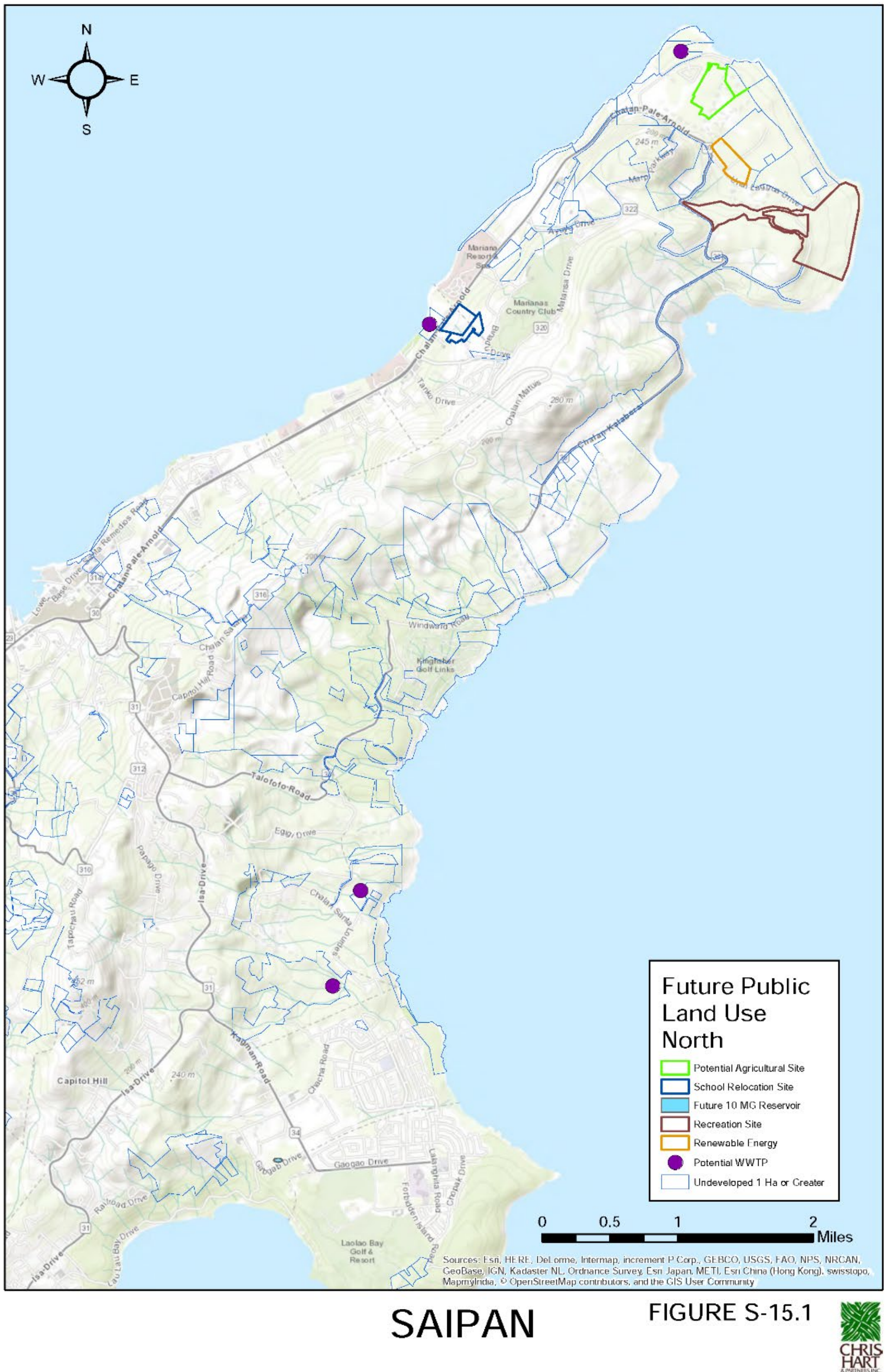


Figure B.4. Future public land use north Saipan.

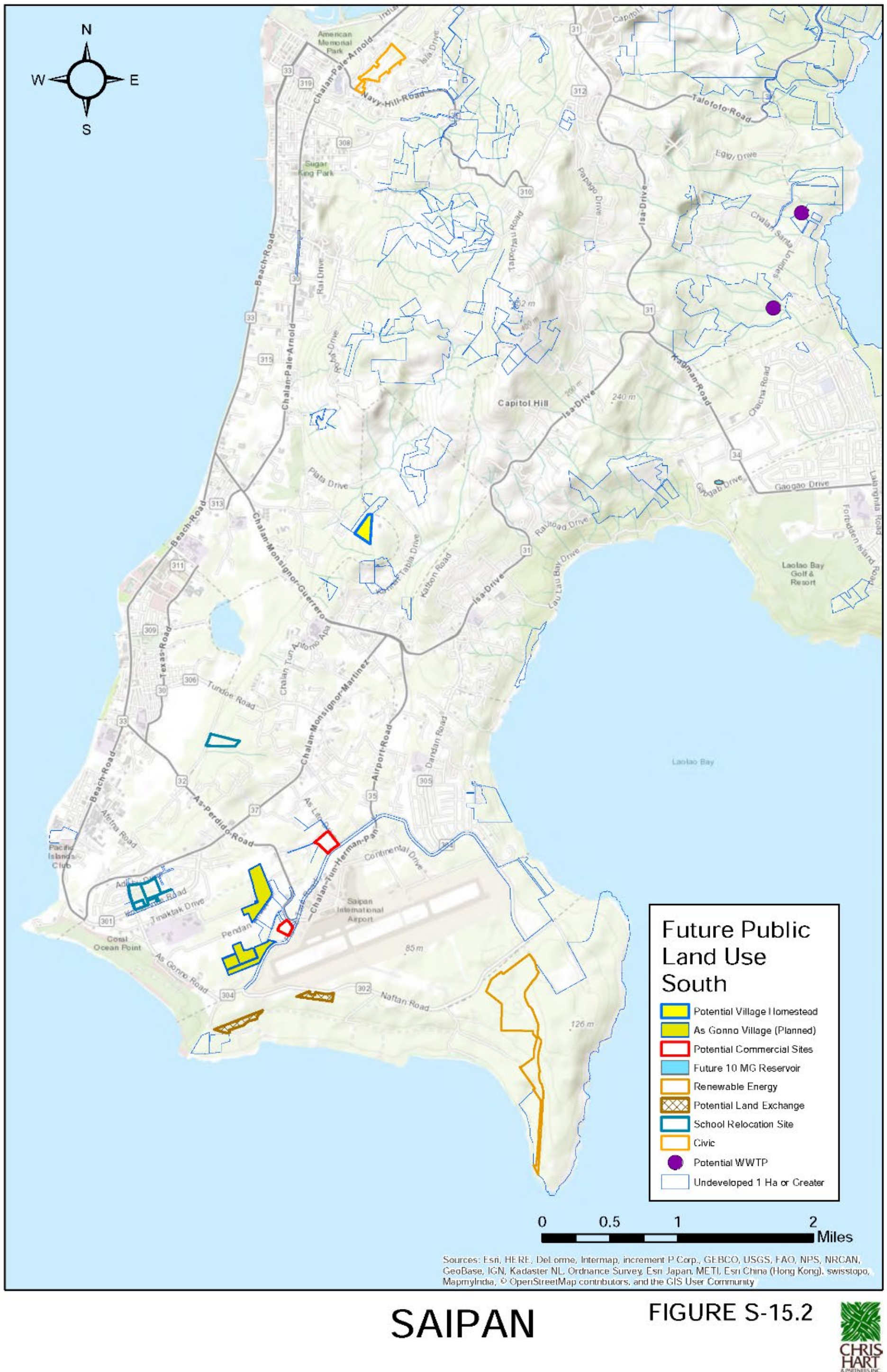
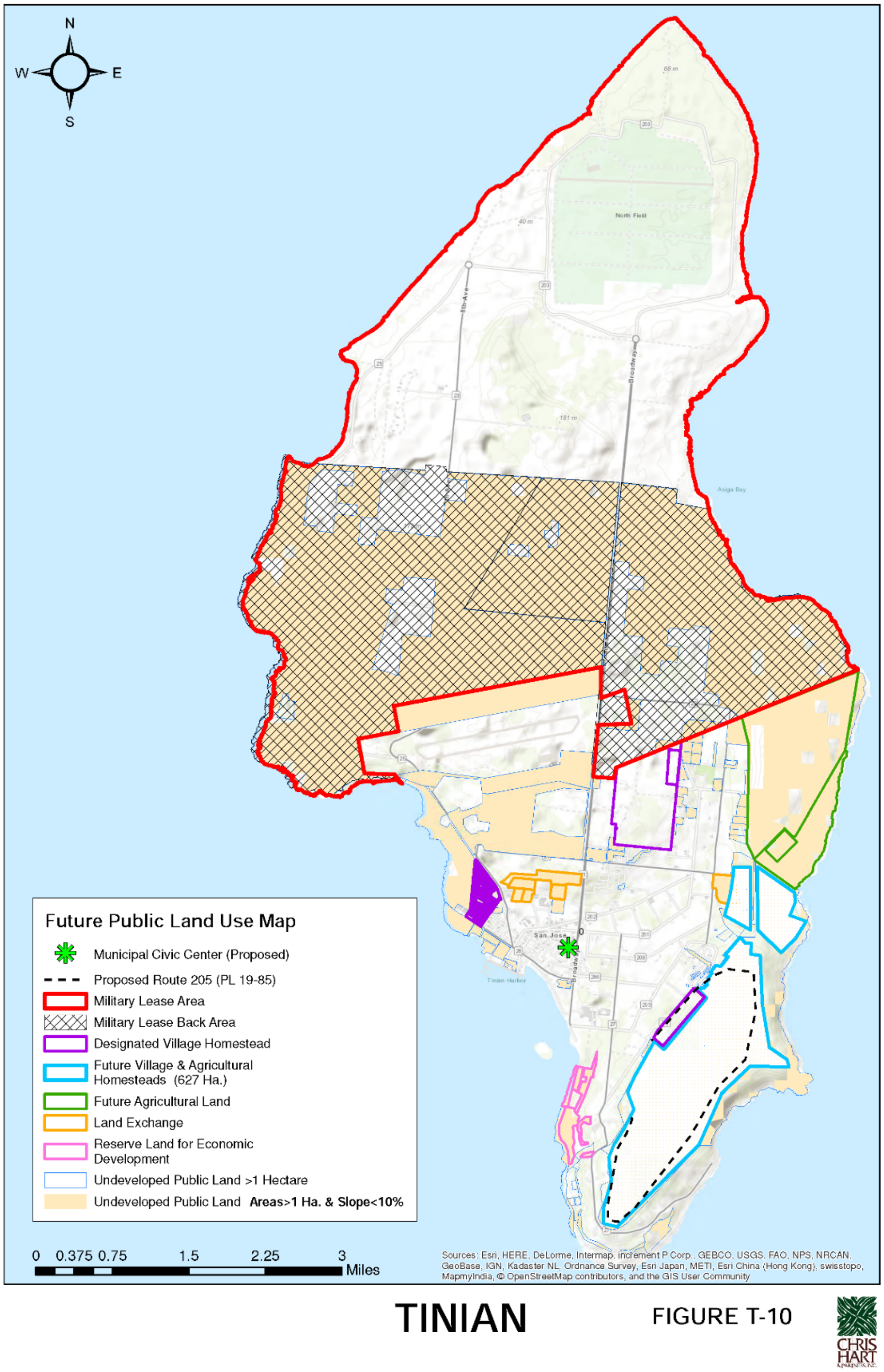


Figure B.5. Future public land use south Saipan



SOURCE: DPL Unifed Parcel Database & Coastal Resources Managment Office

Figure B.6. Future public land use on Tinian.

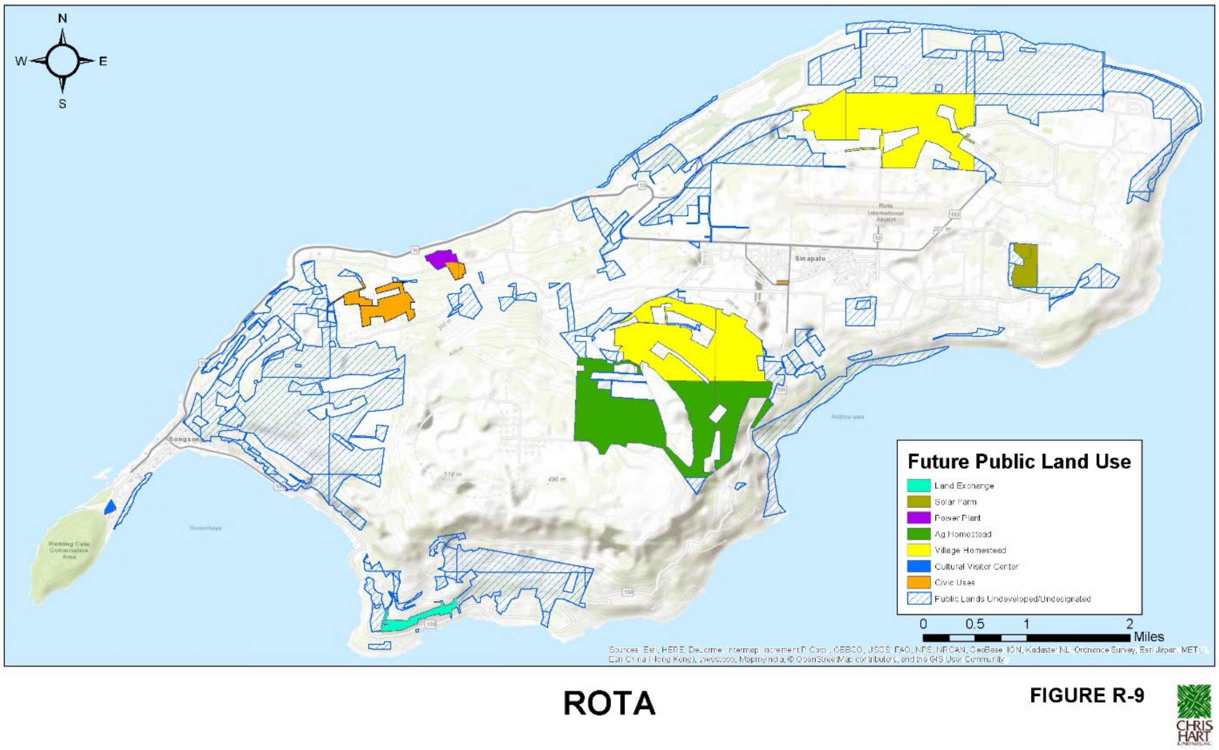


Figure B.7. Future public land use on Rota.

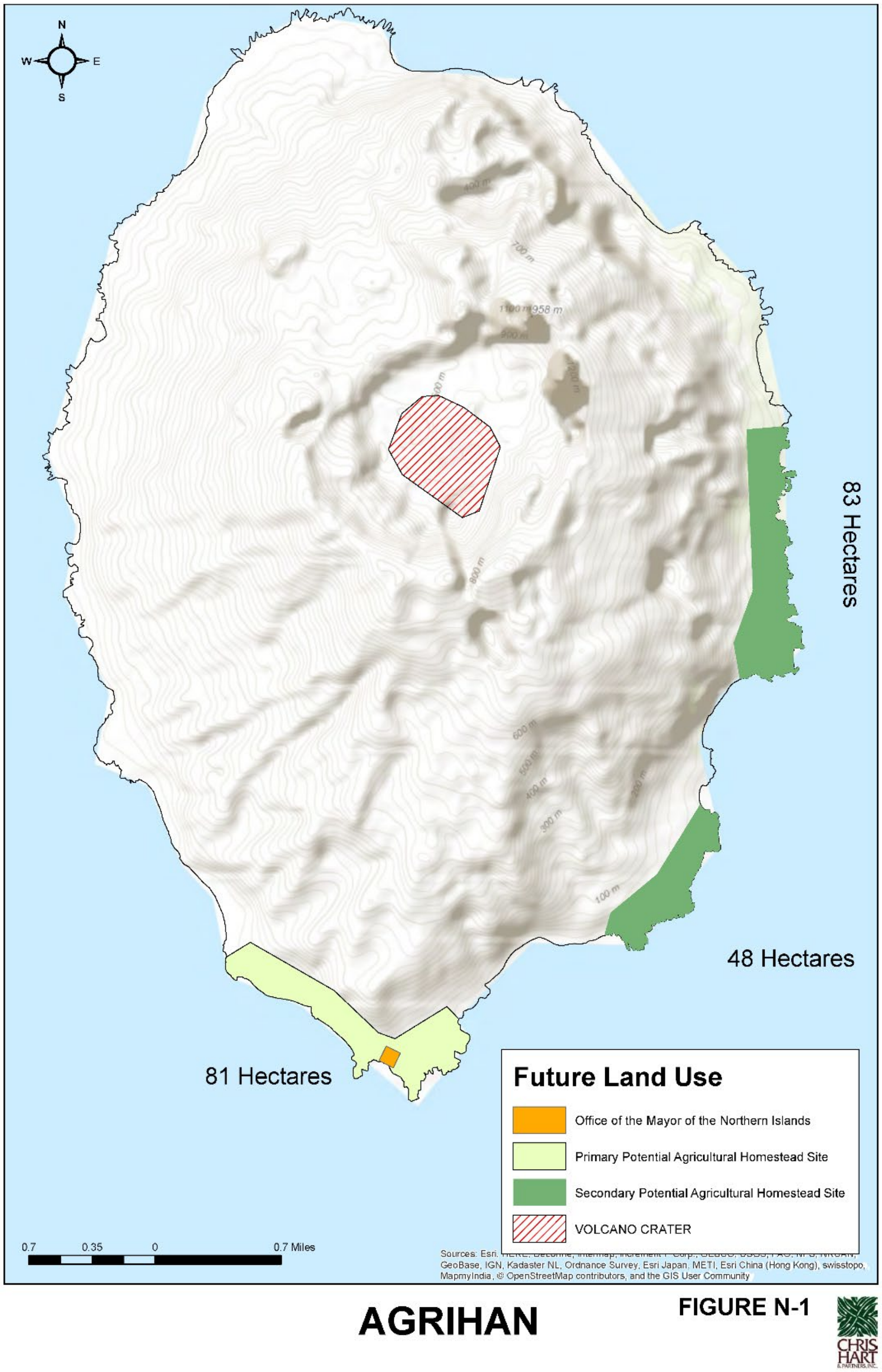
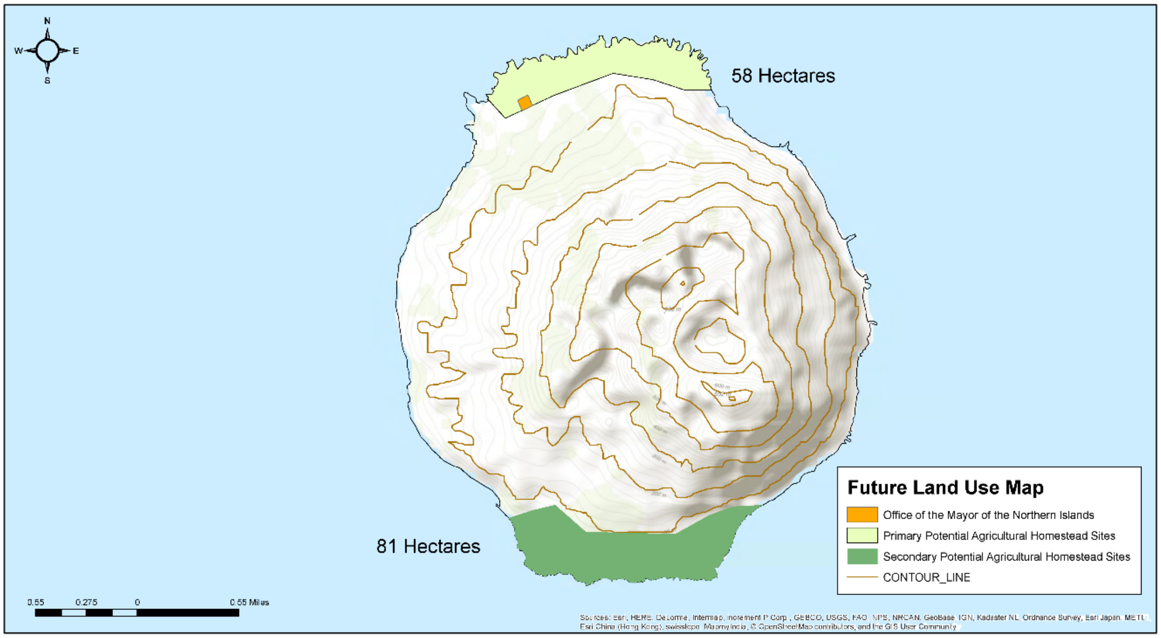


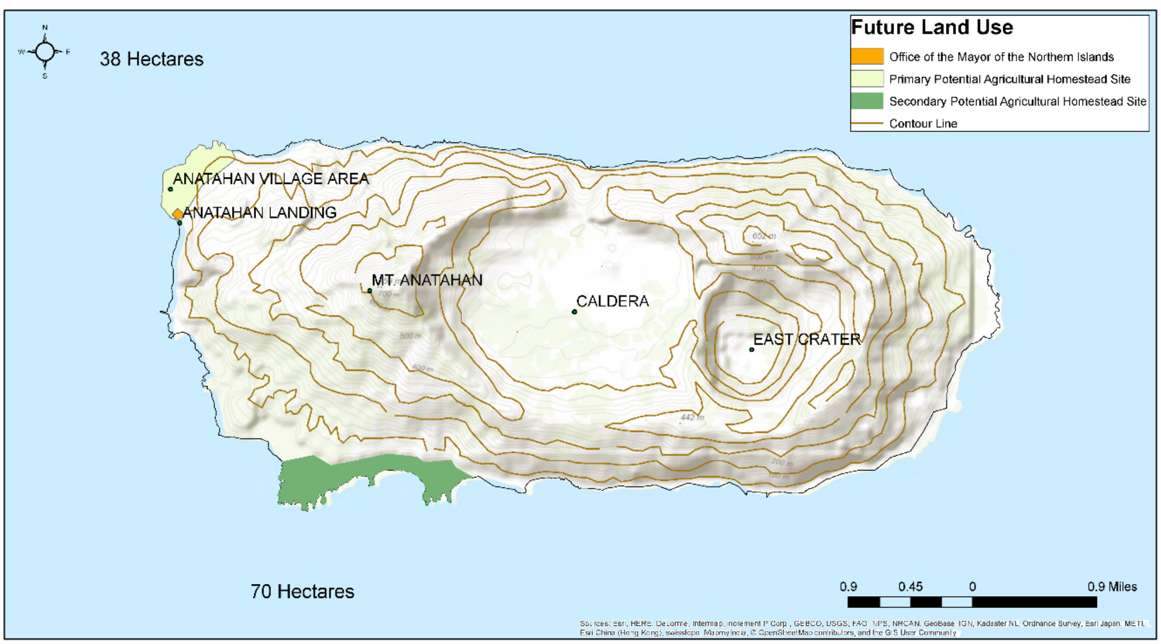
Figure B.8. Future public land use on Agrihan.



ALAMAGAN

FIGURE N-3

Figure B.9. Future public land use on Alamagan.



ANATAHAN

FIGURE N-4

Figure B.10. Future public land use on Anatahan.

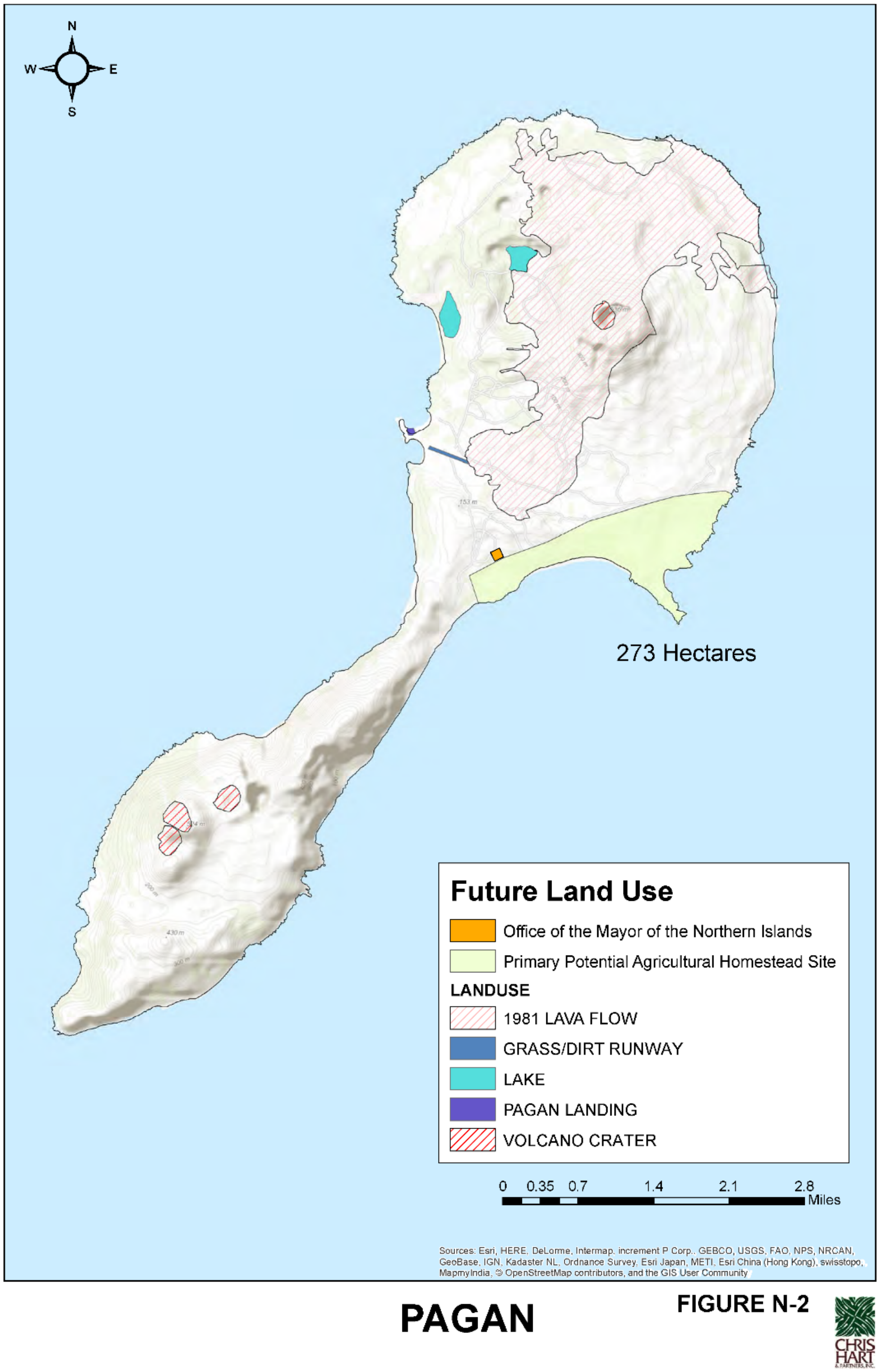


Figure B.11. Future public land use on Pagan.

B.2 Typhoon

B.2.1.1 Extreme Wind Maps

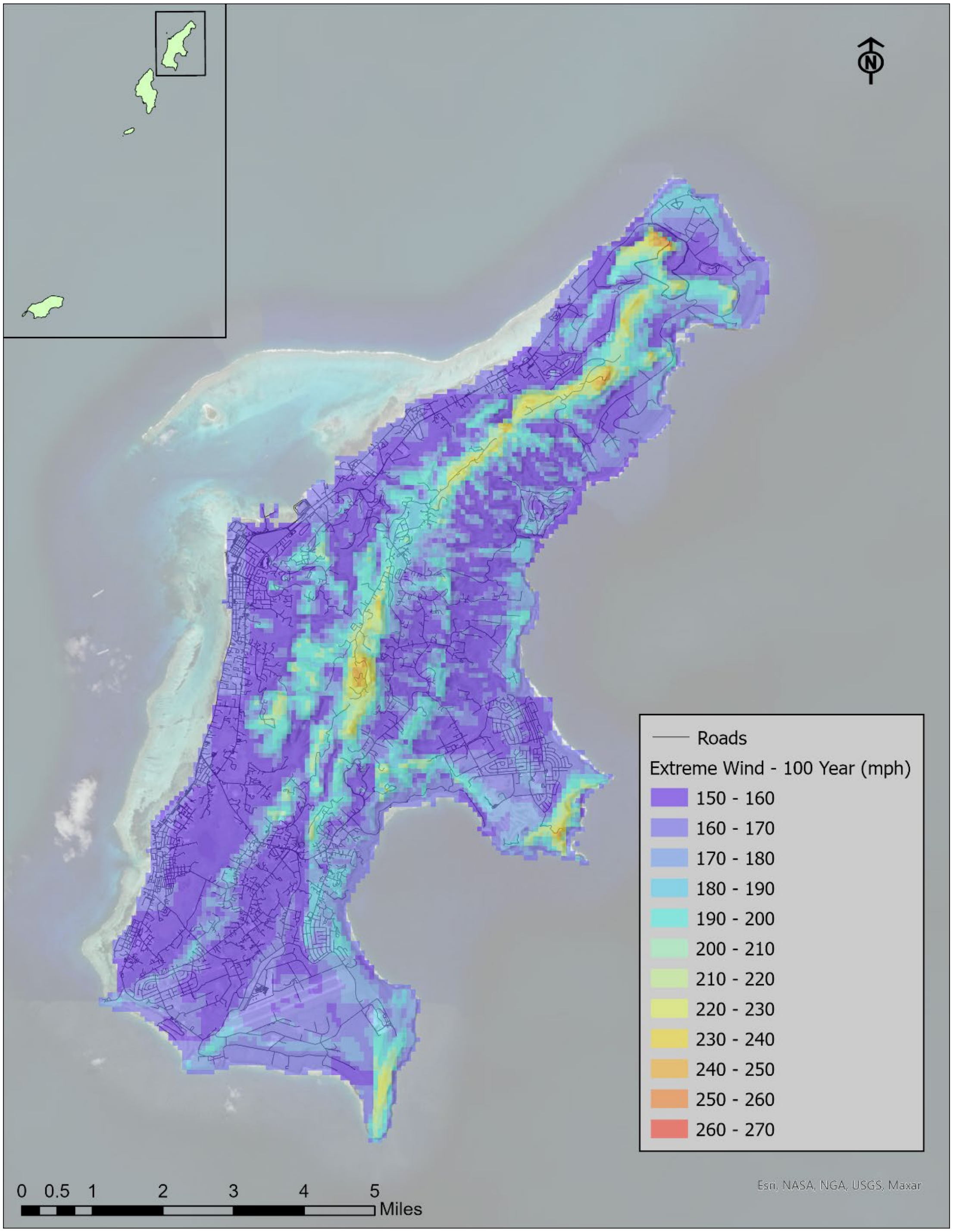


Figure B.12. Extreme Wind Map for 100-year return interval on Saipan.

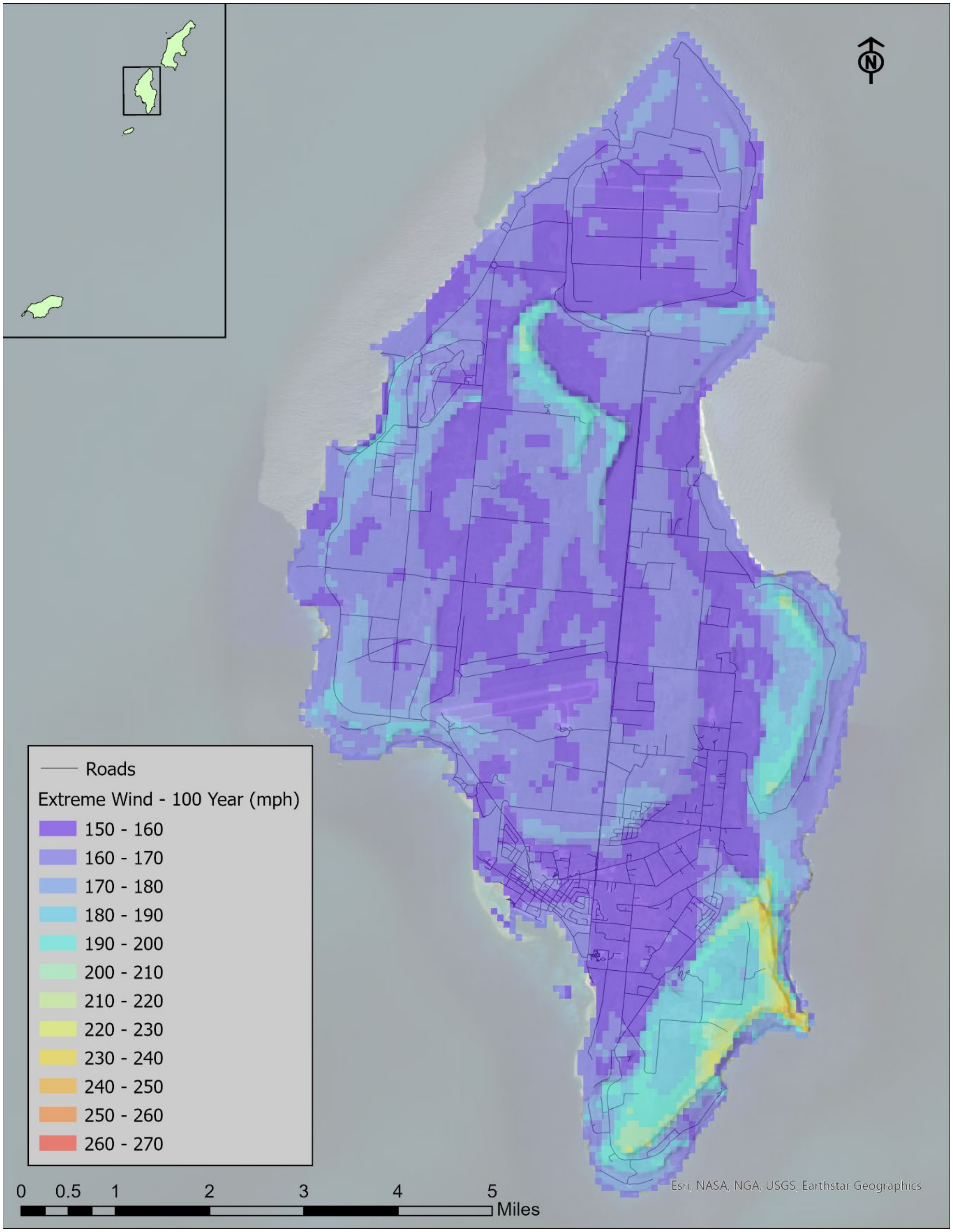


Figure B.13. Extreme Wind Map for 100-year return interval on Tinia.

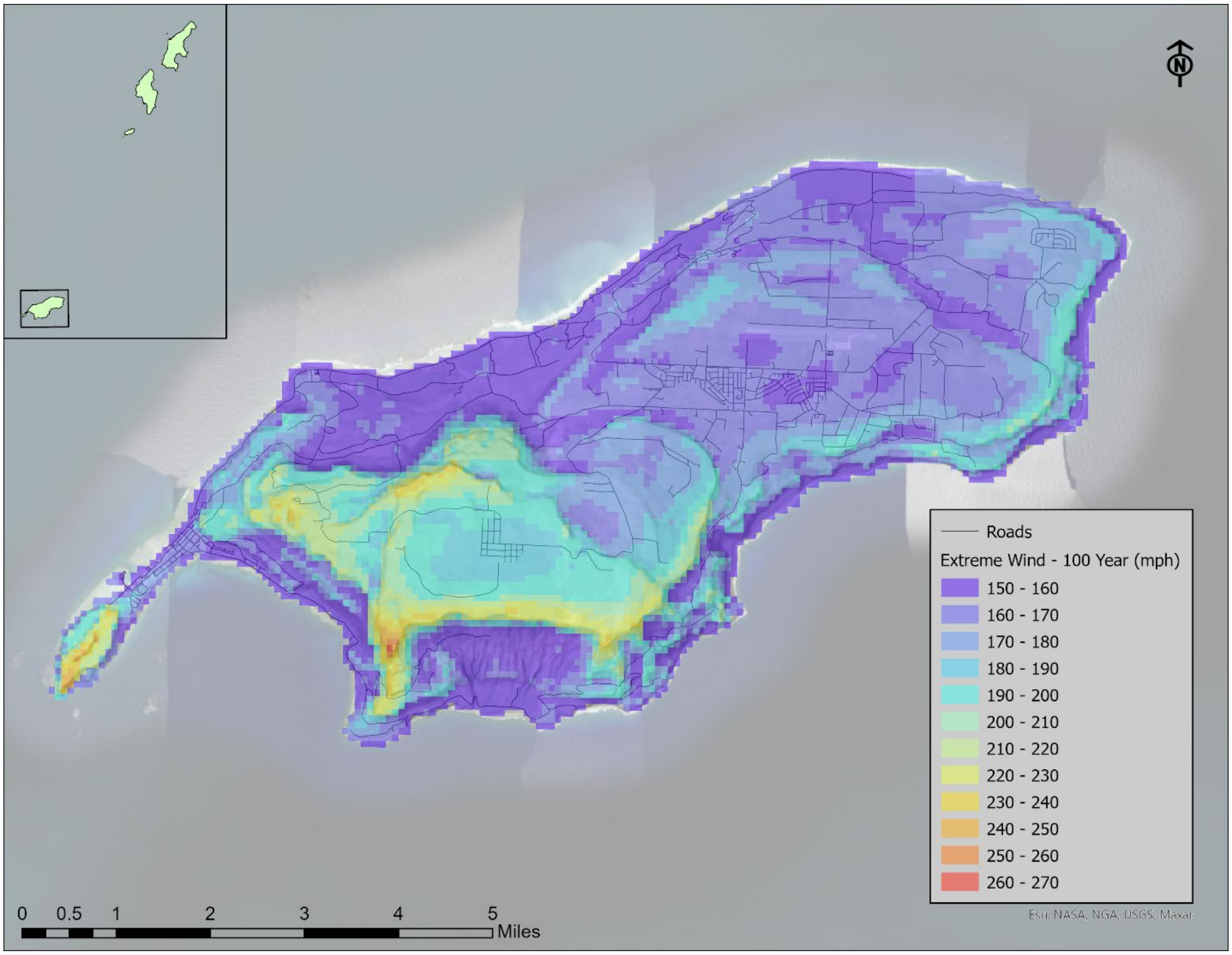


Figure B.14. Extreme Wind Map for 100-year return interval on Rota.

B.2.1.2 Storm Surge

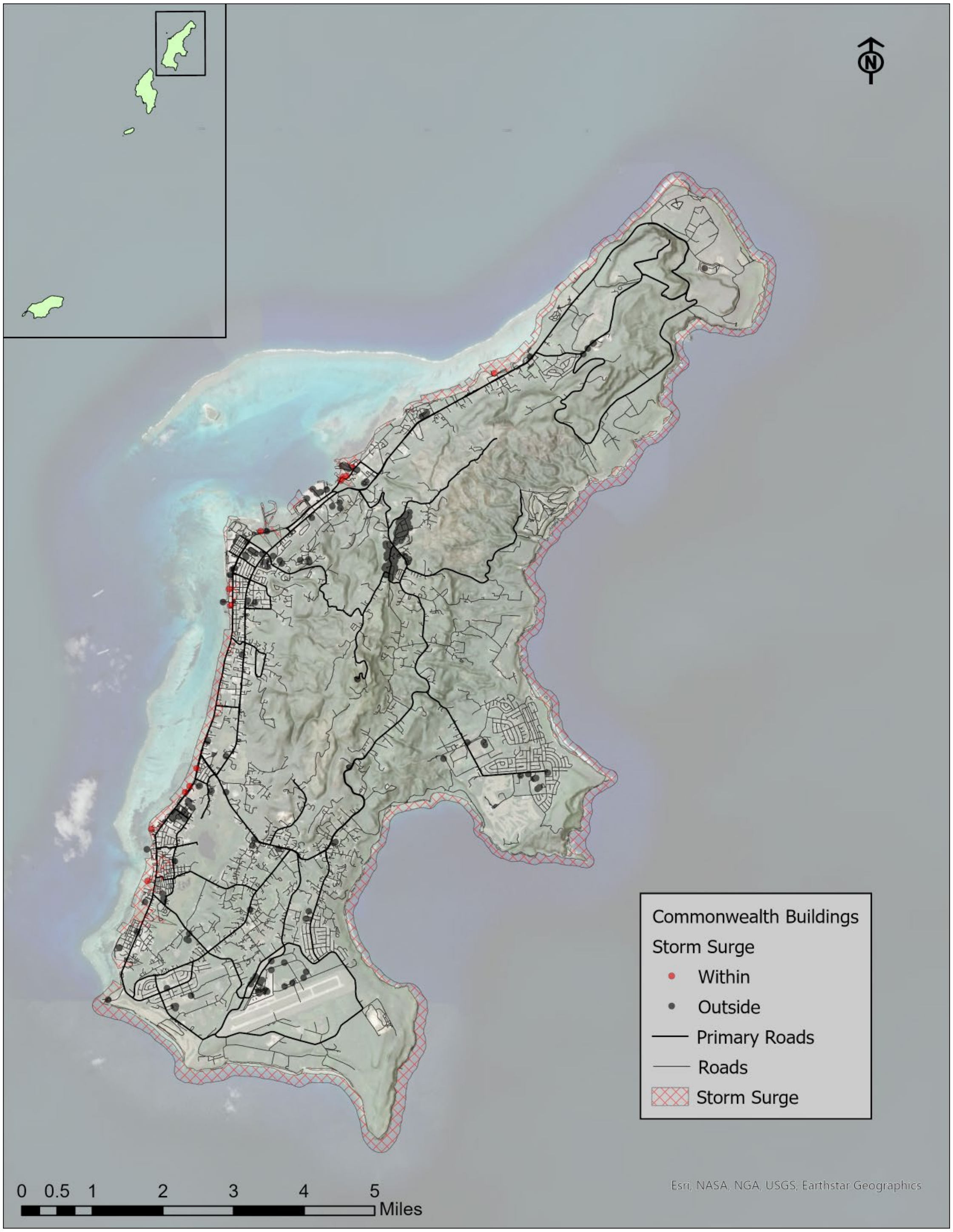


Figure B.2-15. Commonwealth buildings exposed to the typhoon storm surge hazard on Saipan.

Figure B.2-16. Commonwealth buildings exposed to the typhoon storm surge hazard on Tinian.

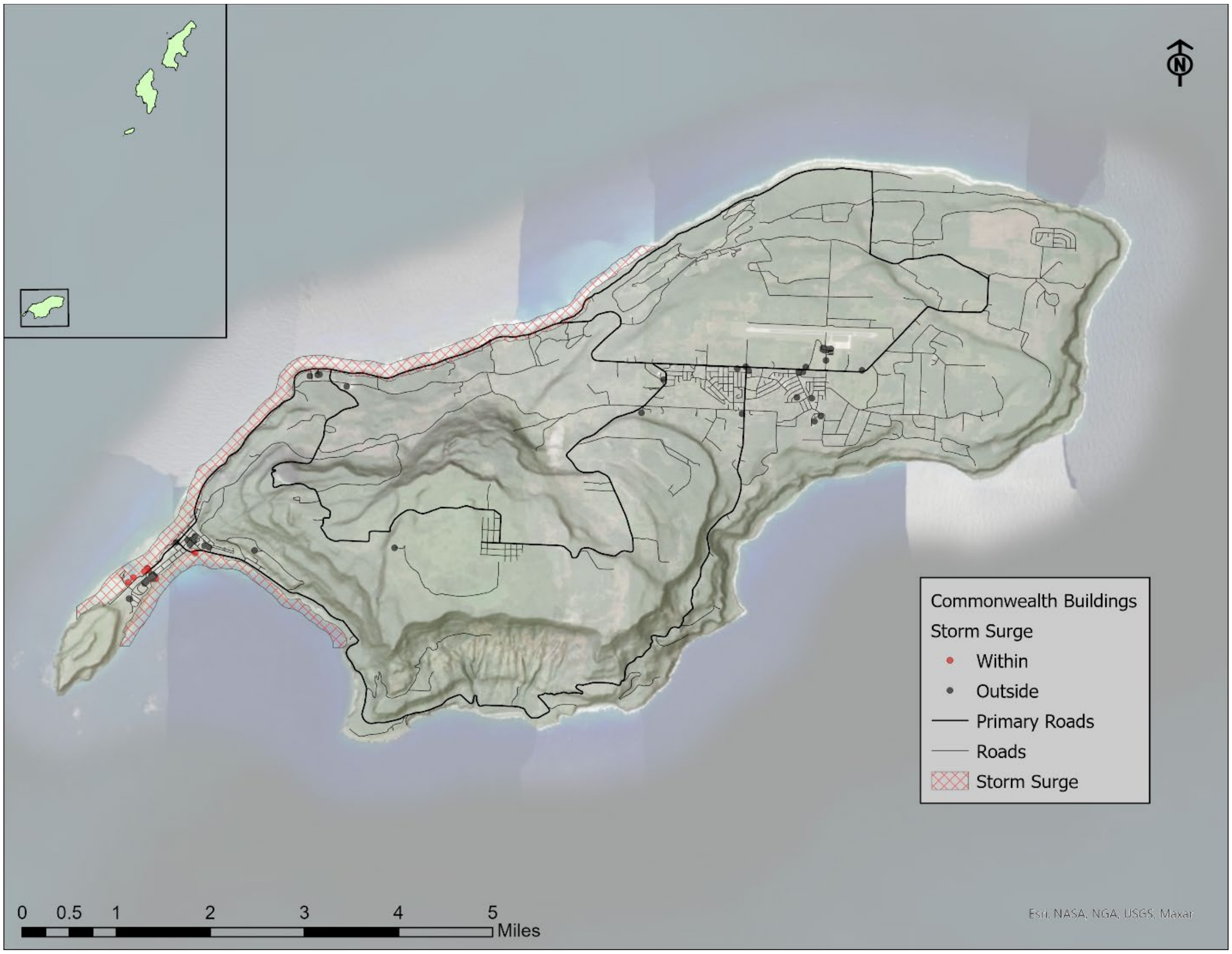


Figure B.2-17. Commonwealth buildings exposed to the typhoon storm surge hazard on Rota.

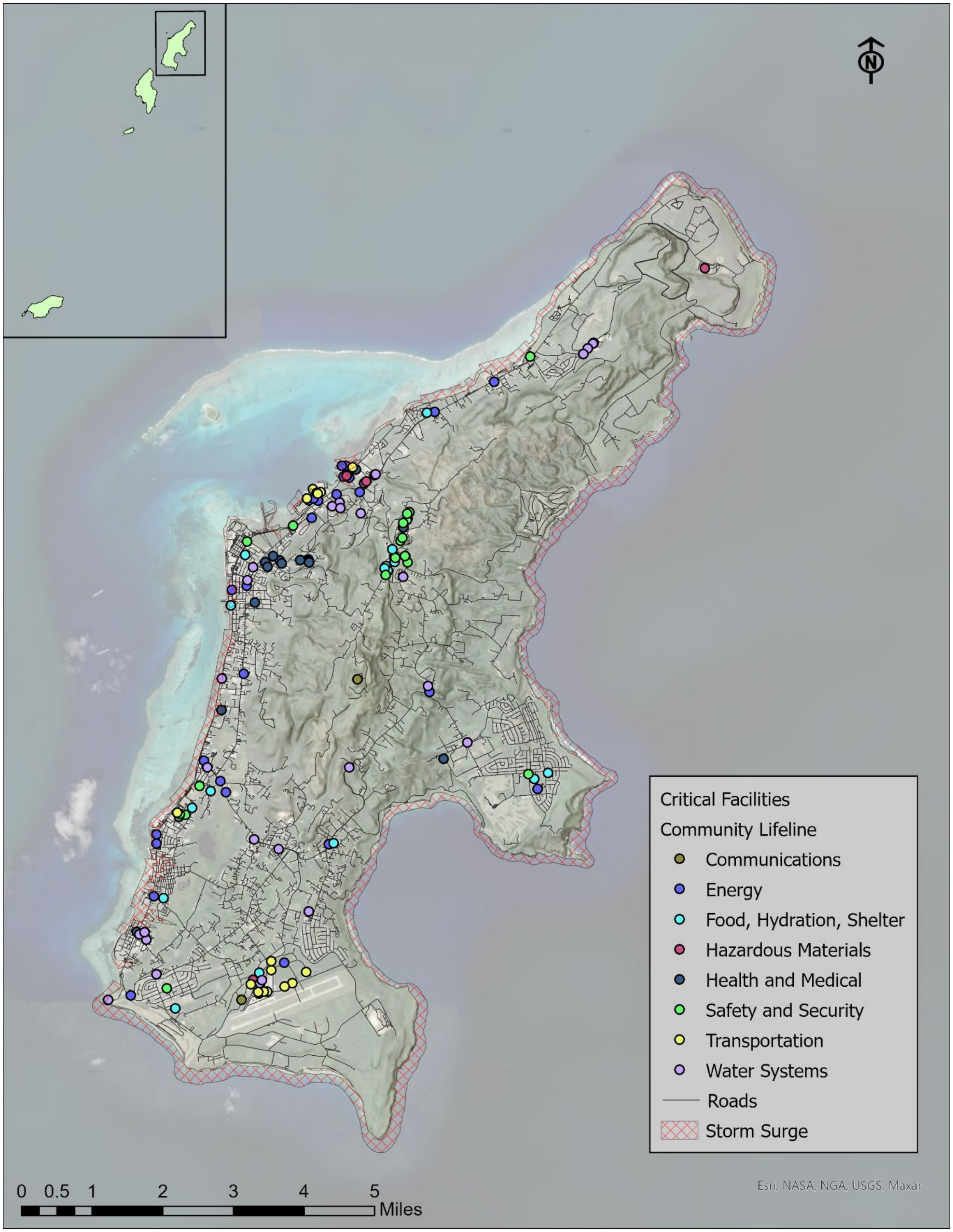


Figure B.2-18. Critical facilities and community lifelines exposed to the typhoon storm surge hazard on Saipan.

Figure B.2-19. Critical facilities and community lifelines exposed to the typhoon storm surge hazard on Tinian.

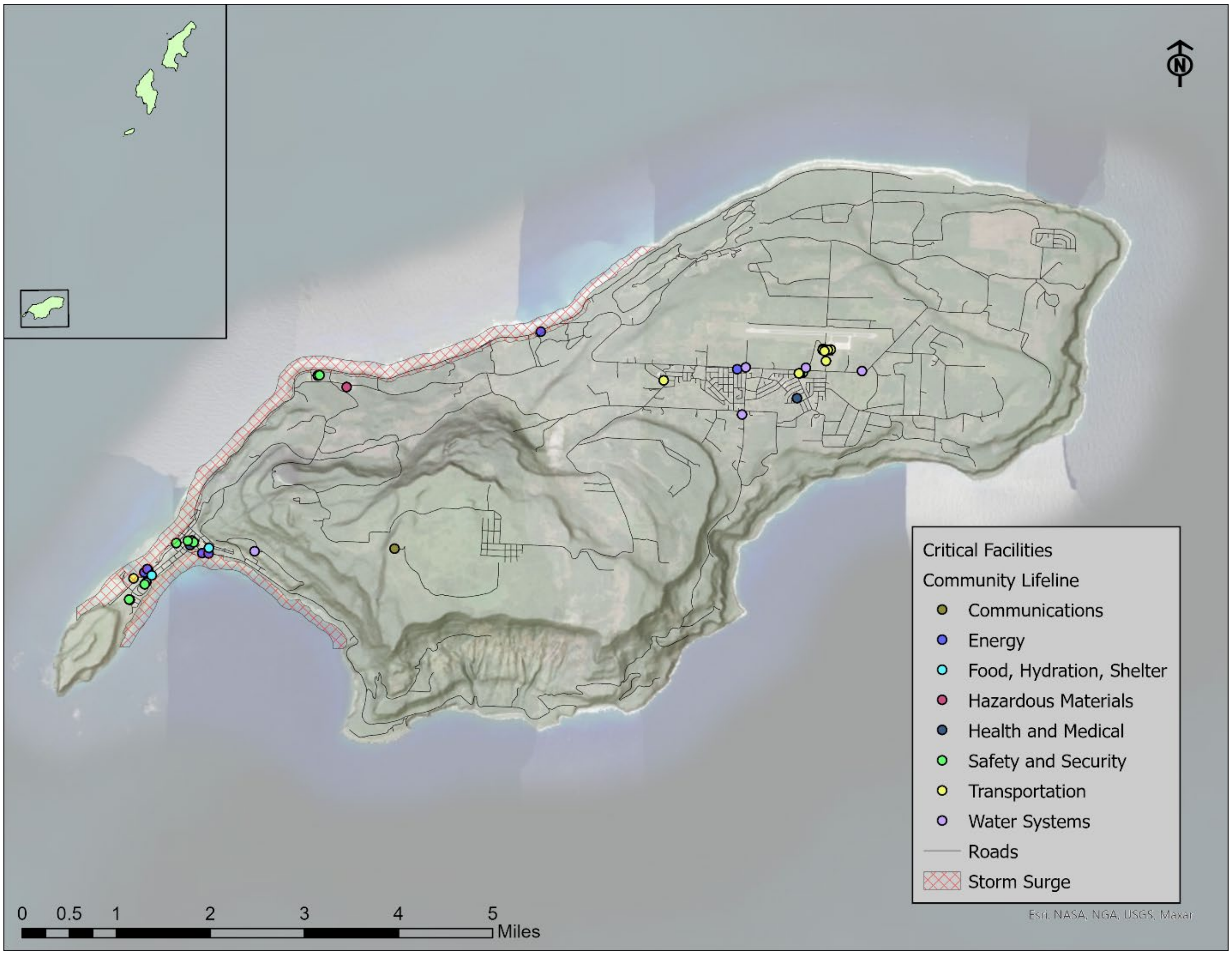


Figure B.2-20. Critical facilities and community lifelines exposed to the typhoon storm surge hazard on Rota.

Figure B.2-21. General building stock exposed to the typhoon storm surge hazard on Saipan.

Figure B.2-22. General building stock exposed to the typhoon storm surge hazard on Tinian.

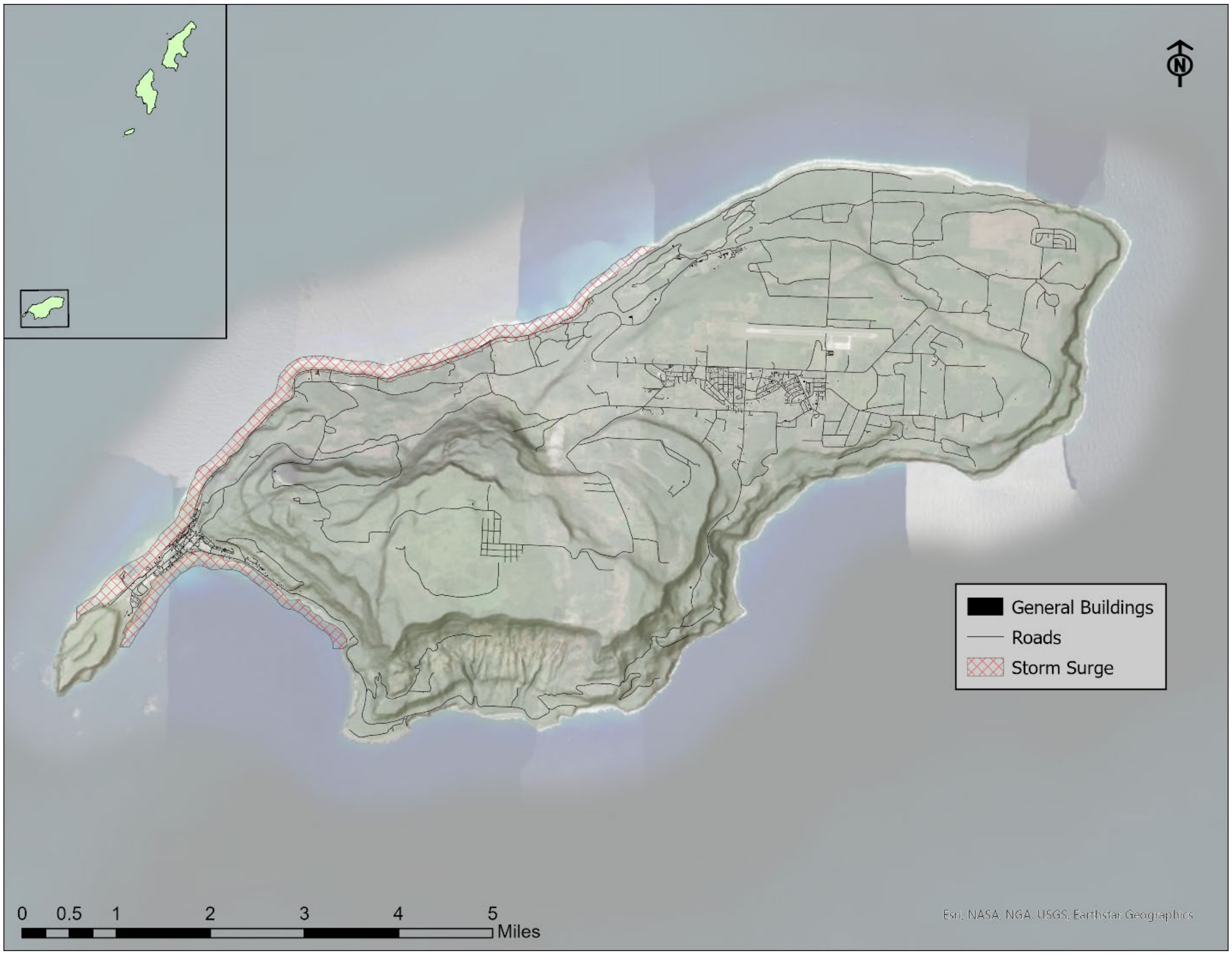


Figure B.2-23. General building stock exposed to the typhoon storm surge hazard on Rota.

Figure B.2-24. Natural resource index for suitable habitats for species of conservation concern and the typhoon storm surge hazard on Saipan.

Figure B.2-25. Natural resource index for suitable habitats for species of conservation concern and the typhoon storm surge hazard on Tinian.

Figure B.2-26. Natural resource index for suitable habitats for species of conservation concern and the typhoon storm surge hazard on Rota.

Figure B.2-27. Areas designated for cultural resources and the typhoon storm surge hazard on Saipan.

Figure B.2-28. Areas designated for cultural resources and the typhoon storm surge hazard on Tinian.

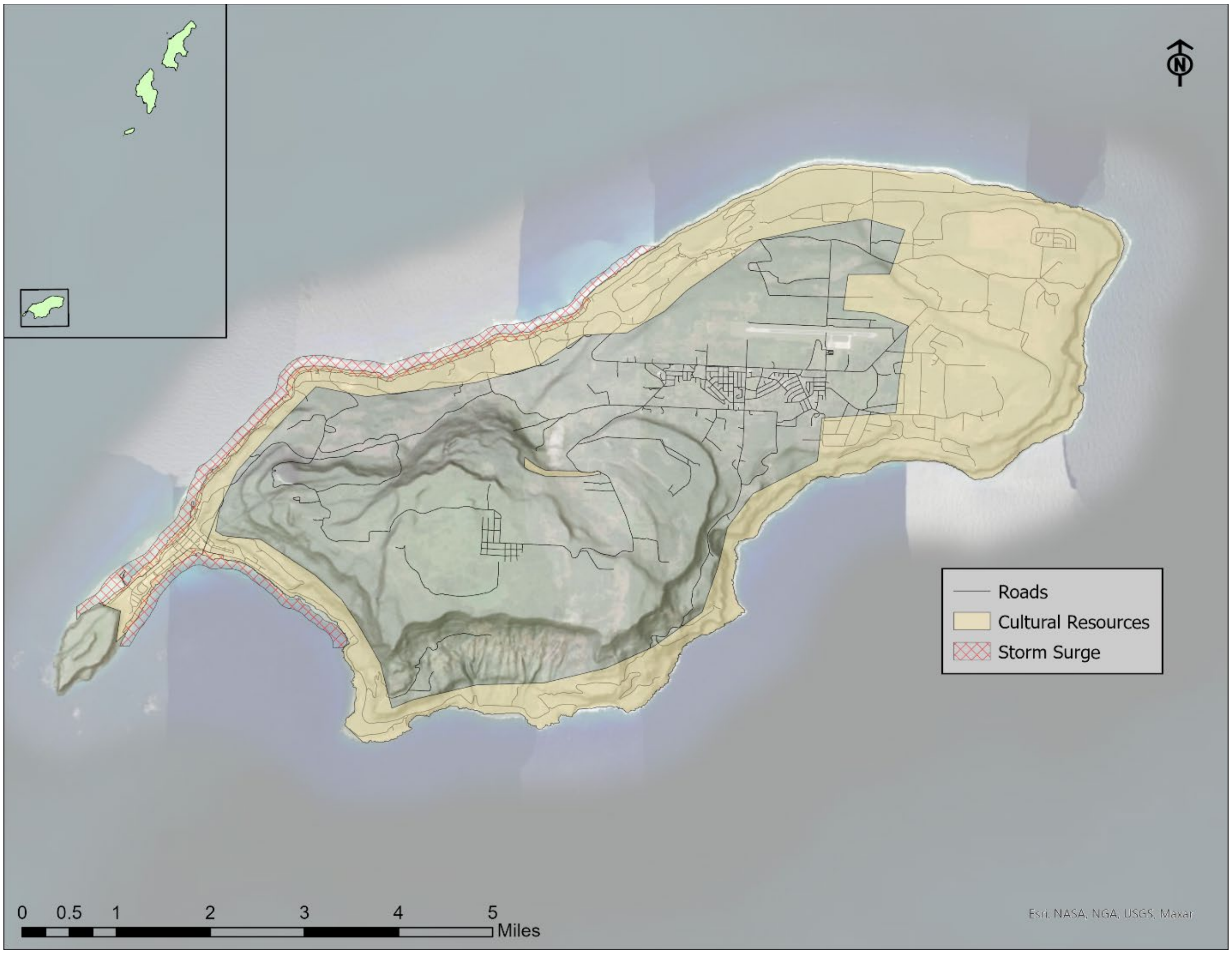


Figure B.2-29. Areas designated for cultural resources and the typhoon storm surge hazard on Rota.

Figure B.2-30. Parcels designated for future development and the typhoon storm surge hazard on Saipan.

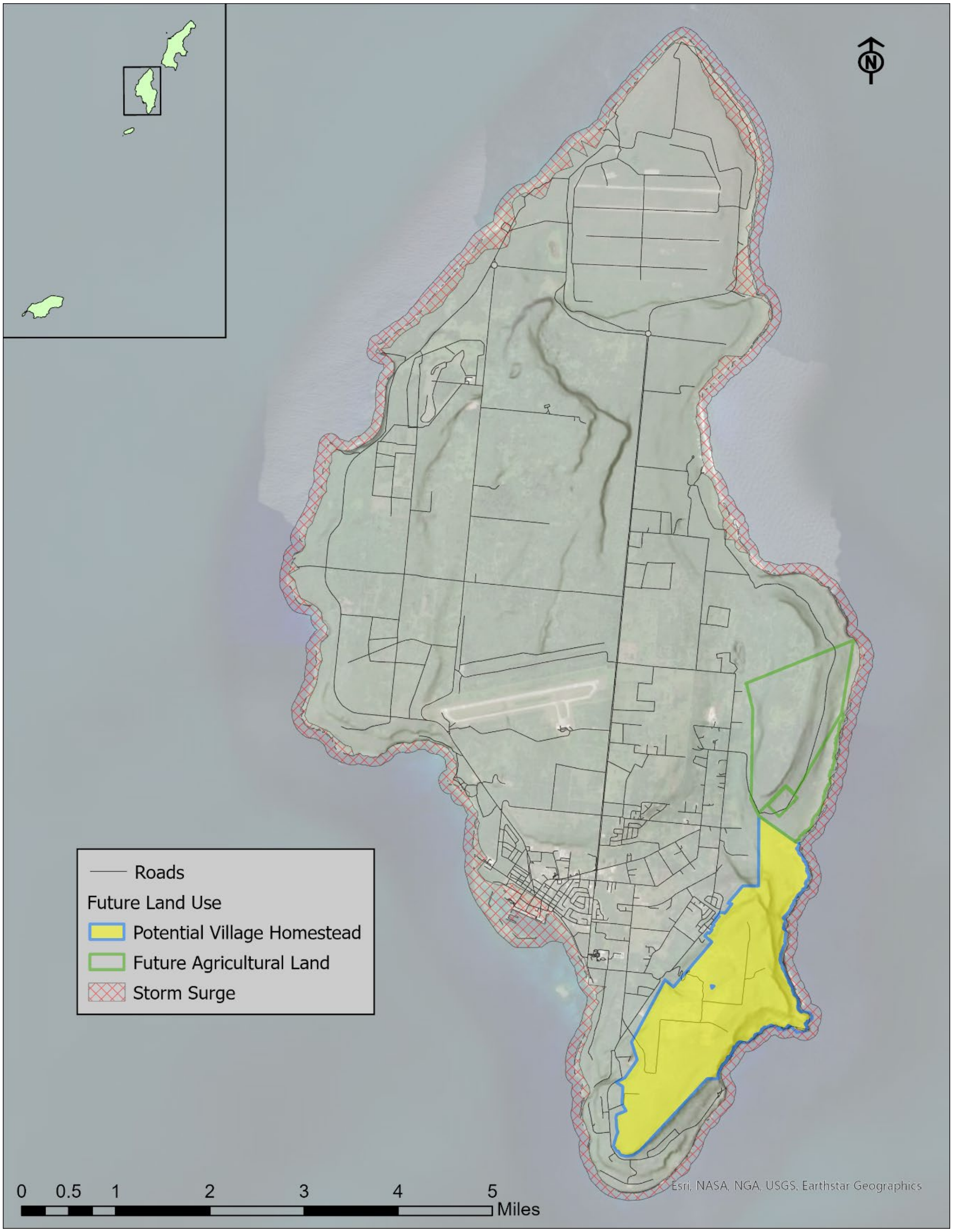


Figure B.2-31. Parcels designated for future development and the typhoon storm surge hazard on Tinian.

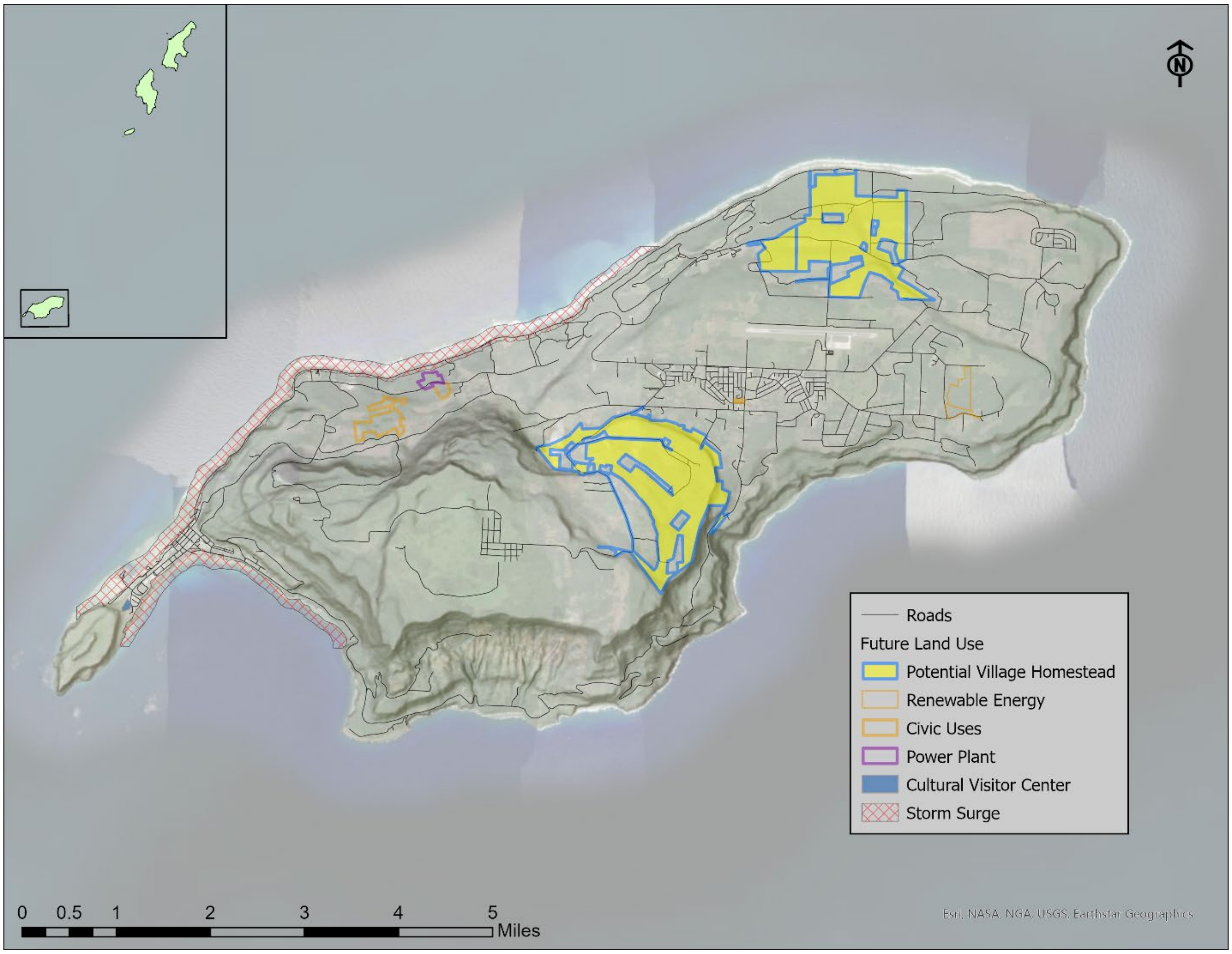


Figure B.2-32. Parcels designated for future development and the typhoon storm surge hazard on Rota.

B.3 Tsunami

Figure B.3-1. Tsunami inundation hazard on Saipan.

Figure B.3-2. Tsunami inundation hazard on Tinian.

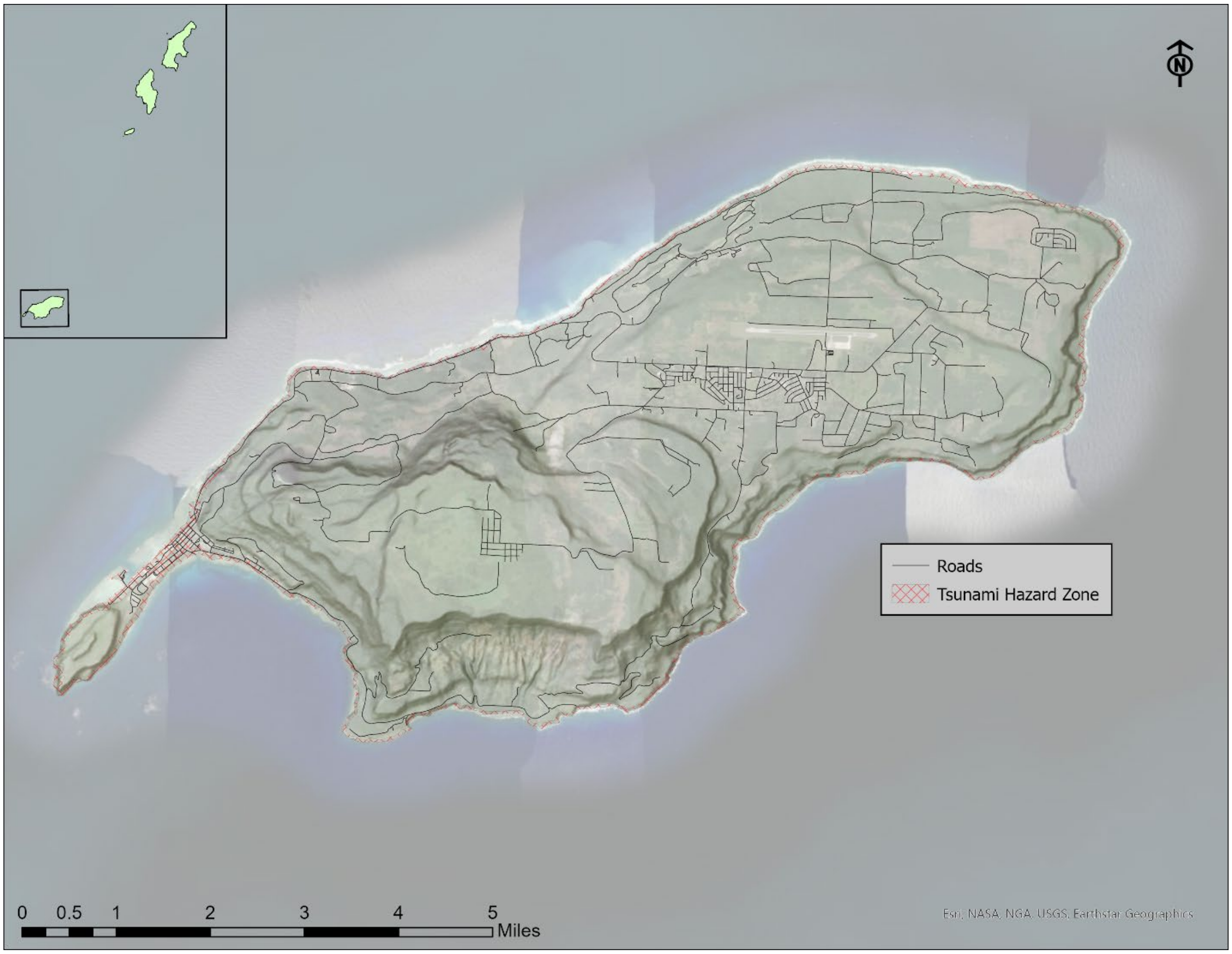


Figure B.3-3. Tsunami inundation hazard on Rota.

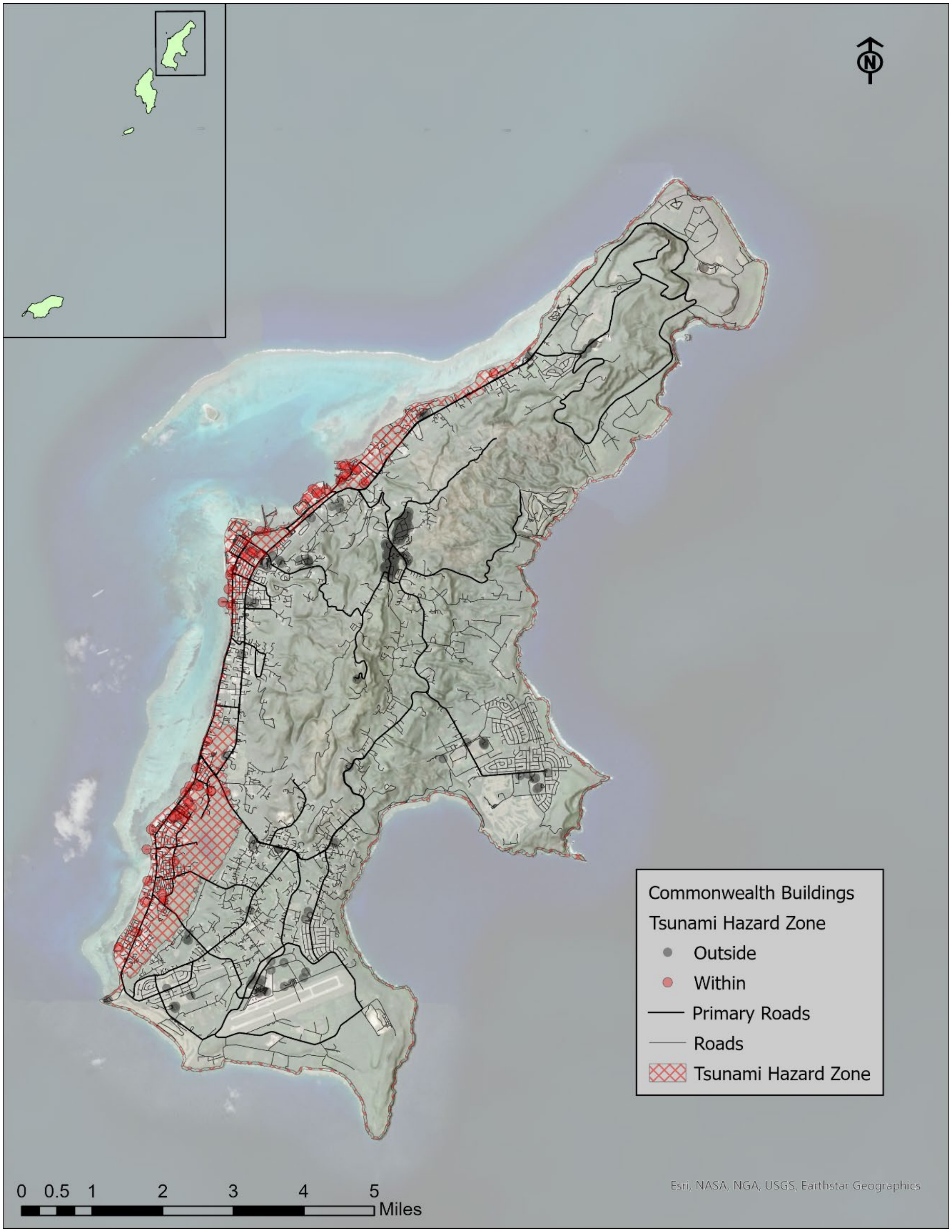


Figure B.3-4. Commonwealth buildings exposed to the tsunami inundation hazard on Saipan.

Figure B.3-5. Commonwealth buildings exposed to the tsunami inundation hazard on Tinian.

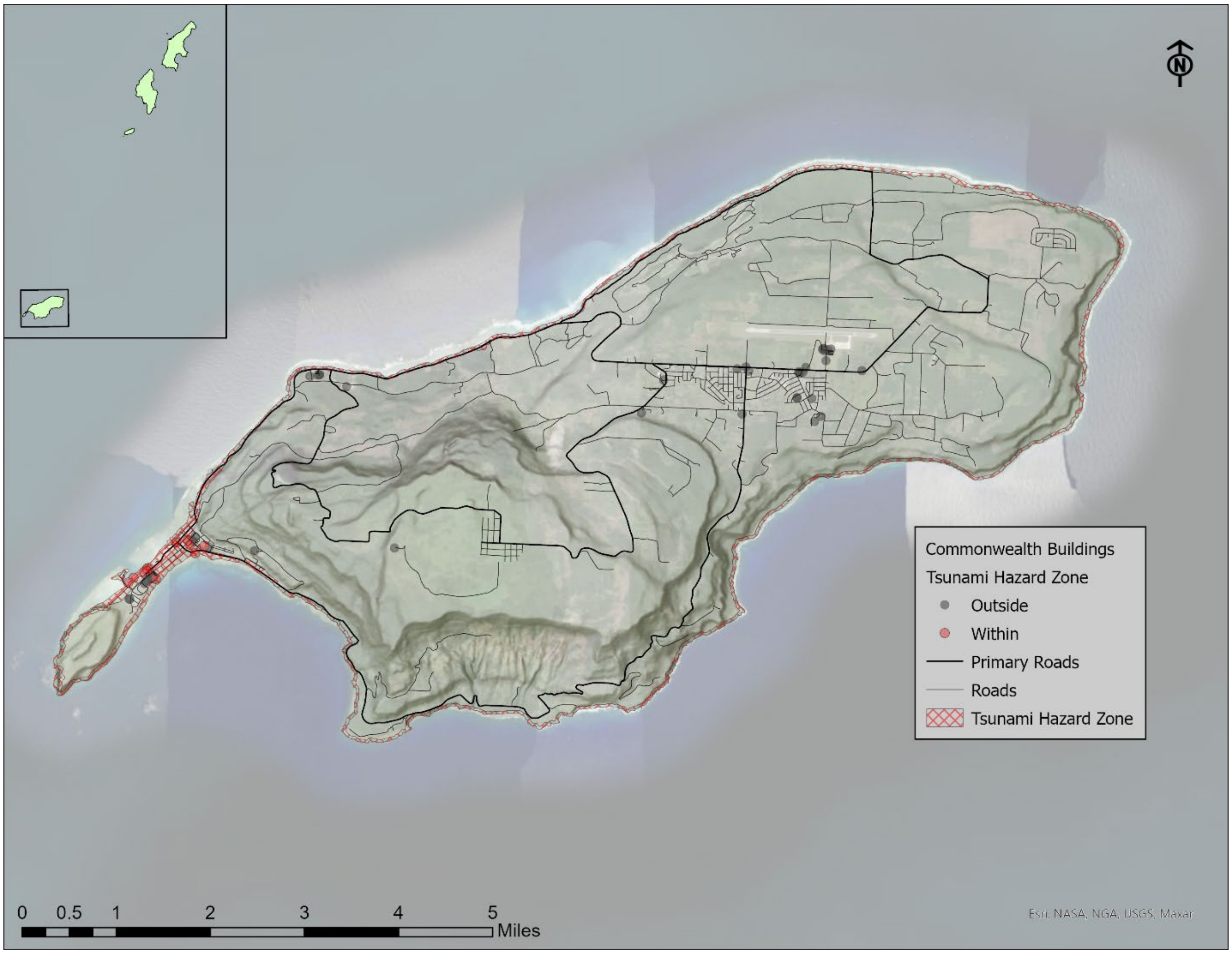


Figure B.3-6. Commonwealth buildings exposed to the tsunami inundation hazard on Rota.

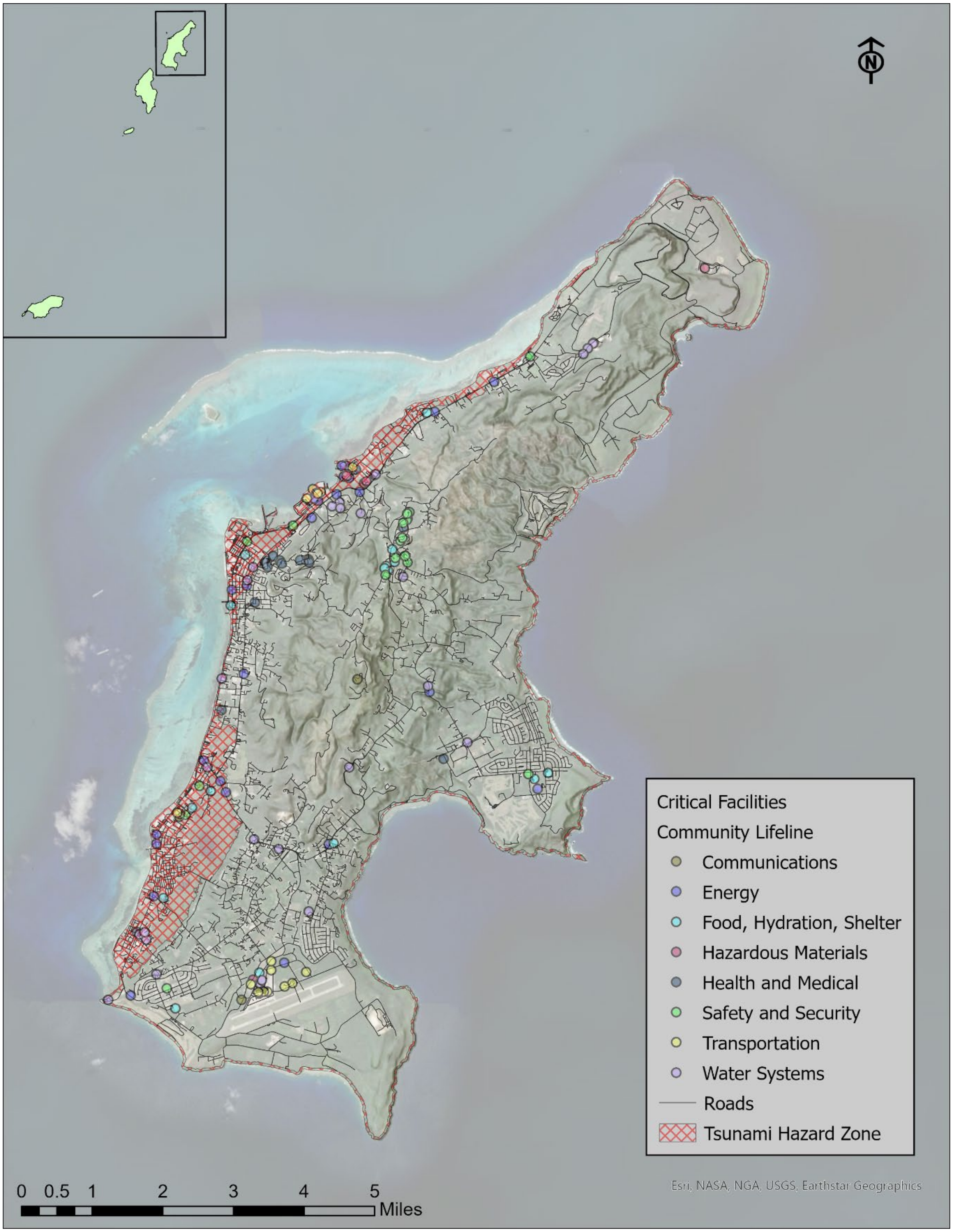


Figure B.3-7. Critical facilities and community lifelines exposed to the tsunami inundation hazard on Saipan.

Figure B.3-8. Critical facilities and community lifelines exposed to the tsunami inundation hazard on Tinian.

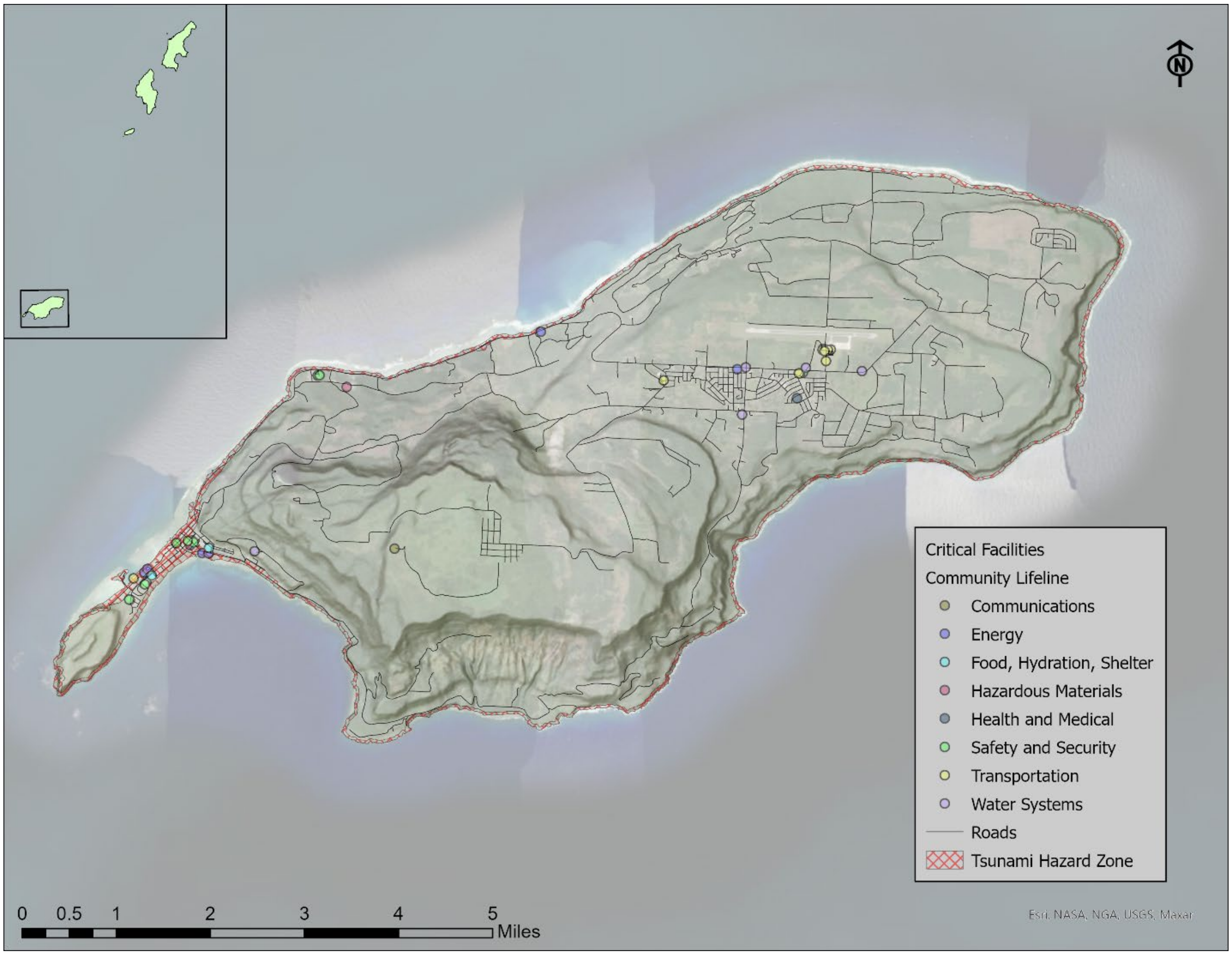


Figure B.3-9. Critical facilities and community lifelines exposed to the tsunami inundation hazard on Rota.

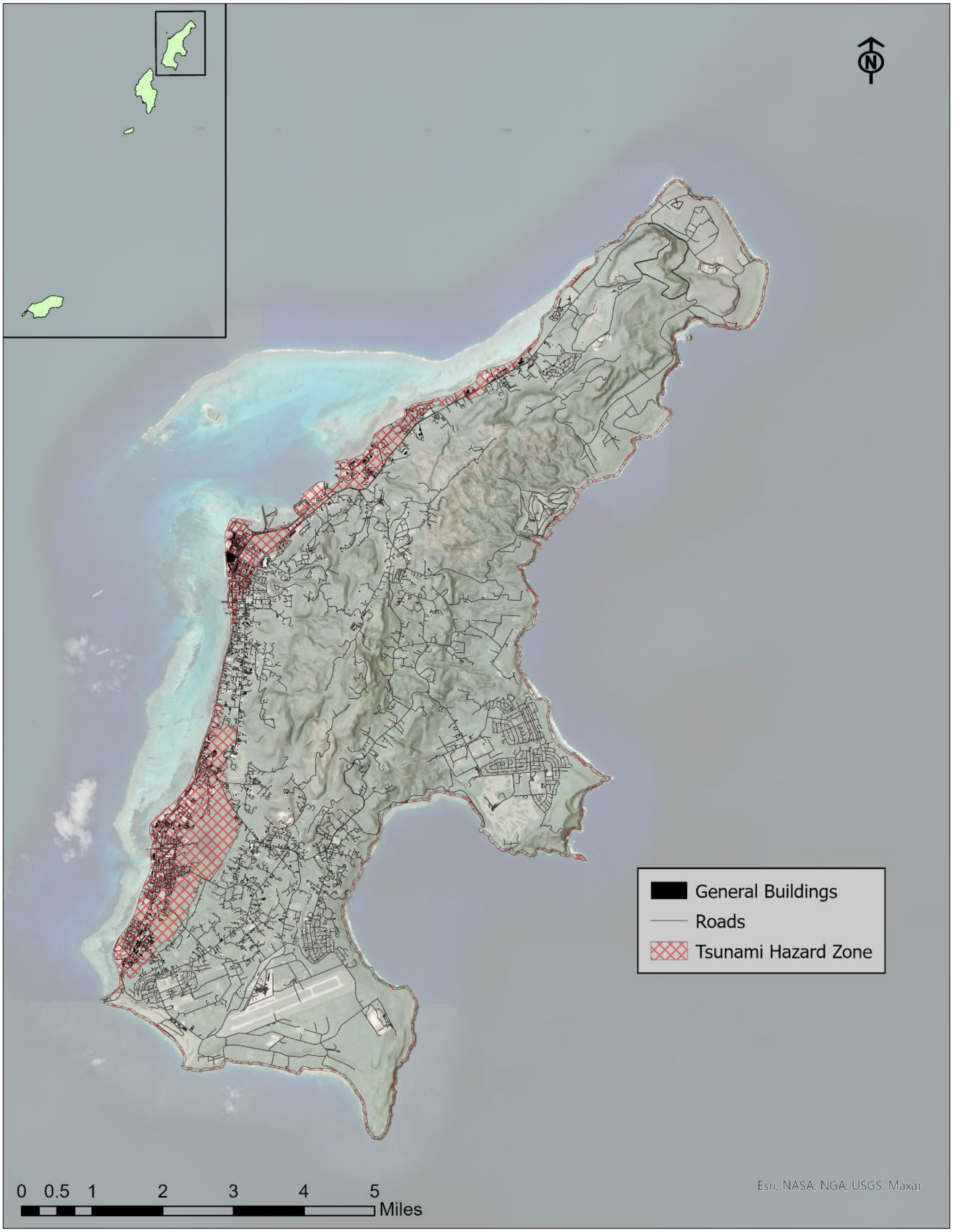


Figure B.3-10. General building stock exposed to the tsunami inundation hazard on Saipan.

Figure B.3-11. General building stock exposed to the tsunami inundation hazard on Tinian.

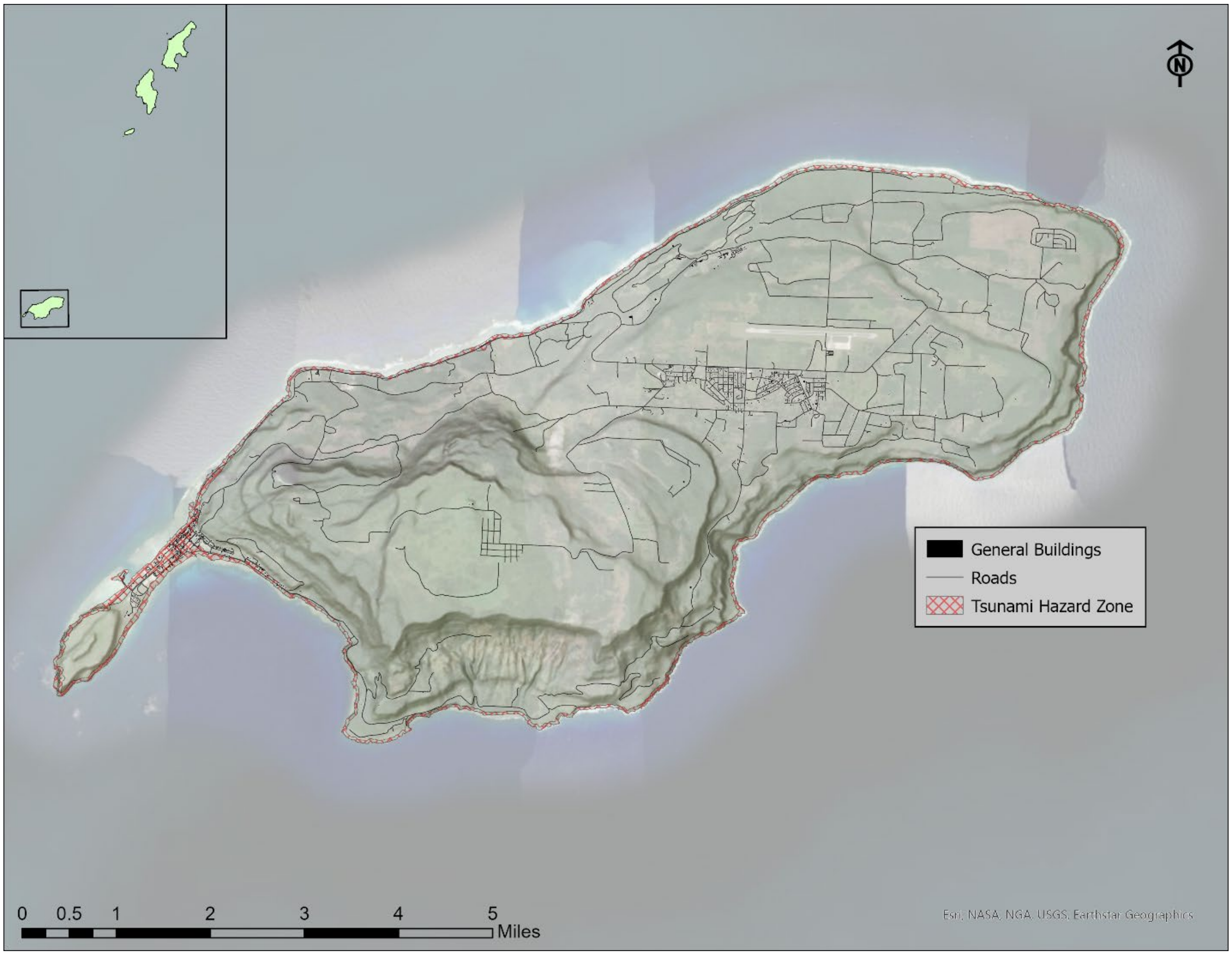


Figure B.3-12. General building stock exposed to the tsunami inundation hazard on Rota.

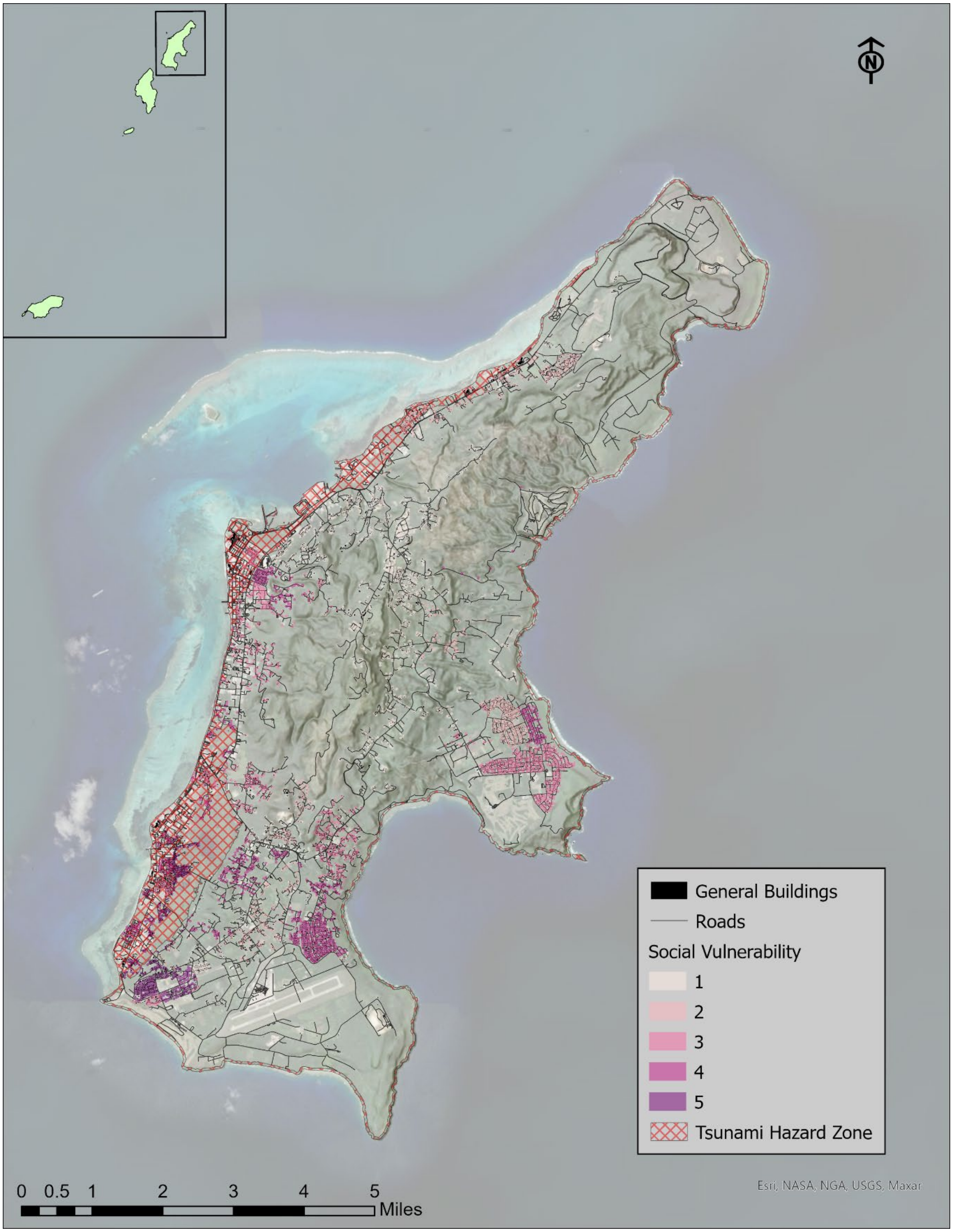


Figure B.3-13. Socially vulnerable index and the tsunami inundation hazard on Saipan

Figure B.3-14. Socially vulnerable index and the tsunami inundation hazard on Tinian.

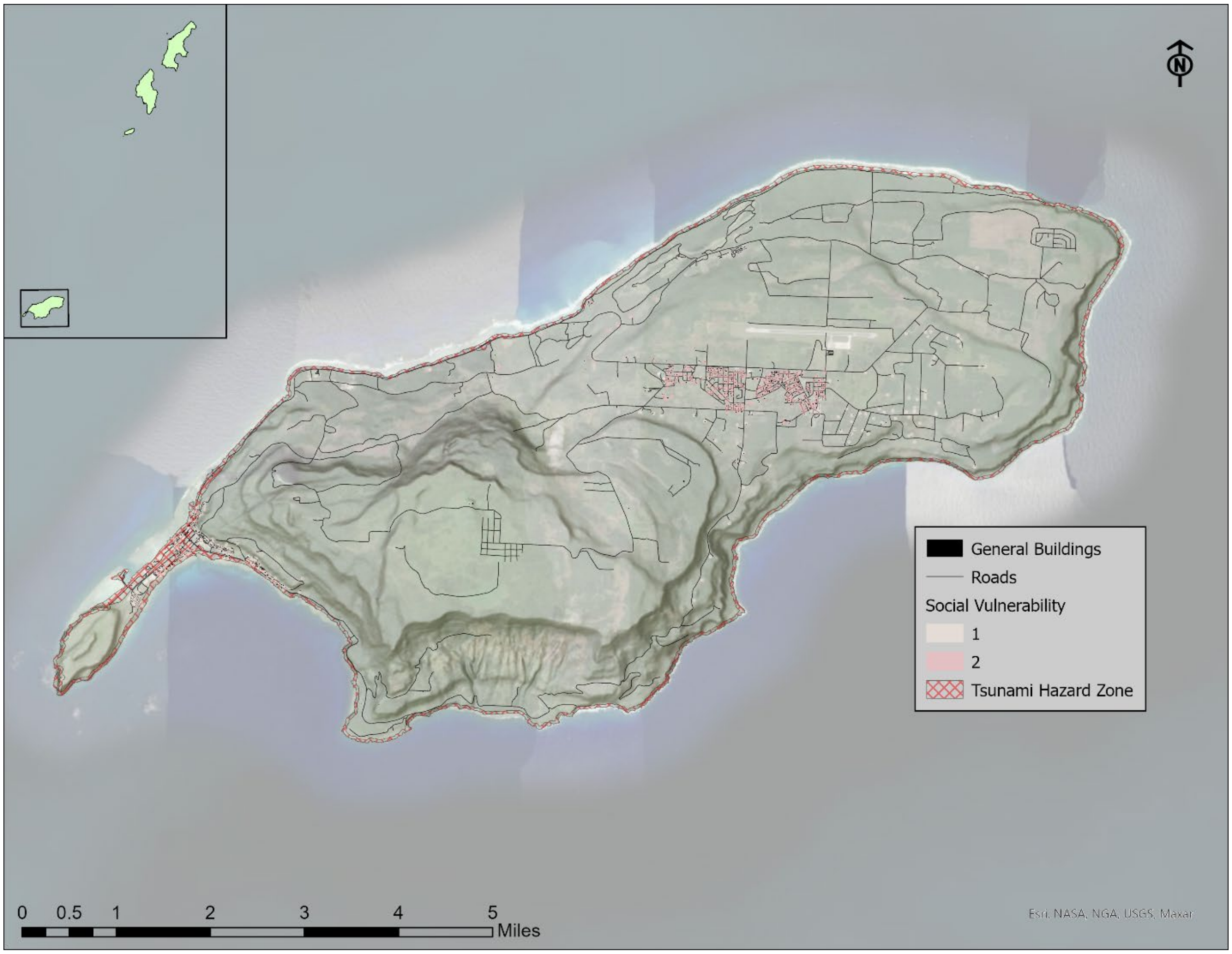


Figure B.3-15. Socially vulnerable index and the tsunami inundation hazard on Rota.

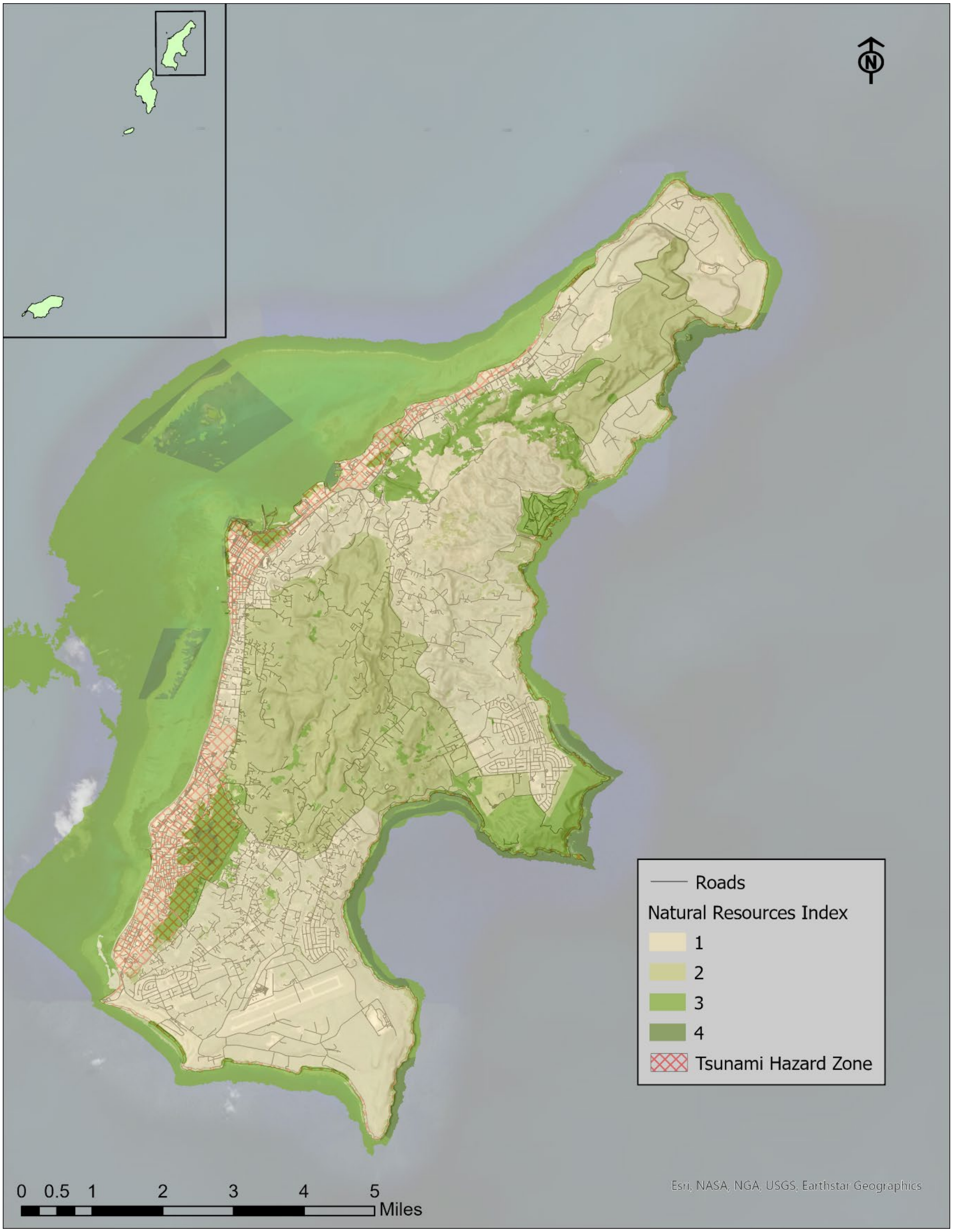


Figure B.3-16. Natural resource index for suitable habitats for species of conservation concern and the tsunami inundation hazard on Saipan.

Figure B.3-17. Natural resource index for suitable habitats for species of conservation concern and the tsunami inundation hazard on Tinian.

Figure B.3-18. Natural resource index for suitable habitats for species of conservation concern and the tsunami inundation hazard on Rota.

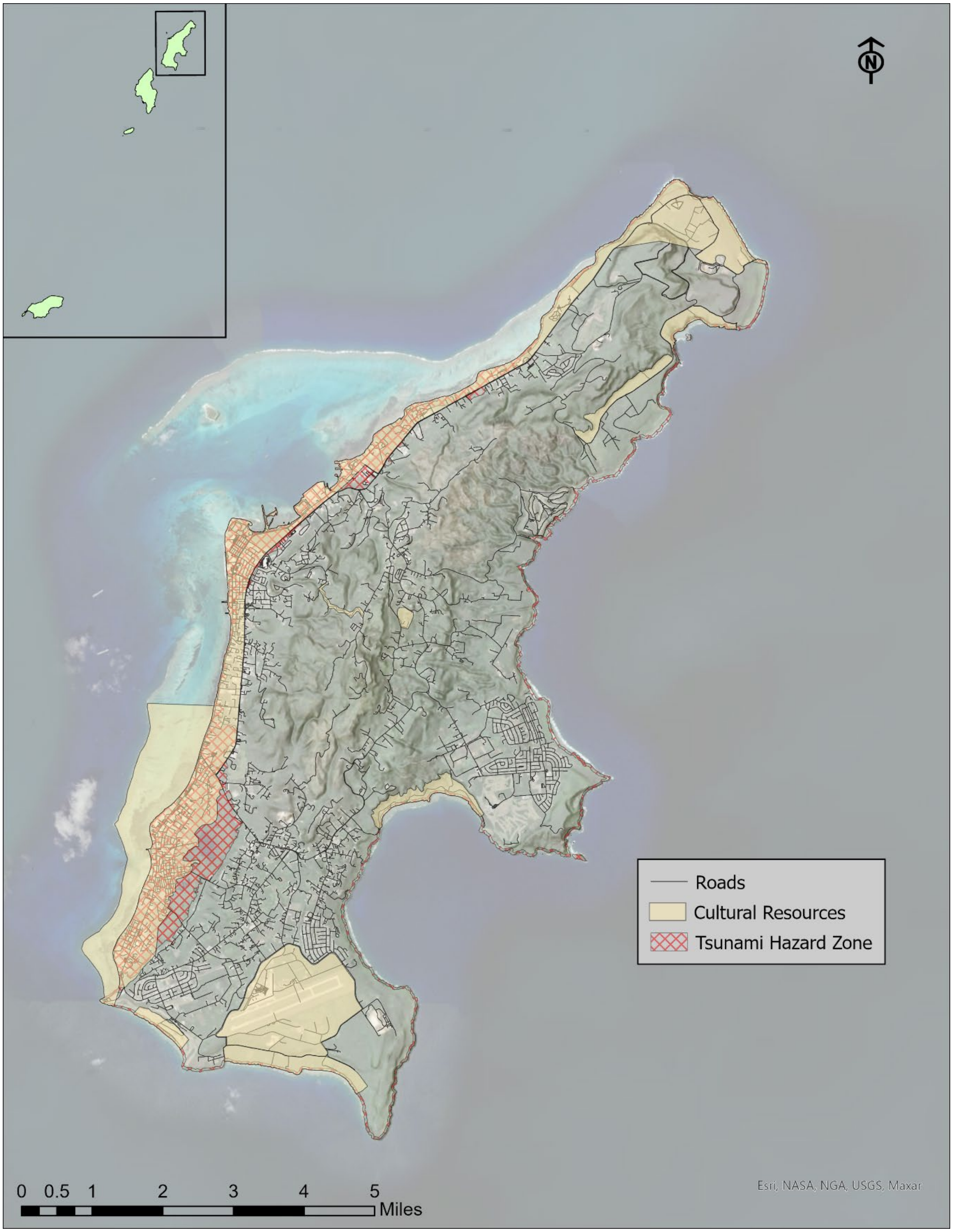


Figure B.3-19. Areas designated for cultural resources and the tsunami inundation hazard on Saipan.

Figure B.3-20. Areas designated for cultural resources and the tsunami inundation hazard on Tinian.

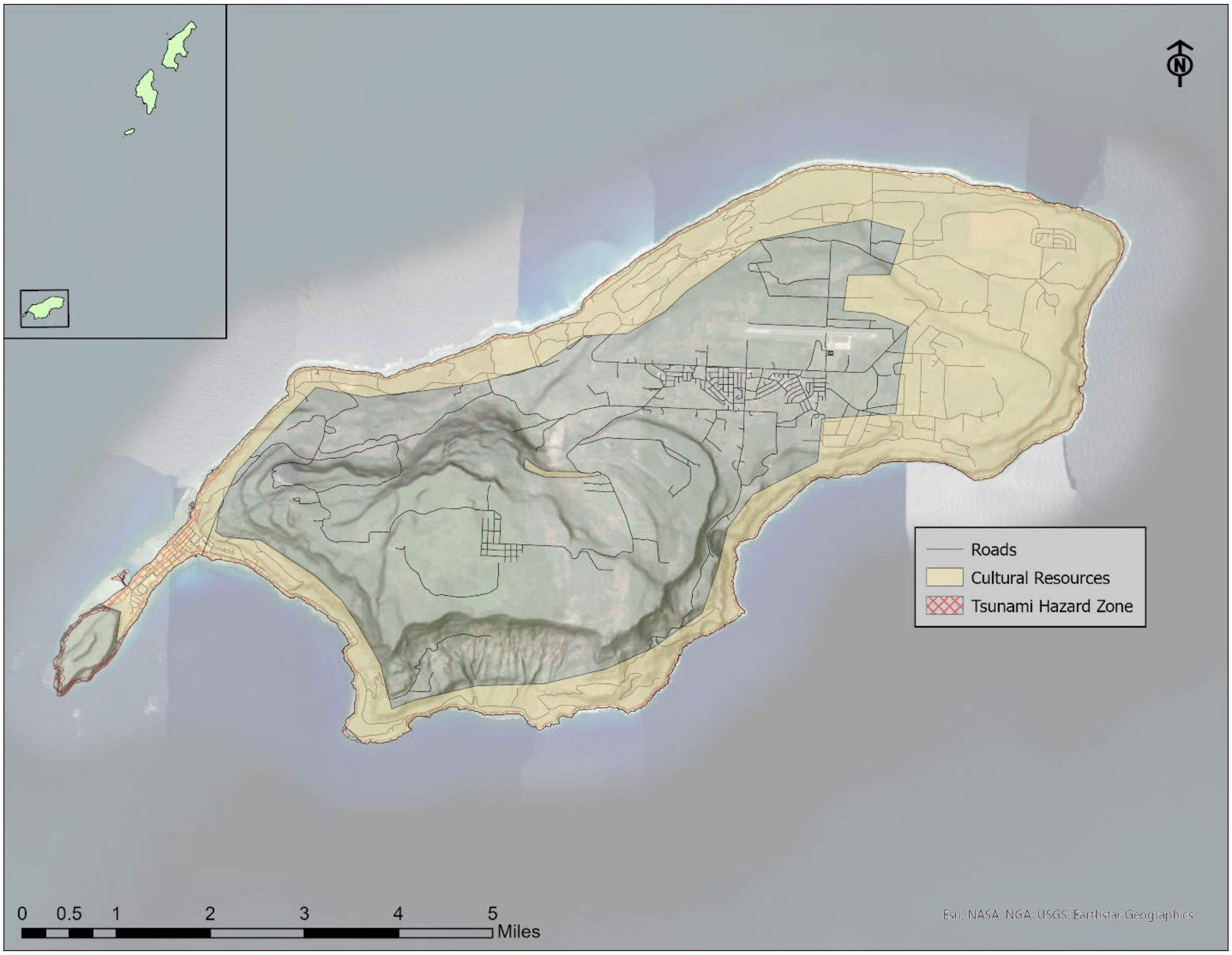


Figure B.3-21. Areas designated for cultural resources and the tsunami inundation hazard on Rota.

Figure B.3-22. Parcels designated for future development and the tsunami inundation hazard on Saipan.

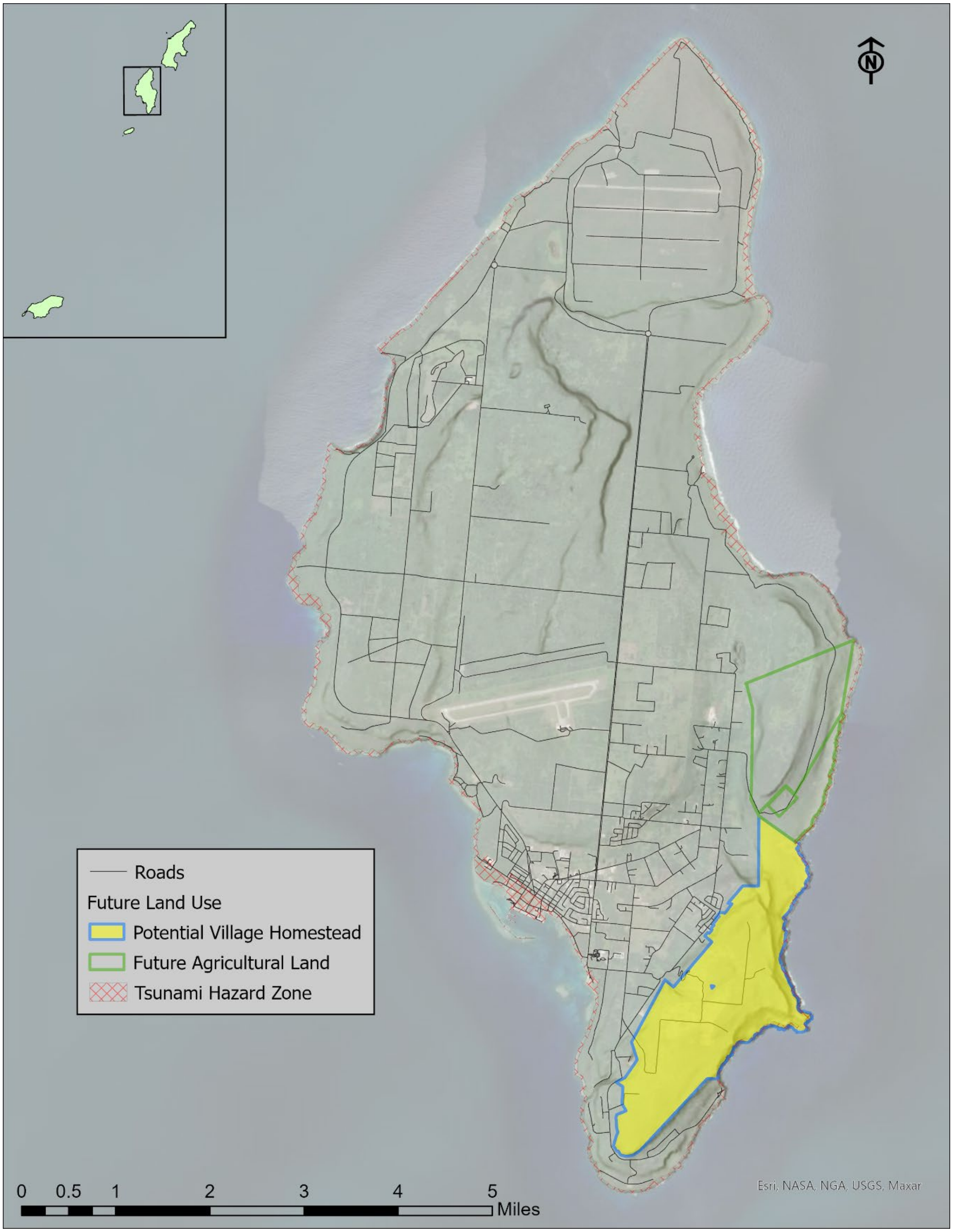


Figure B.3-23. Parcels designated for future development and the tsunami inundation hazard on Tinian.

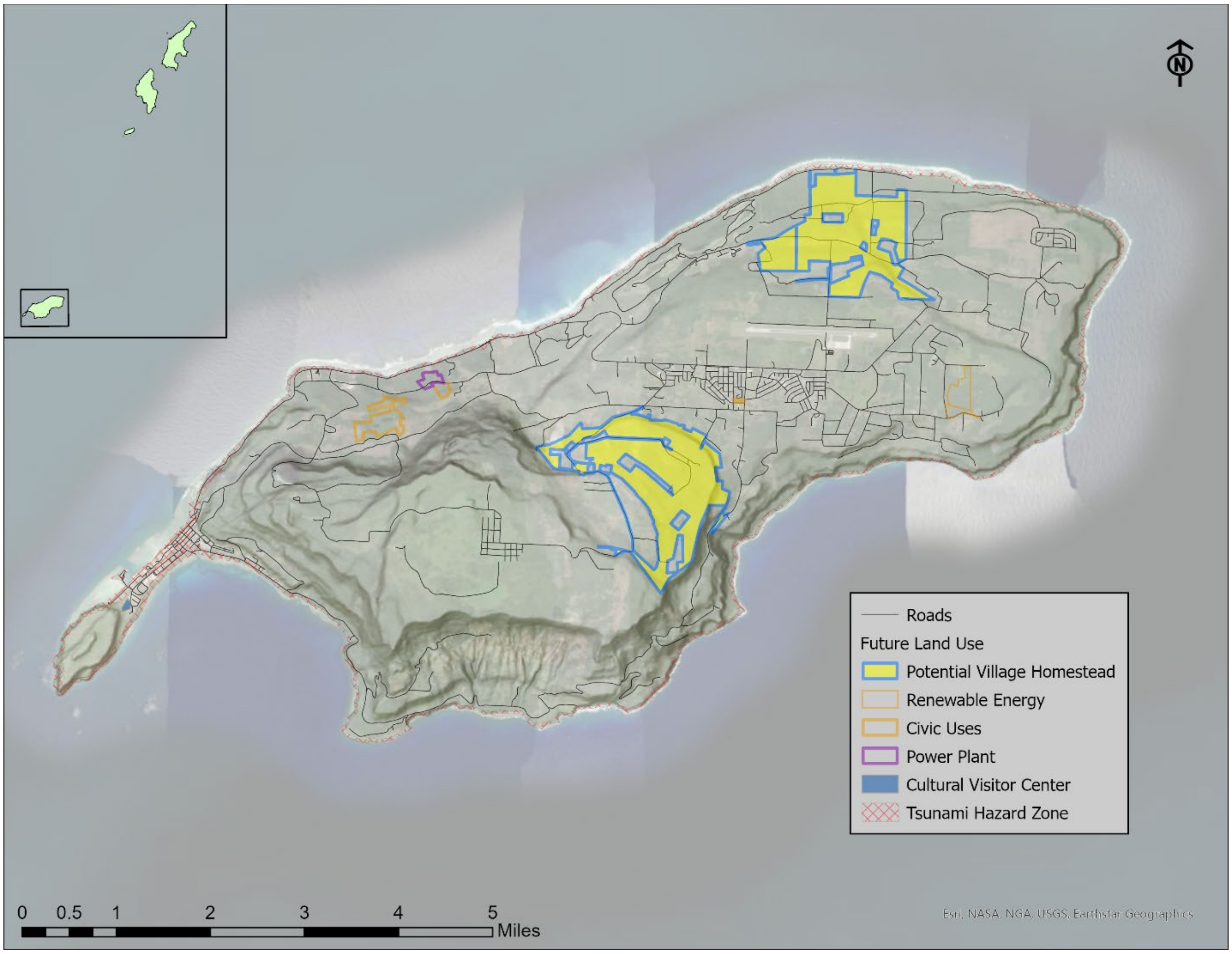


Figure B.3-24. Parcels designated for future development and the tsunami inundation hazard on Rota.

B.4 Drought

There are no additional maps to support Section 4.2 (Drought).

B.5 Flood

B.5.1 Event-based Flood

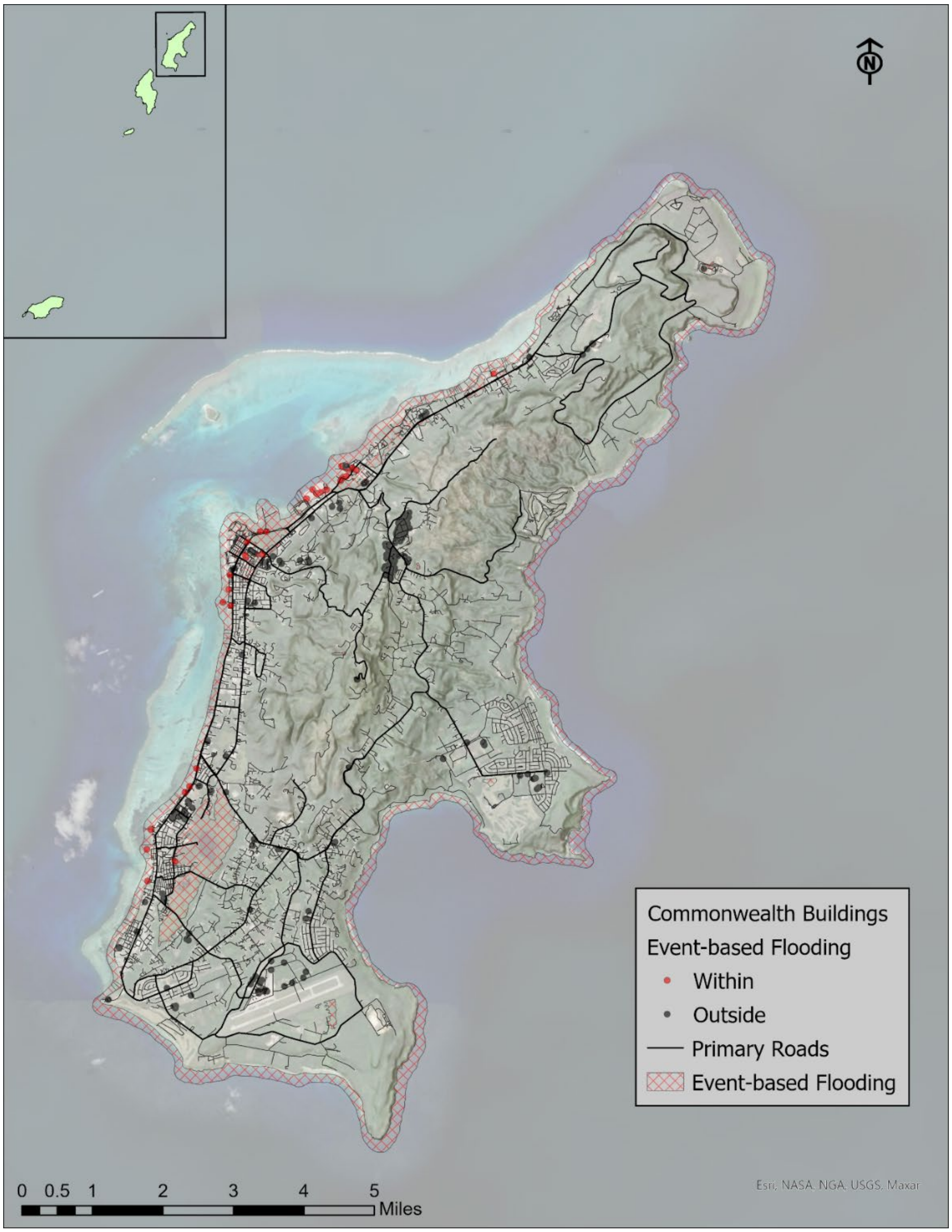


Figure B.5-1. Commonwealth buildings in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-2. Commonwealth buildings in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

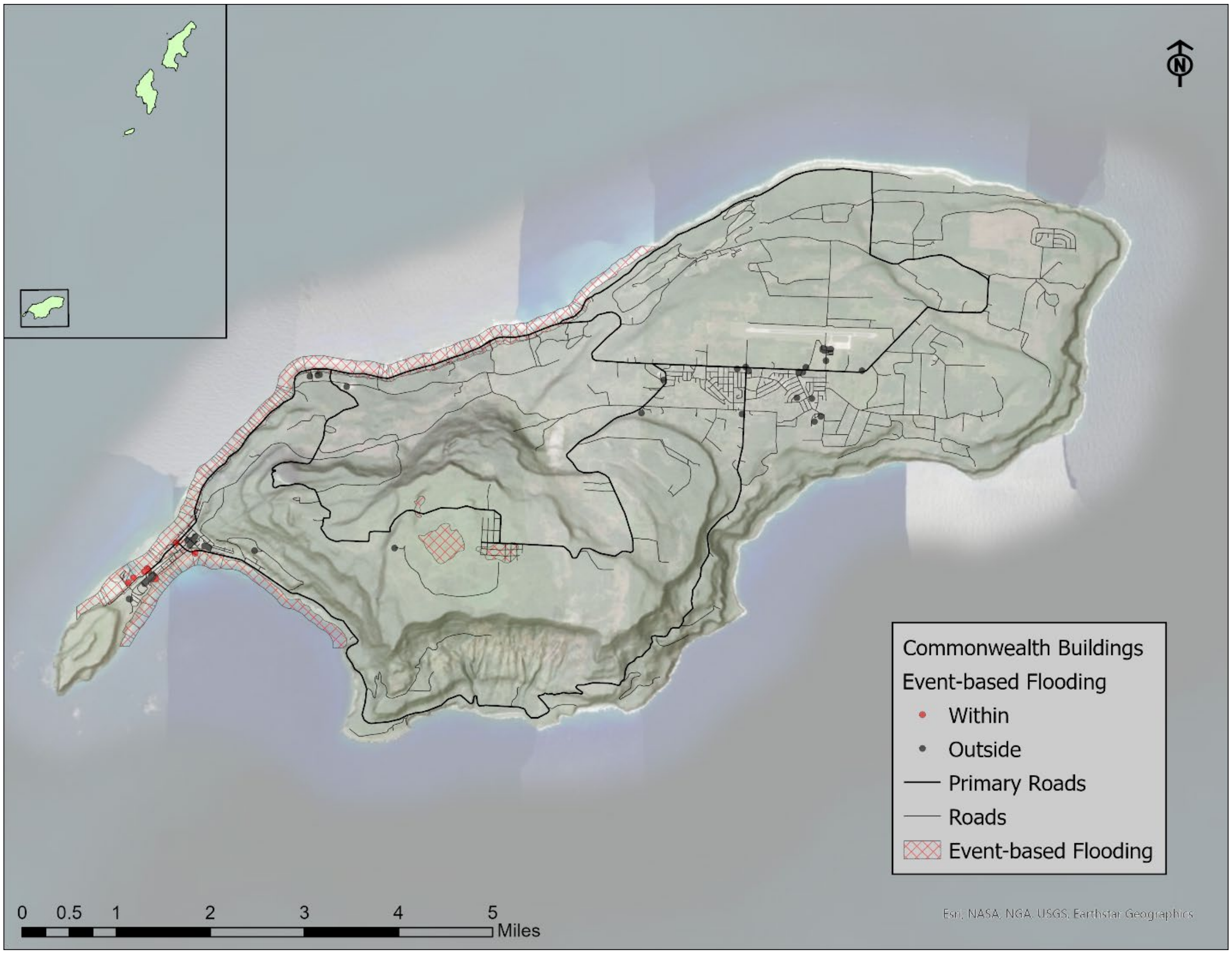


Figure B.5-3. Commonwealth buildings in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

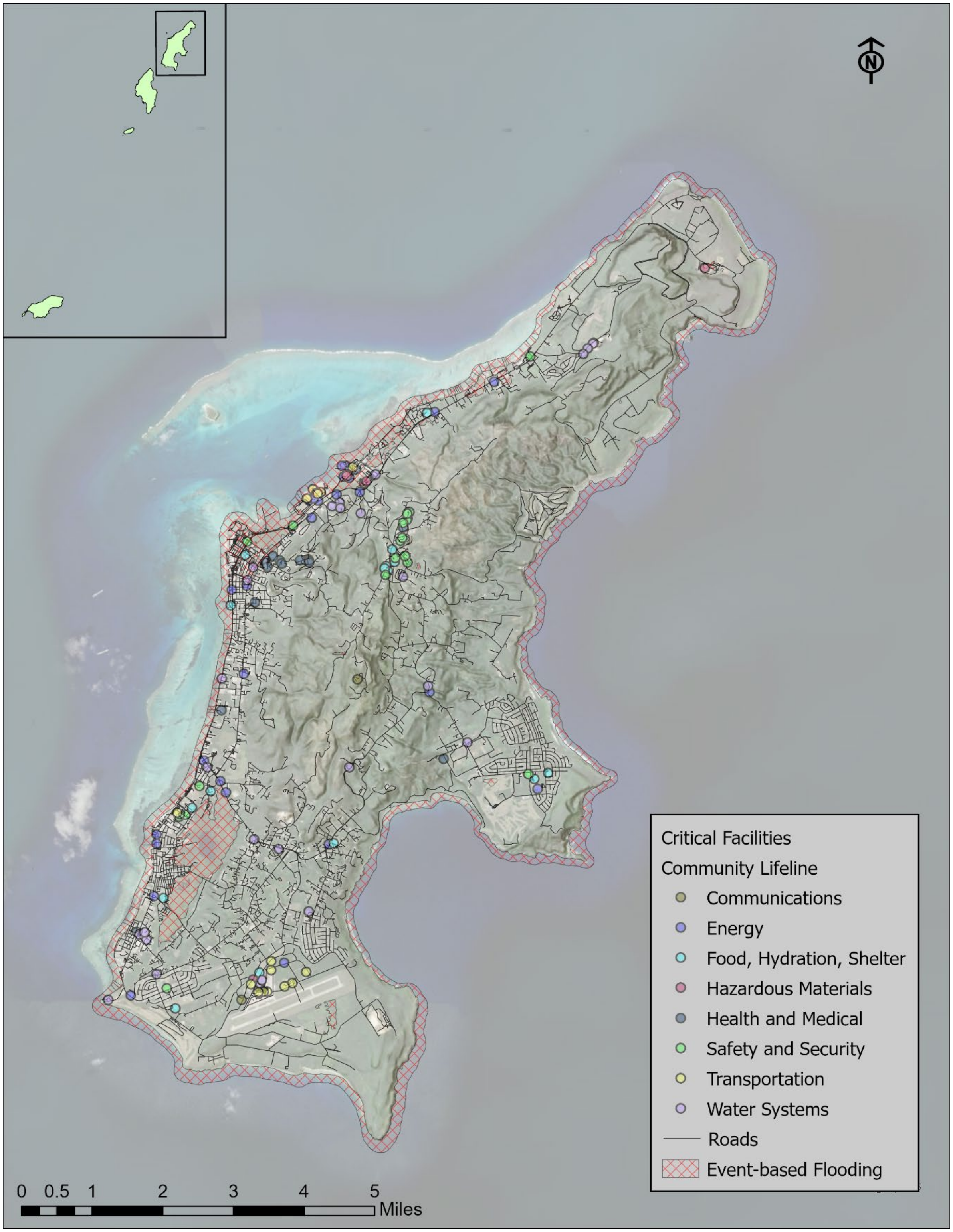


Figure B.5-4. Critical facilities and community lifelines in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-5. Critical facilities and community lifelines in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

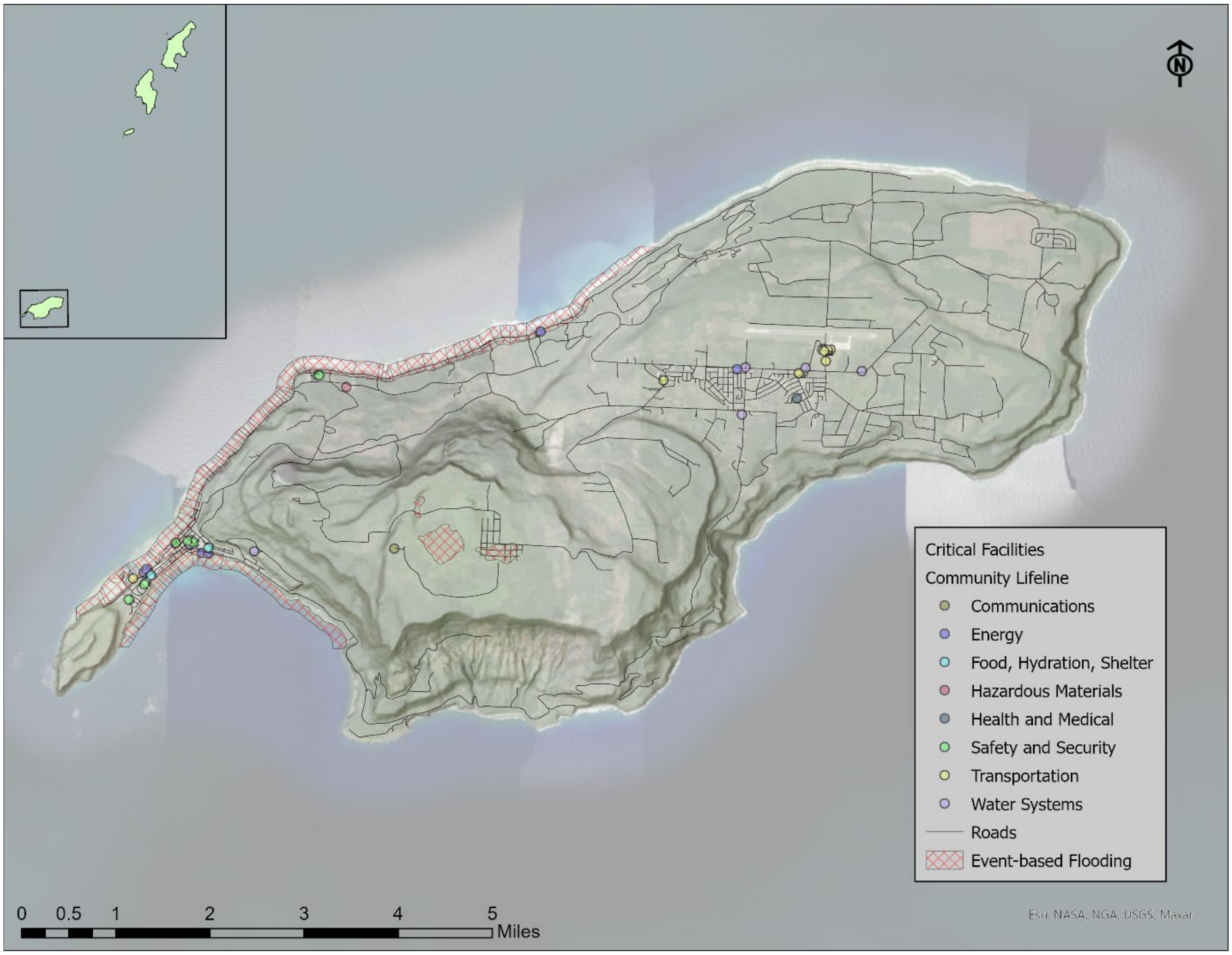


Figure B.5-6. Critical facilities and community lifelines in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

Figure B.5-7. General building stock in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-8. General building stock in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

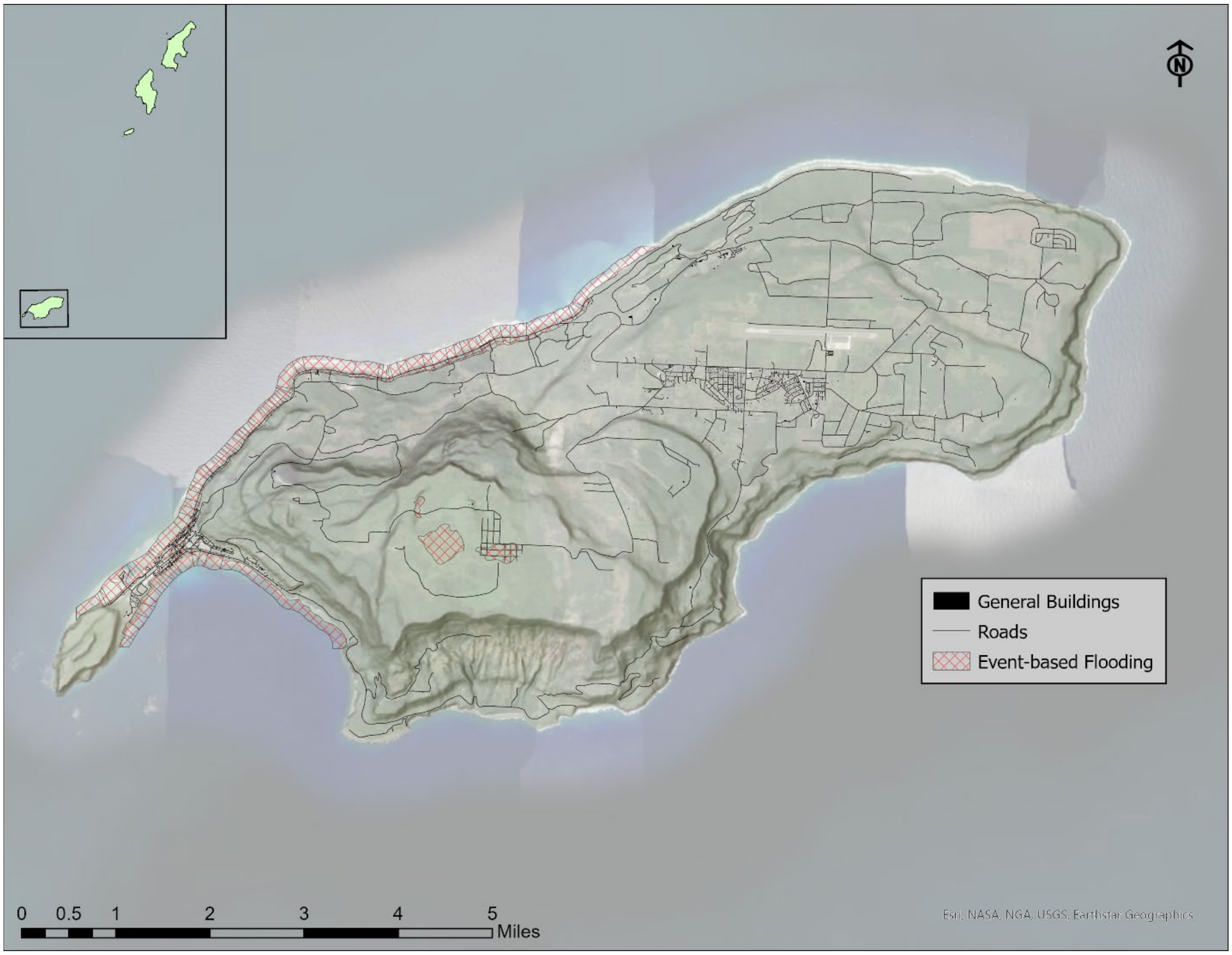


Figure B.5-9. General building stock in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

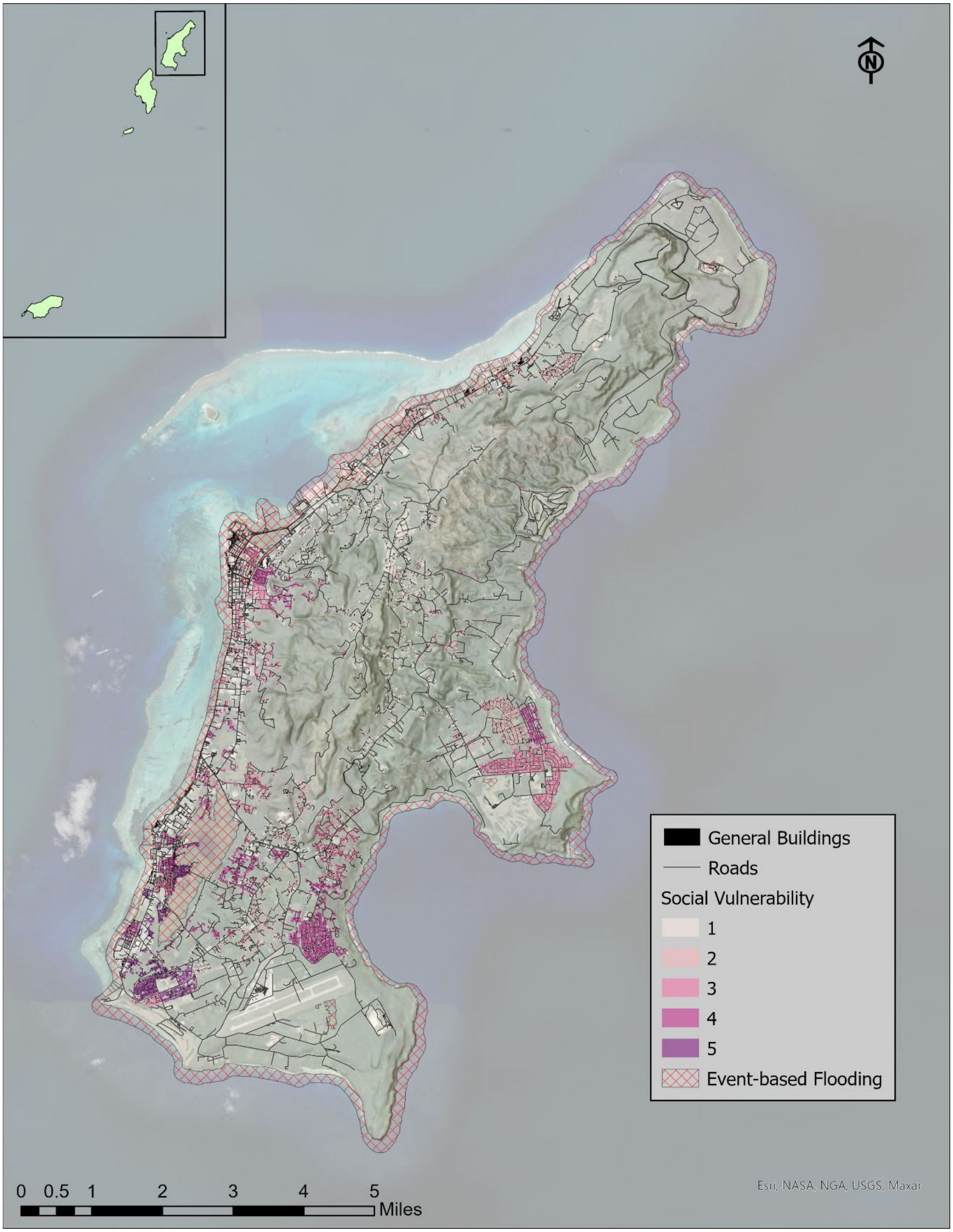


Figure B.5-10. Socially vulnerable index in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-11. Socially vulnerable index in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

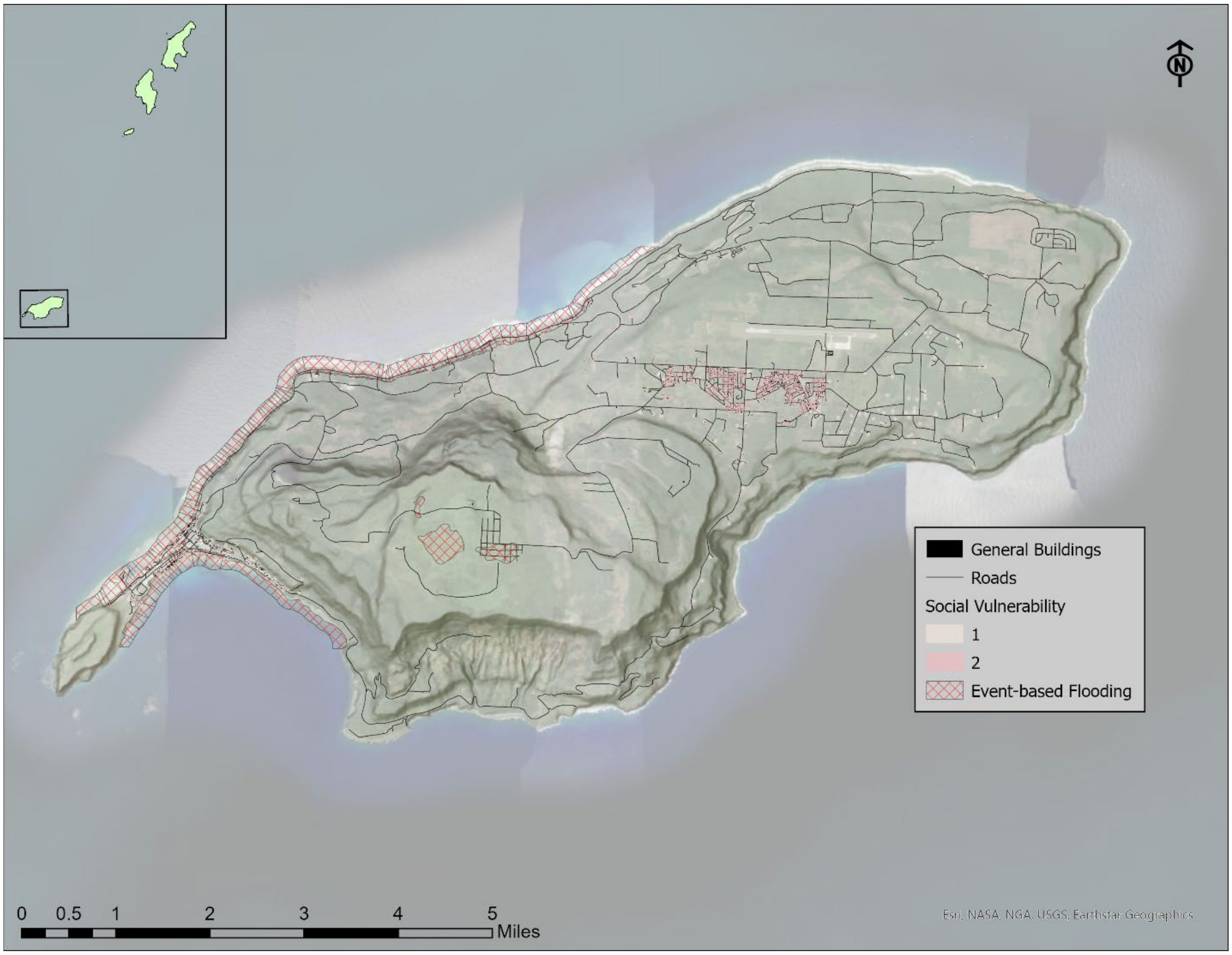


Figure B.5-12. Socially vulnerable index in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

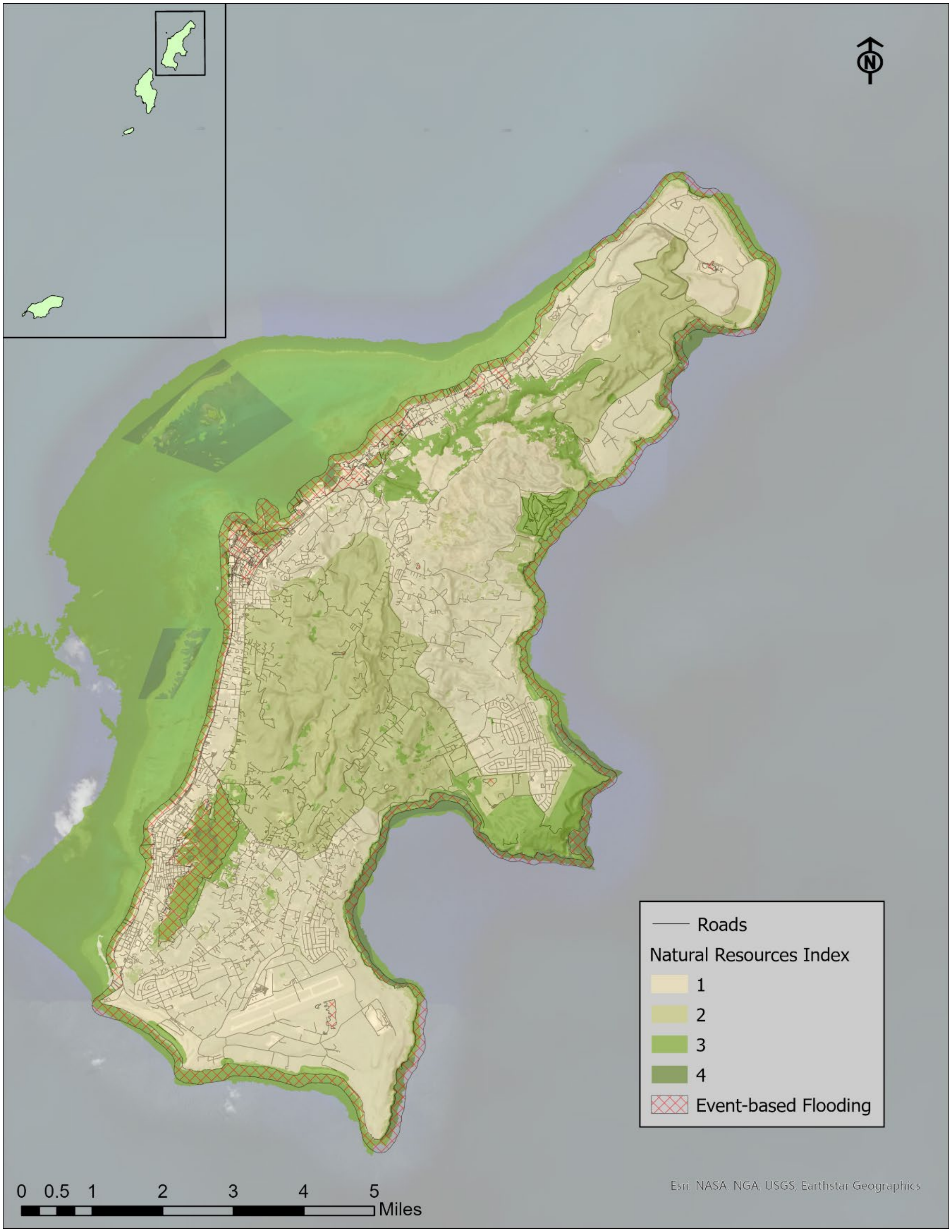


Figure B.5-13. Natural resource index for suitable habitats for species of conservation concern in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-14. Natural resource index for suitable habitats for species of conservation concern in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

Figure B.5-15. Natural resource index for suitable habitats for species of conservation concern in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

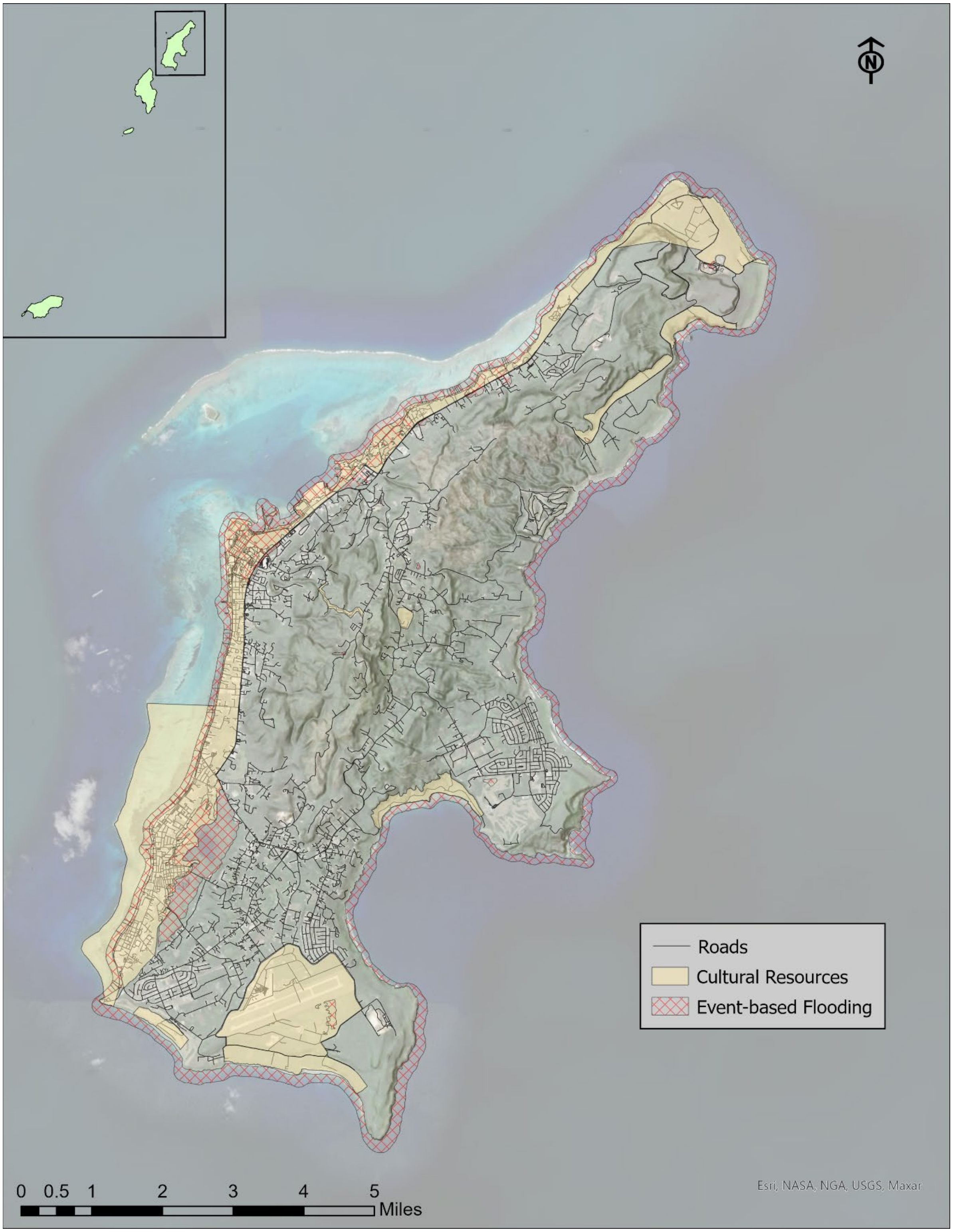


Figure B.5-16. Areas designated for cultural resources in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Saipan.

Figure B.5-17. Areas designated for cultural resources in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Tinian.

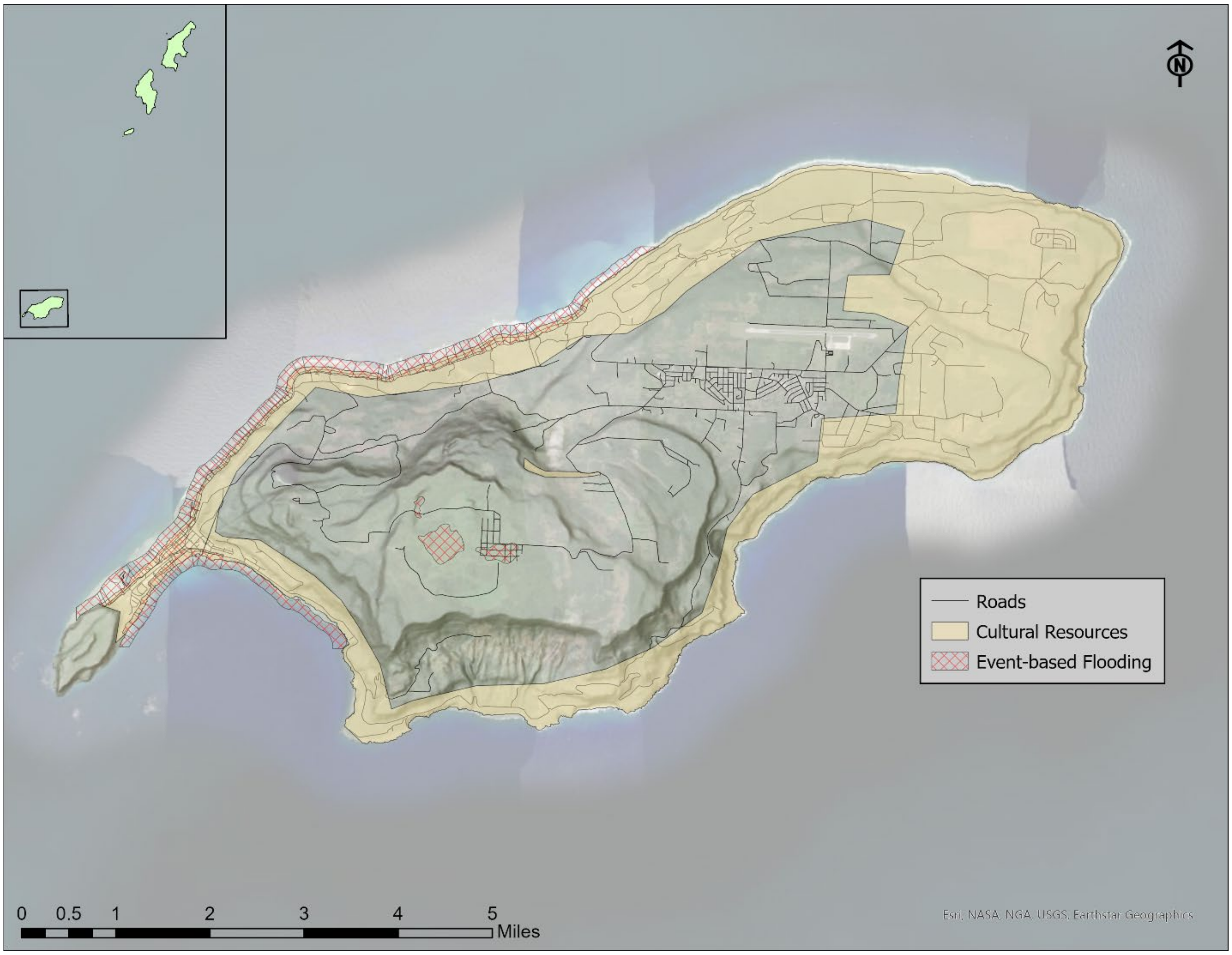


Figure B.5-18. Areas designated for cultural resources in the Special Flood Hazard Area and exposed to the 1% annual chance event-based flood hazard on Rota.

Figure B.5-19. Commonwealth buildings exposed on Saipan to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-20. Commonwealth buildings exposed on Tinian to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge

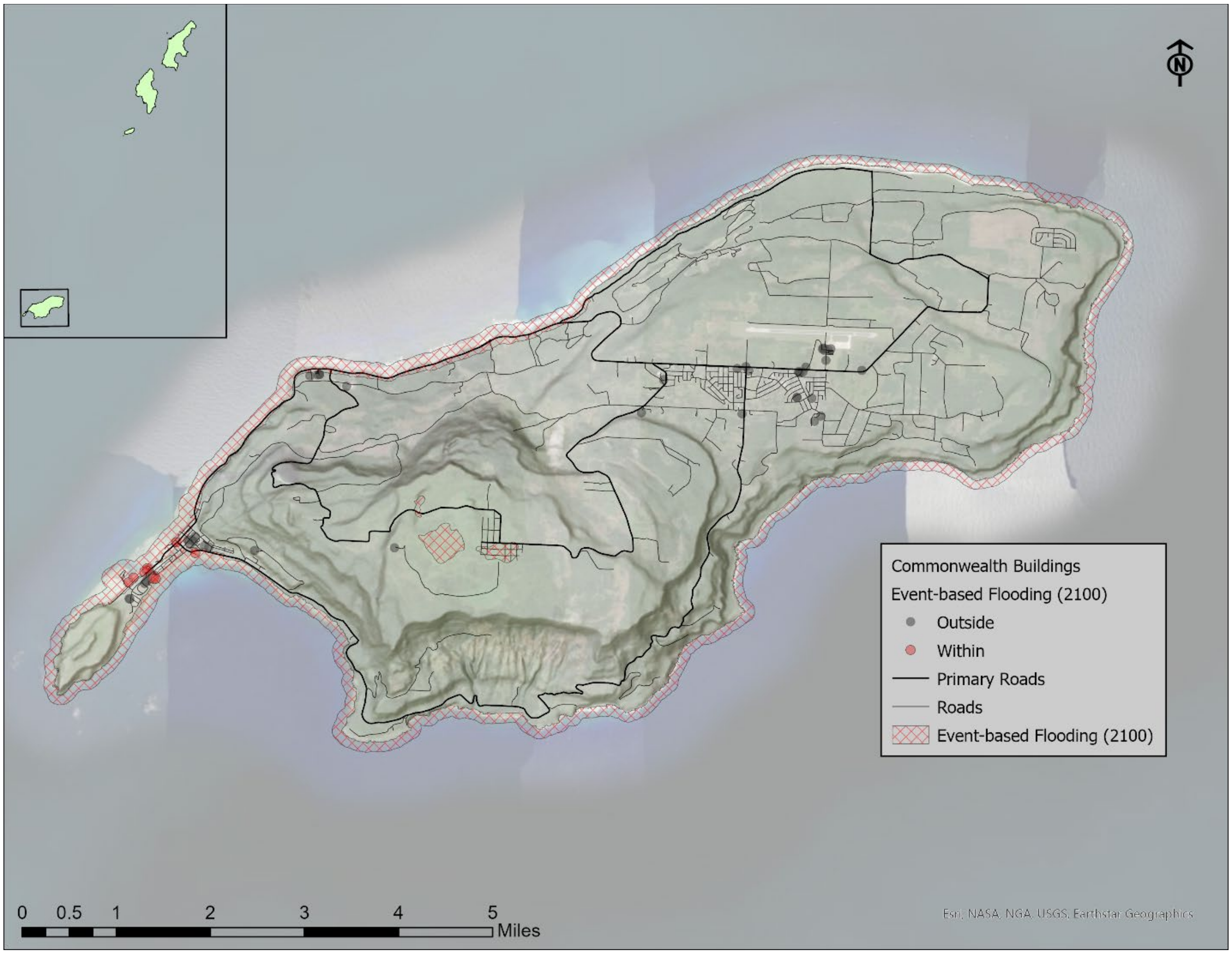


Figure B.5-21. Commonwealth buildings exposed on Rota to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge

Figure B.5-22. Critical facilities and community lifelines exposed on Saipan to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-23. Critical facilities and community lifelines exposed on Tinian to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

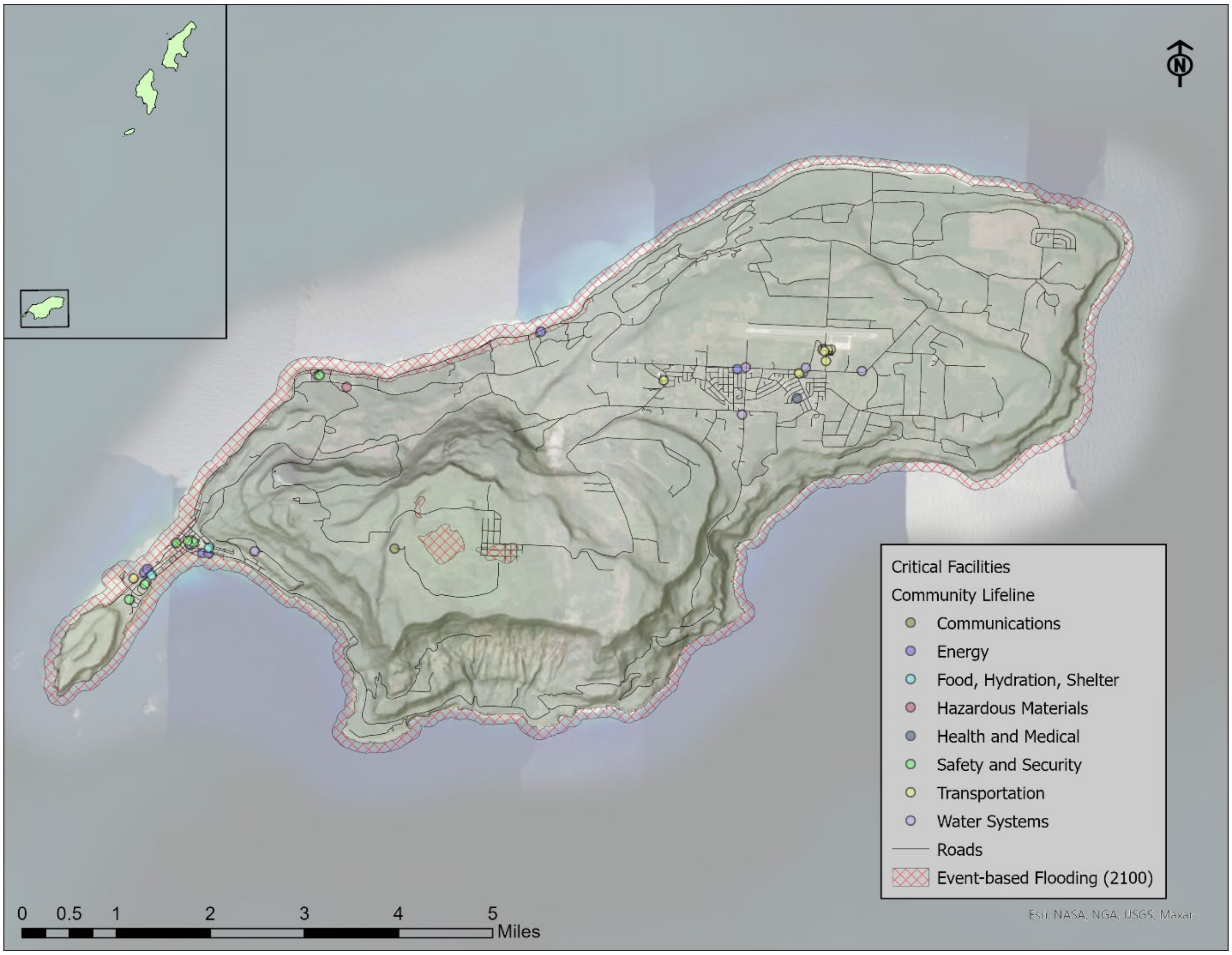


Figure B.5-24. Critical facilities and community lifelines exposed on Rota to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-25. General building stock exposed on Saipan to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-26. General building stock exposed on Tinian to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

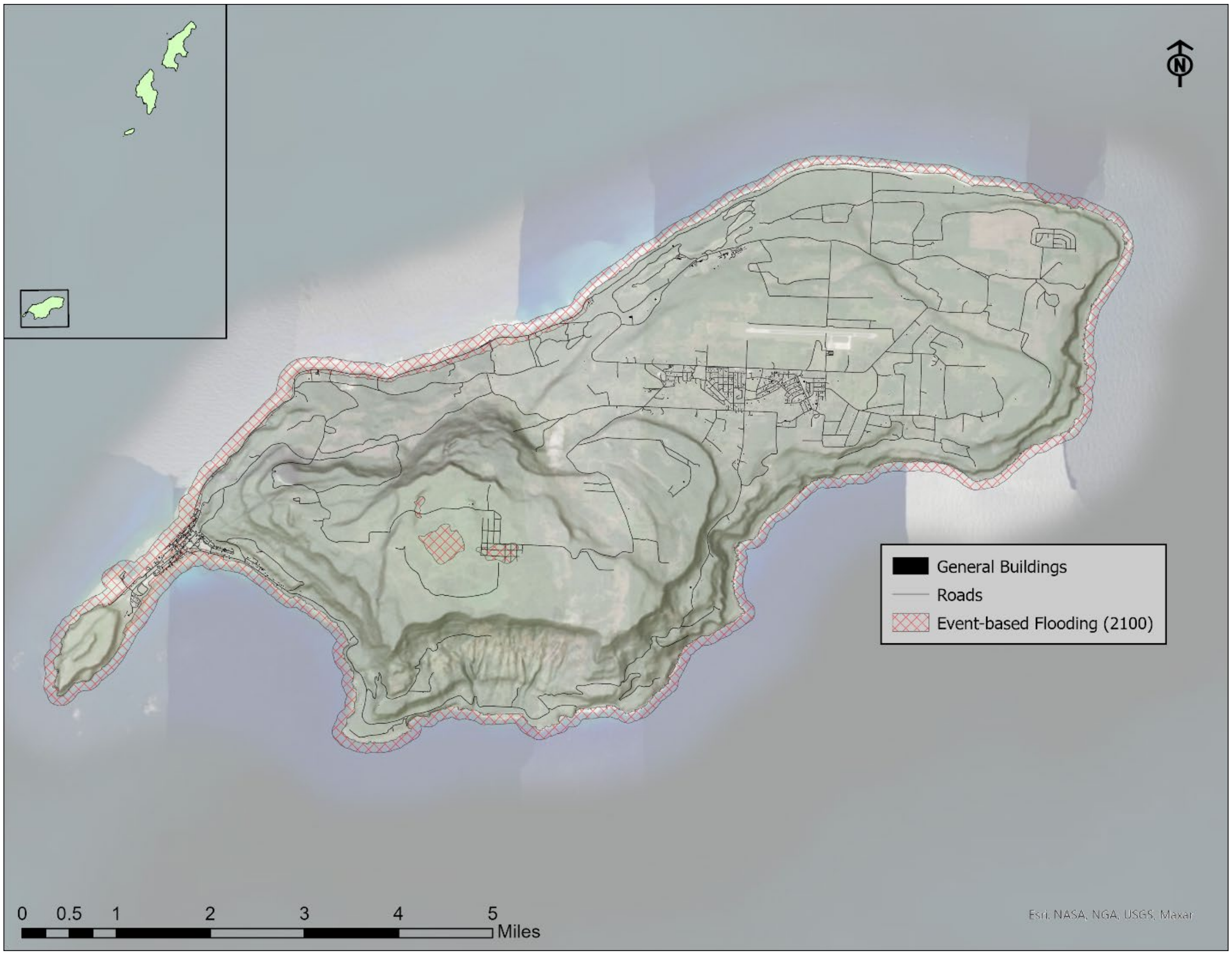


Figure B.5-27. General building stock exposed on Rota to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

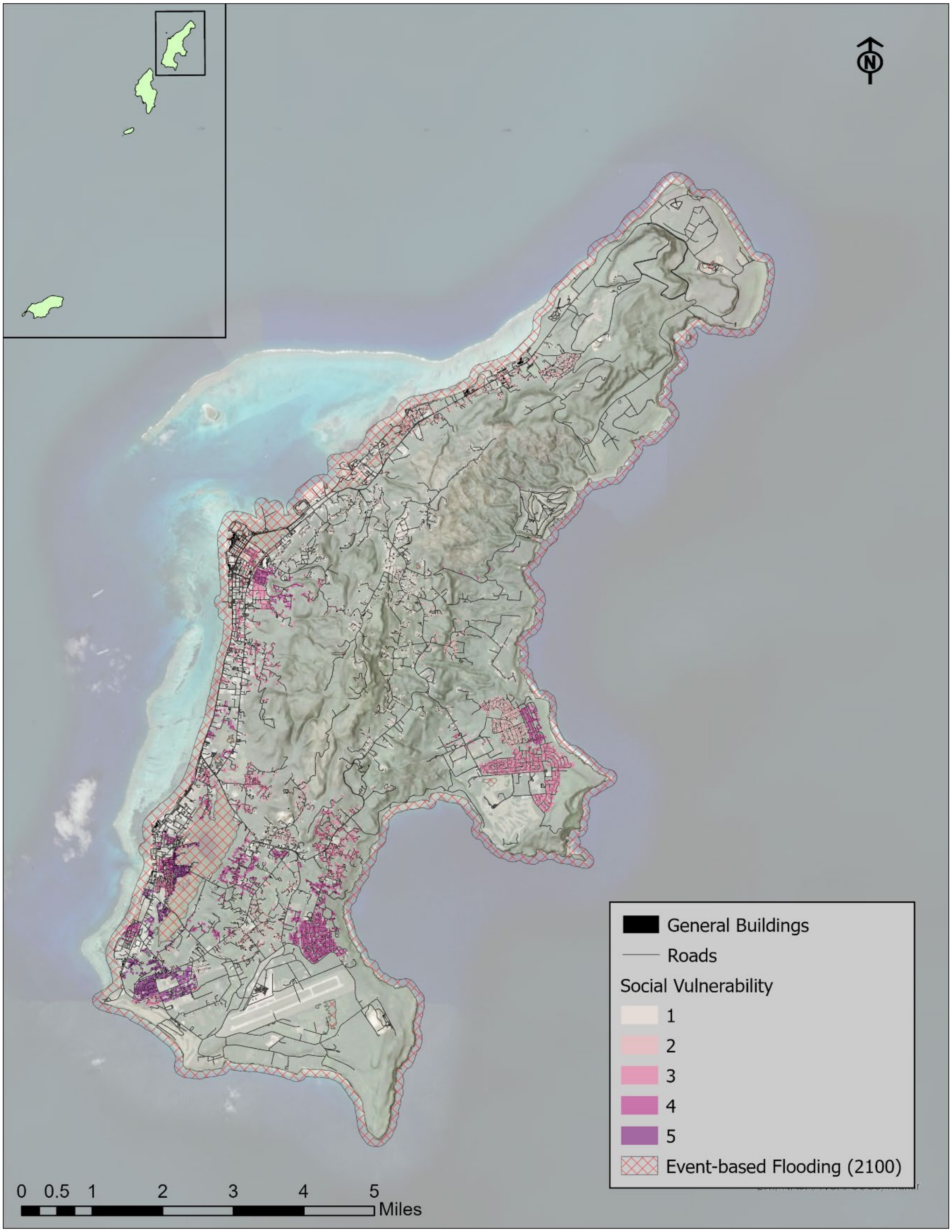


Figure B.5-28. Socially vulnerable index area exposed on Saipan to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-29. Socially vulnerable index area exposed on Tinian to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

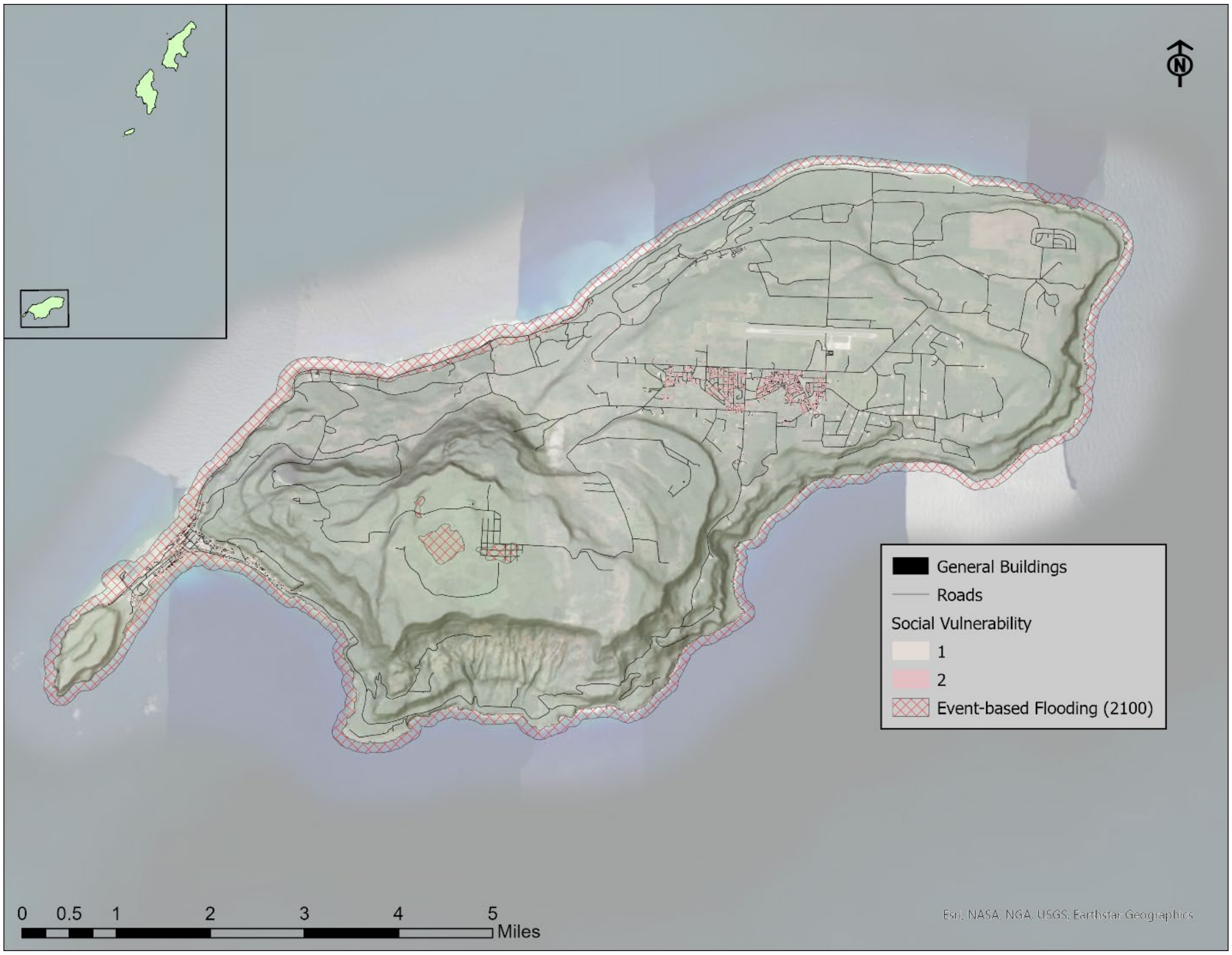


Figure B.5-30. Socially vulnerable index area exposed on Rota to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

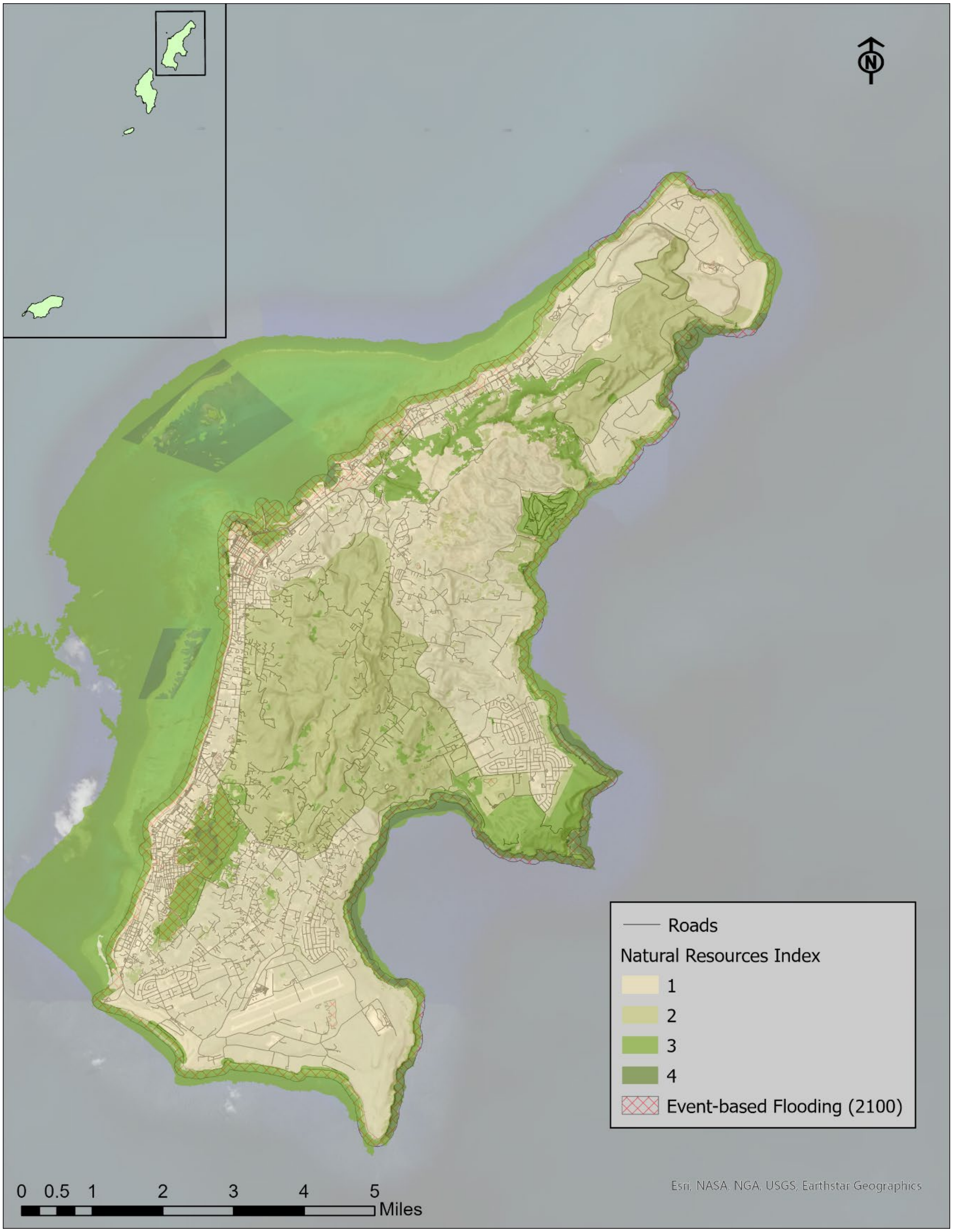


Figure B.5-31. Natural resource index for suitable habitats for species of conservation concern on Saipan exposed to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge

Figure B.5-32. Natural resource index for suitable habitats for species of conservation concern on Tinian exposed to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-33. Natural resource index for suitable habitats for species of conservation concern on Rota exposed to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge

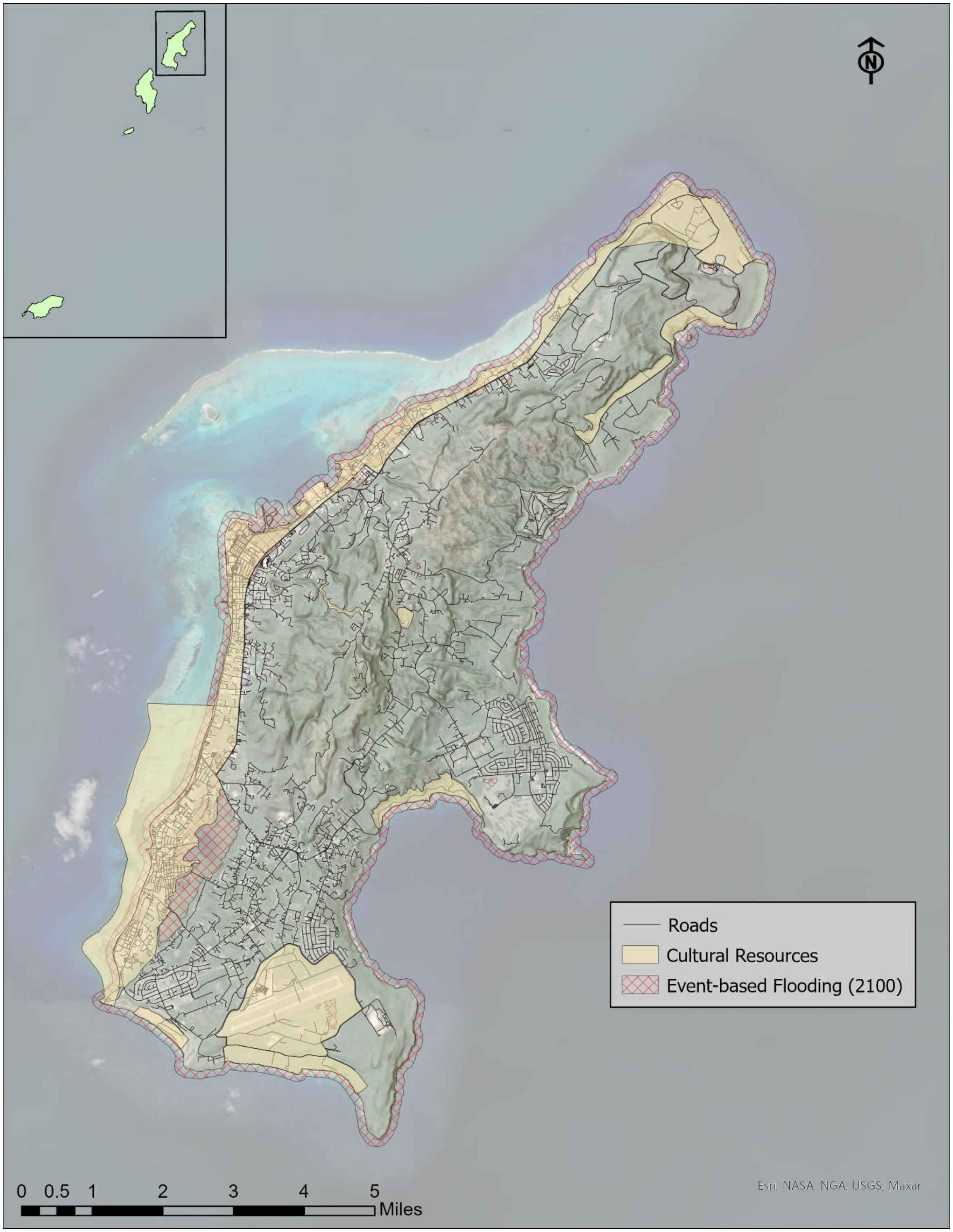


Figure B.5-34. Areas designated for cultural resources on Saipan to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-35. Areas designated for cultural resources on Tinian to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

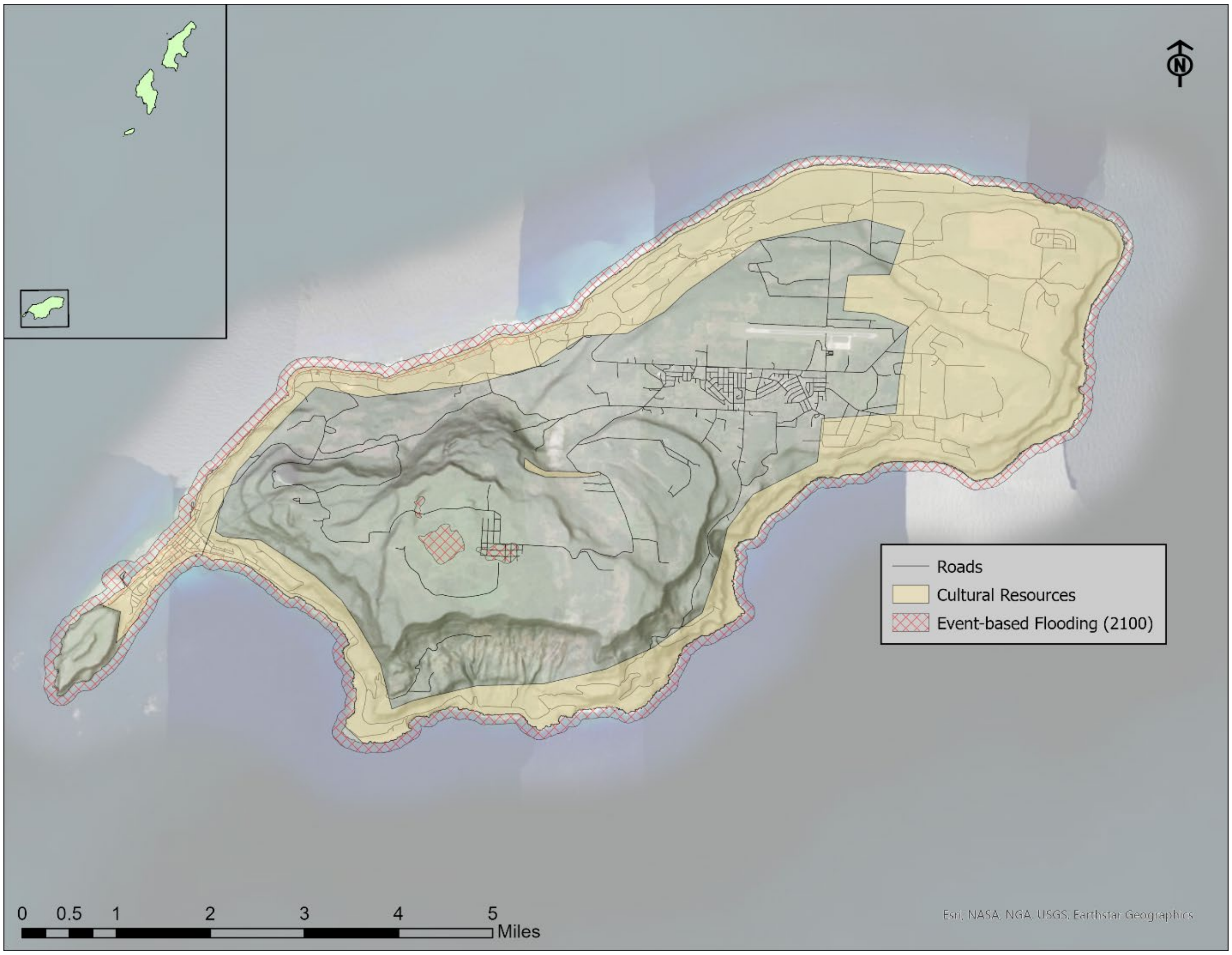


Figure B.5-36. Areas designated for cultural resources on Rota to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

Figure B.5-37. Parcels designated for future development on Saipan exposure to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

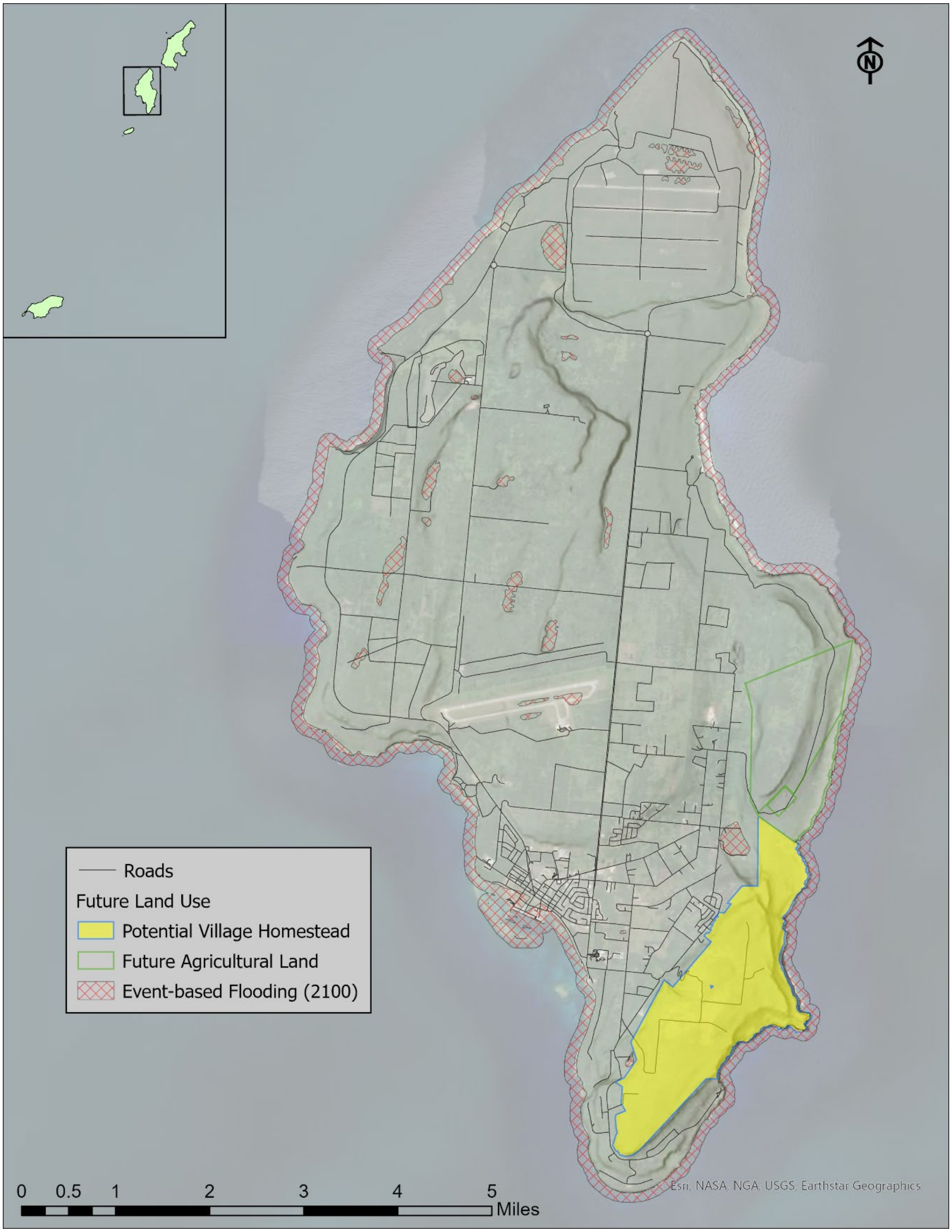


Figure B.5-38. Parcels designated for future development on Tinian exposure to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge..

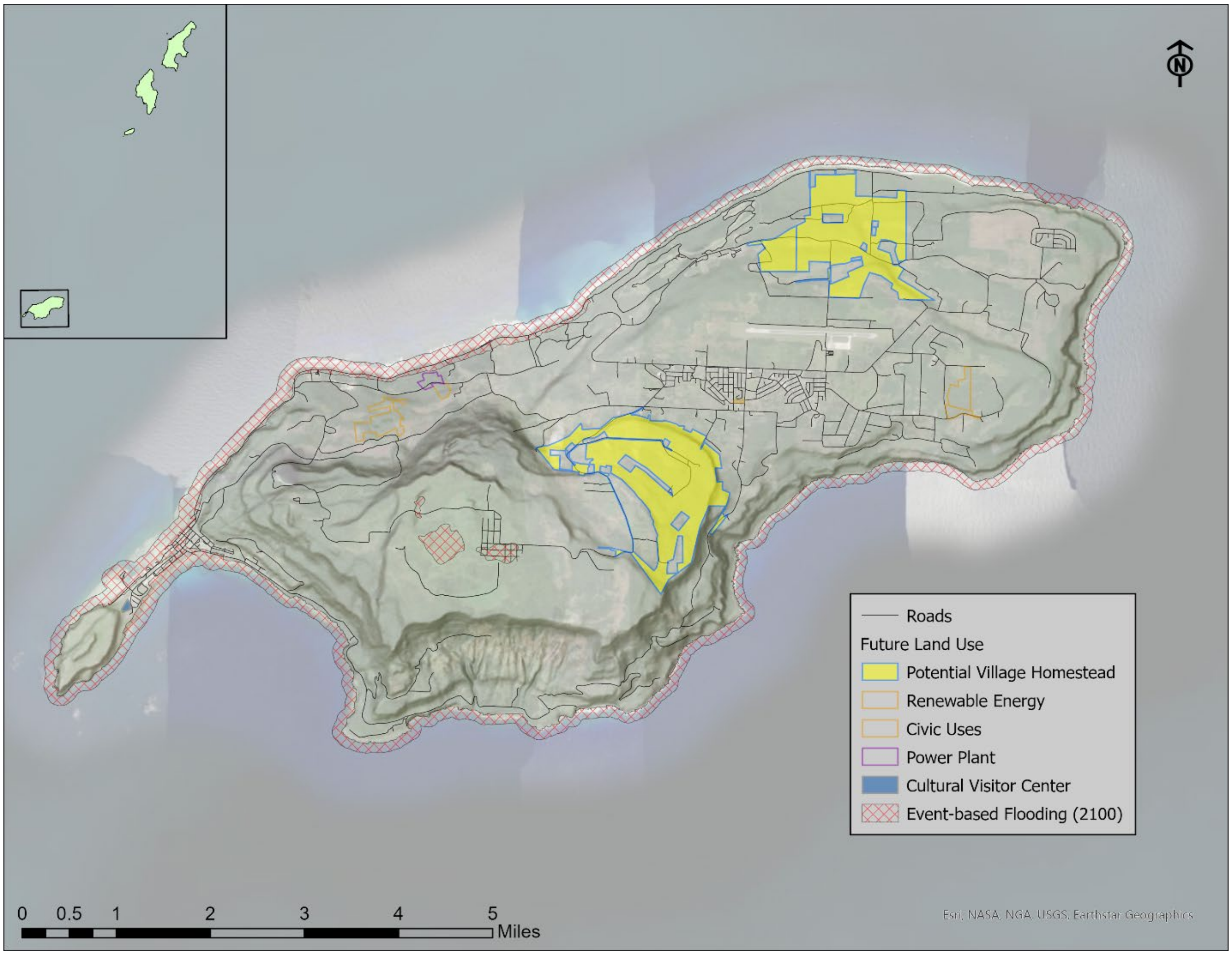


Figure B.5-39. Parcels designated for future development on Rota exposure to the future flood hazard including the 1% annual chance flood, 3 ft of sea level rise, and 10% annual chance storm surge.

B.5.2 Chronic Coastal Flood

Figure B.5-40. Commonwealth buildings exposed to the chronic coastal flood hazard on Saipan.

Figure B.5-41. Commonwealth buildings exposed to the chronic coastal flood hazard on Tinian.

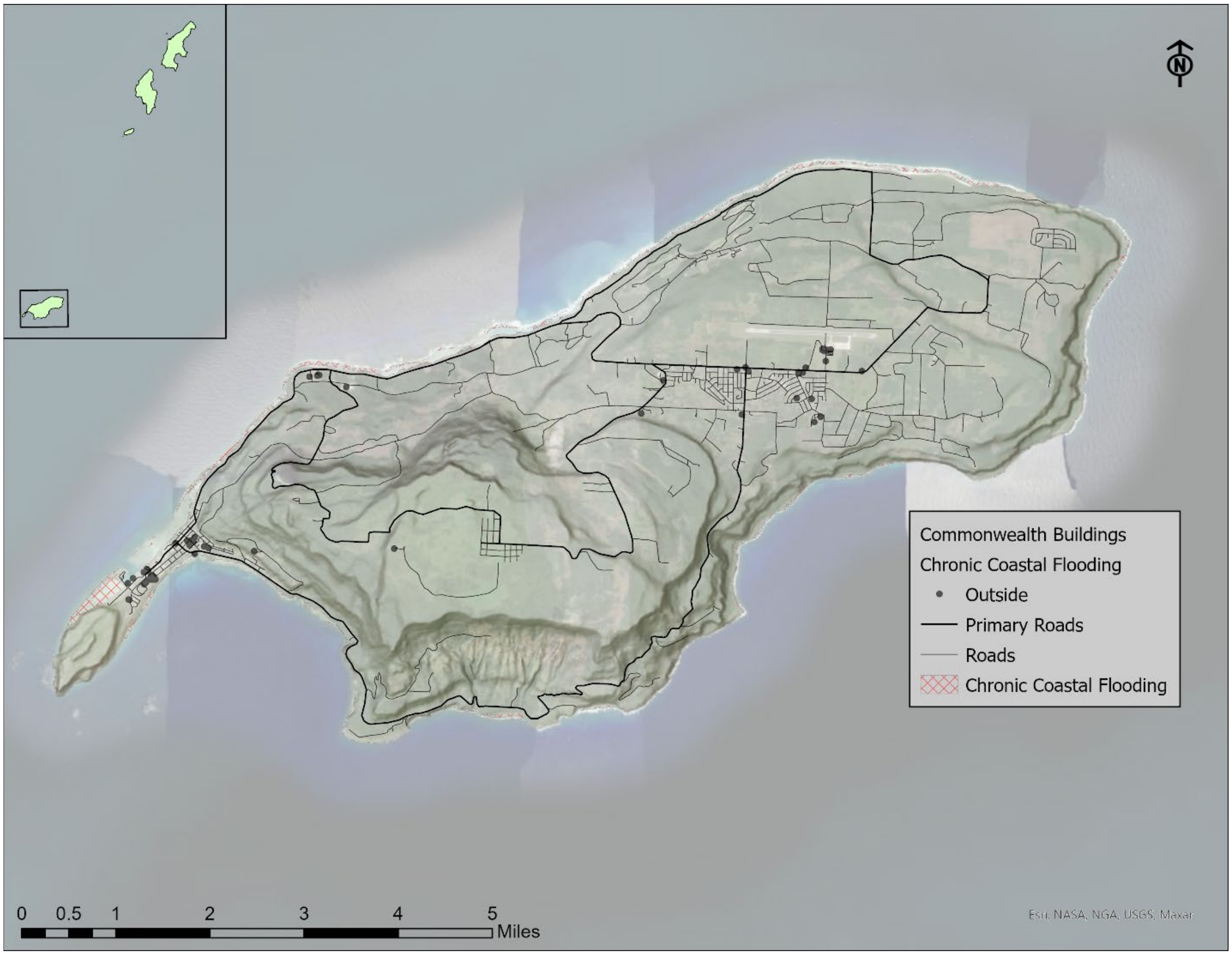


Figure B.5-42. Commonwealth buildings exposed to the chronic coastal flood hazard on Rota.

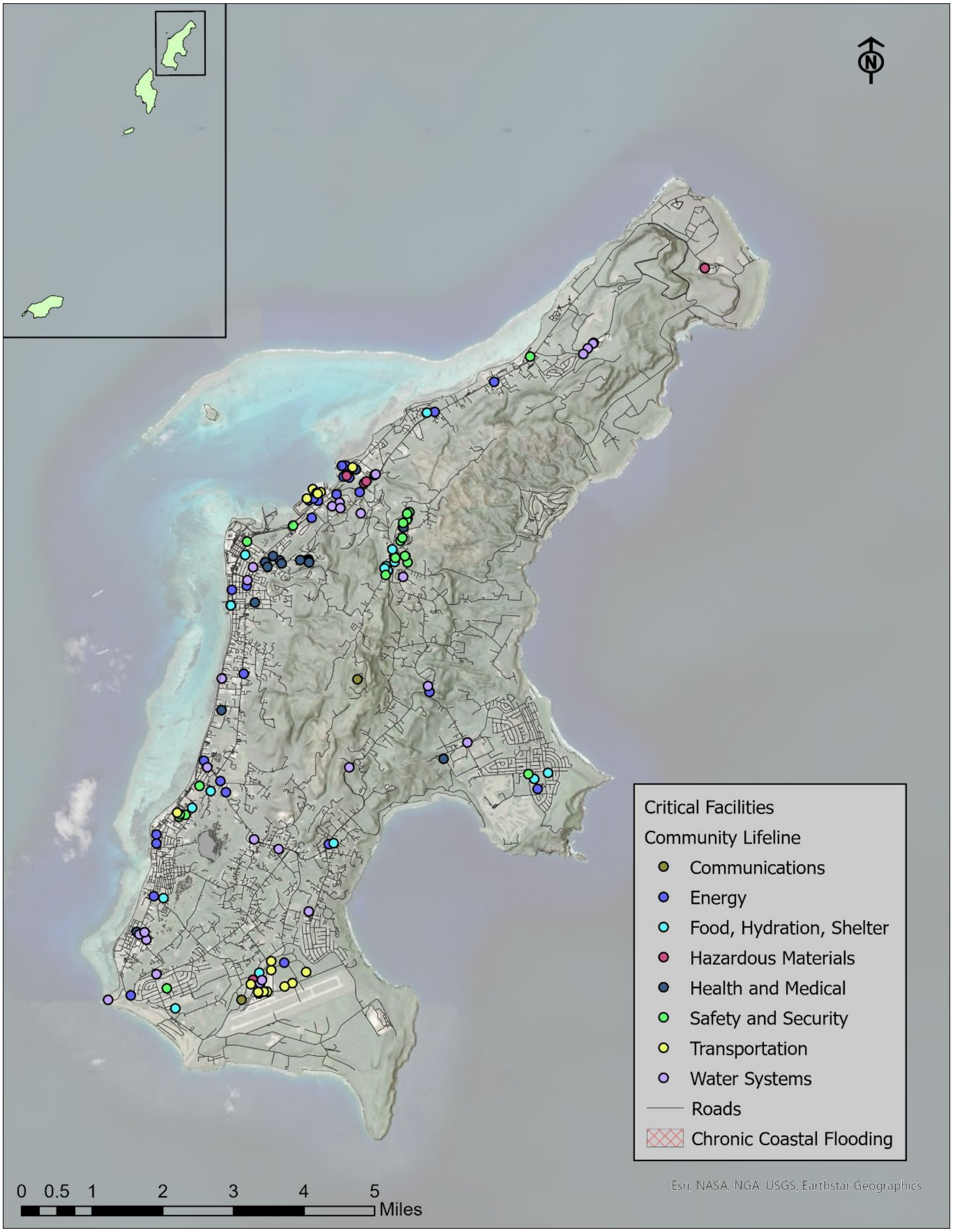


Figure B.5-43. Critical facilities and community lifelines exposed to the chronic coastal flood hazard on Saipan.

Figure B.5-44. Critical facilities and community lifelines exposed to the chronic coastal flood hazard on Tinian.

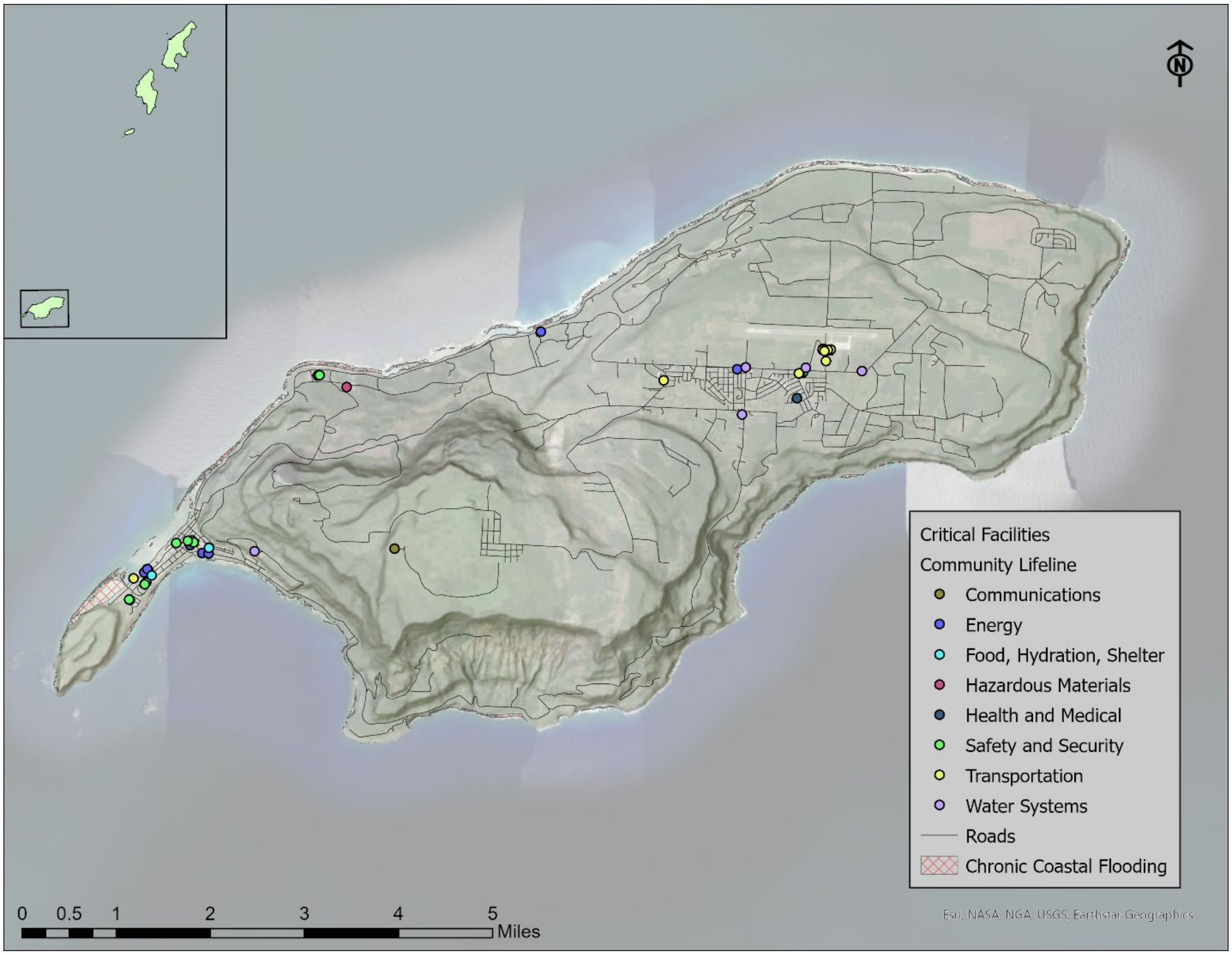


Figure B.5-45. Critical facilities and community lifelines exposed to the chronic coastal flood hazard on Rota.

Figure B.5-46. General building stock exposed to the chronic coastal flood hazard on Saipan.

Figure B.5-47. General building stock exposed to the chronic coastal flood hazard on Tinian.

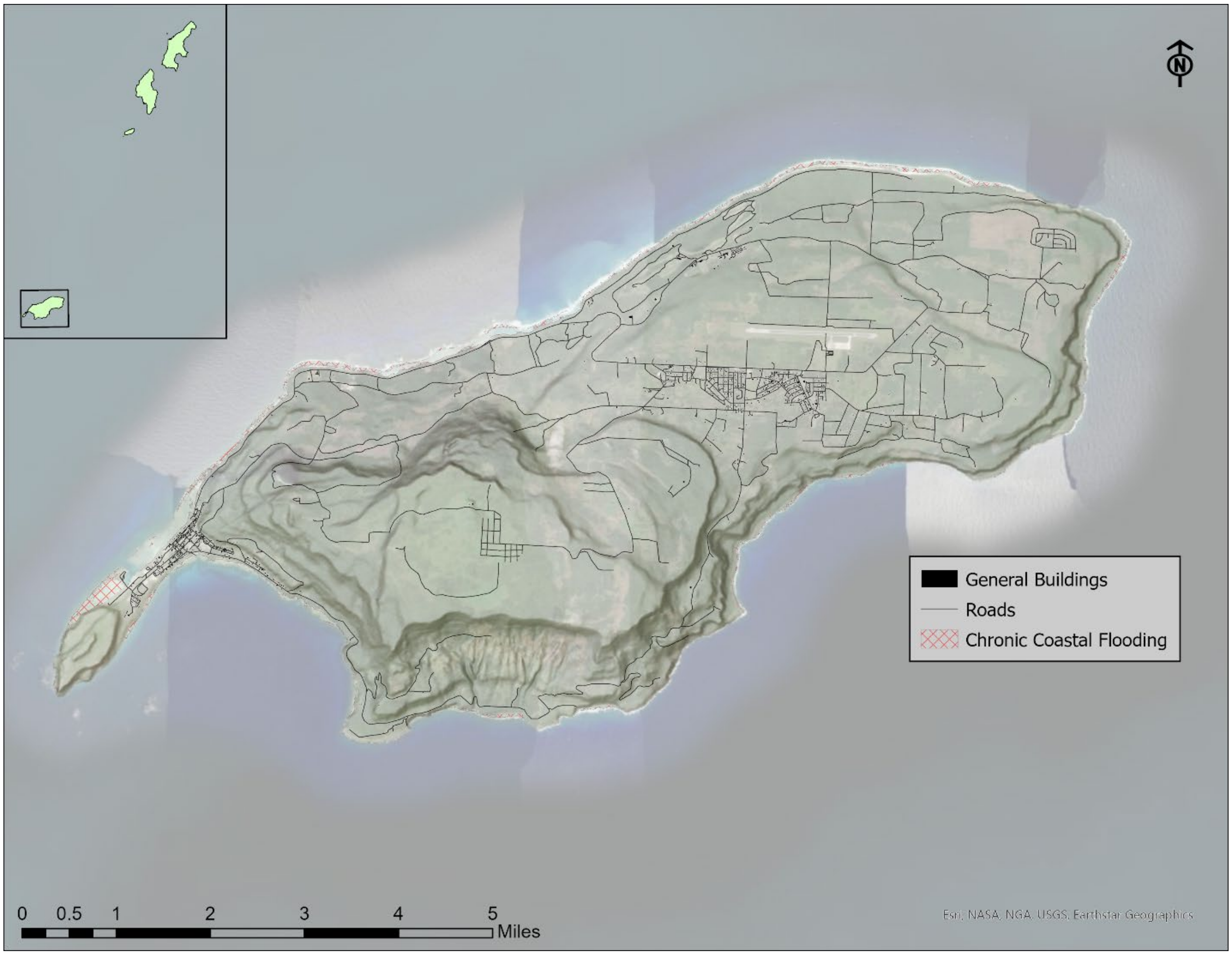


Figure B.5-48. General building stock exposed to the chronic coastal flood hazard on Rota.

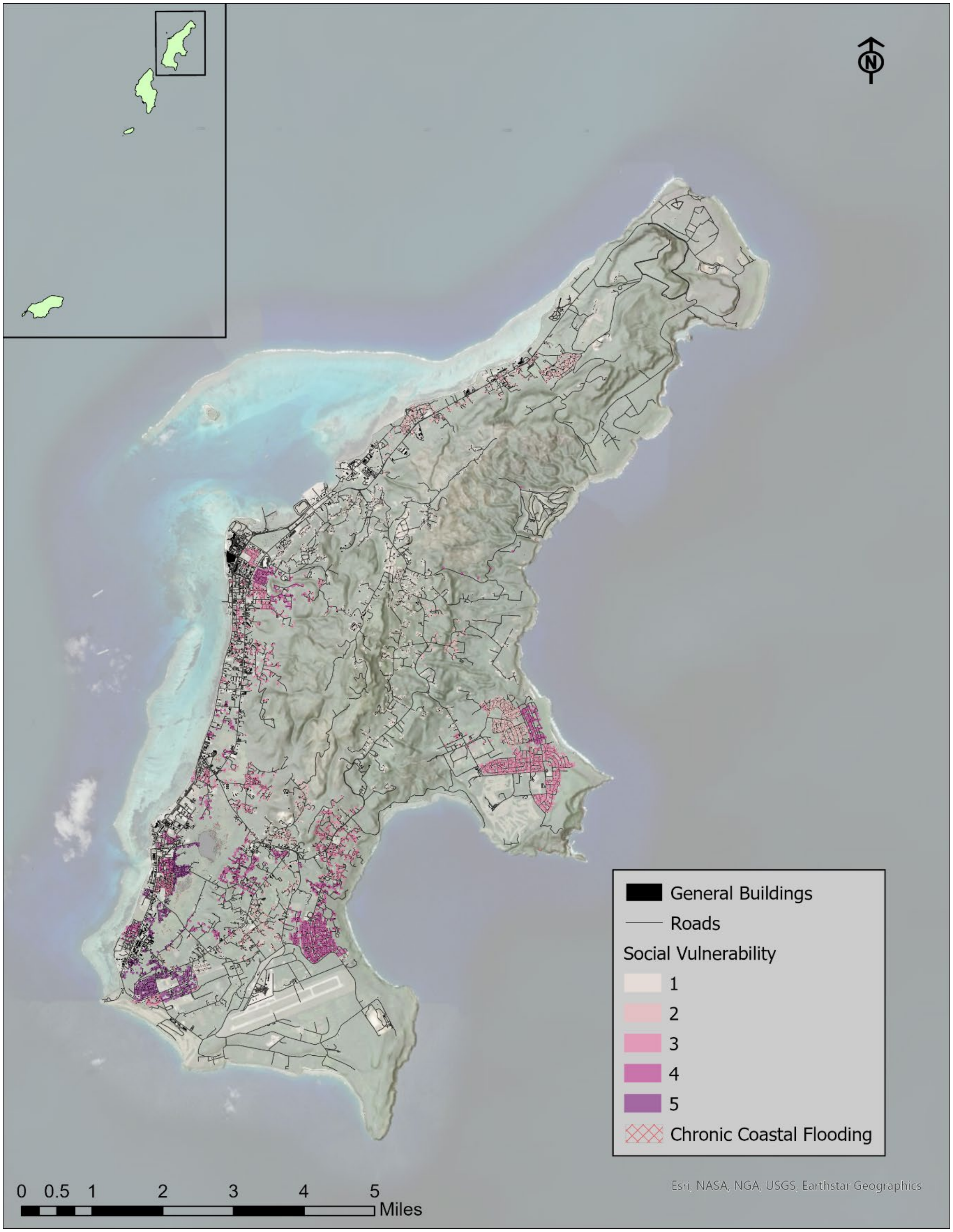


Figure B.5-49. Socially vulnerable index and the chronic coastal flood hazard on Saipan.

Figure B.5-50. Socially vulnerable index and the chronic coastal flood hazard on Tinian.

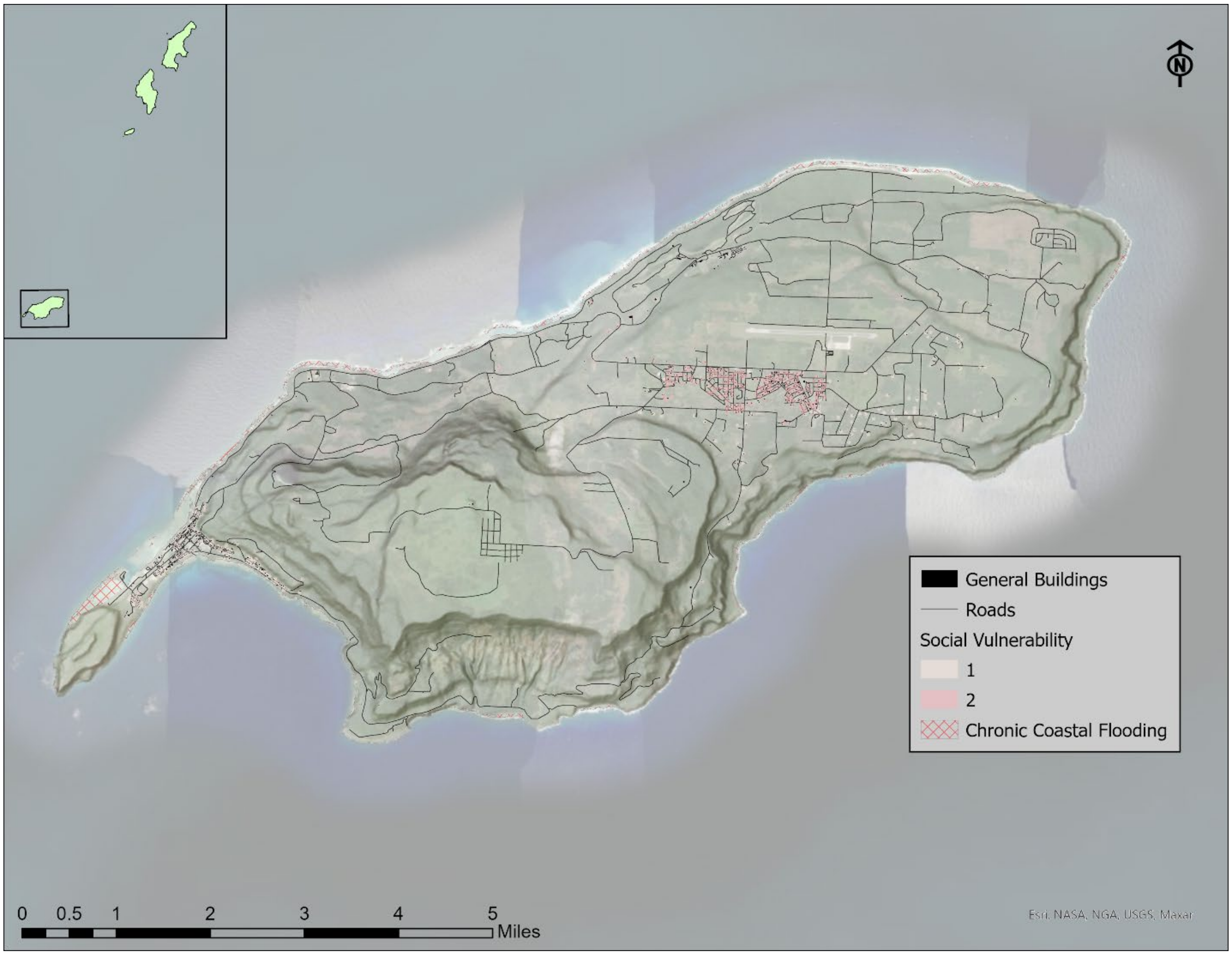


Figure B.5-51. Socially vulnerable index and the chronic coastal flood hazard on Rota.

Figure B.5-52. Natural resource index for suitable habitats for species of conservation concern and the chronic coastal flood hazard on Saipan.

Figure B.5-53. Natural resource index for suitable habitats for species of conservation concern and the chronic coastal flood hazard on Tinian.

Figure B.5-54. Natural resource index for suitable habitats for species of conservation concern and the chronic coastal flood hazard on Rota.

Figure B.5-55. Areas designated for cultural resources and the chronic coastal flood hazard on Saipan.

Figure B.5-56. Areas designated for cultural resources and the chronic coastal flood hazard on Tinian.

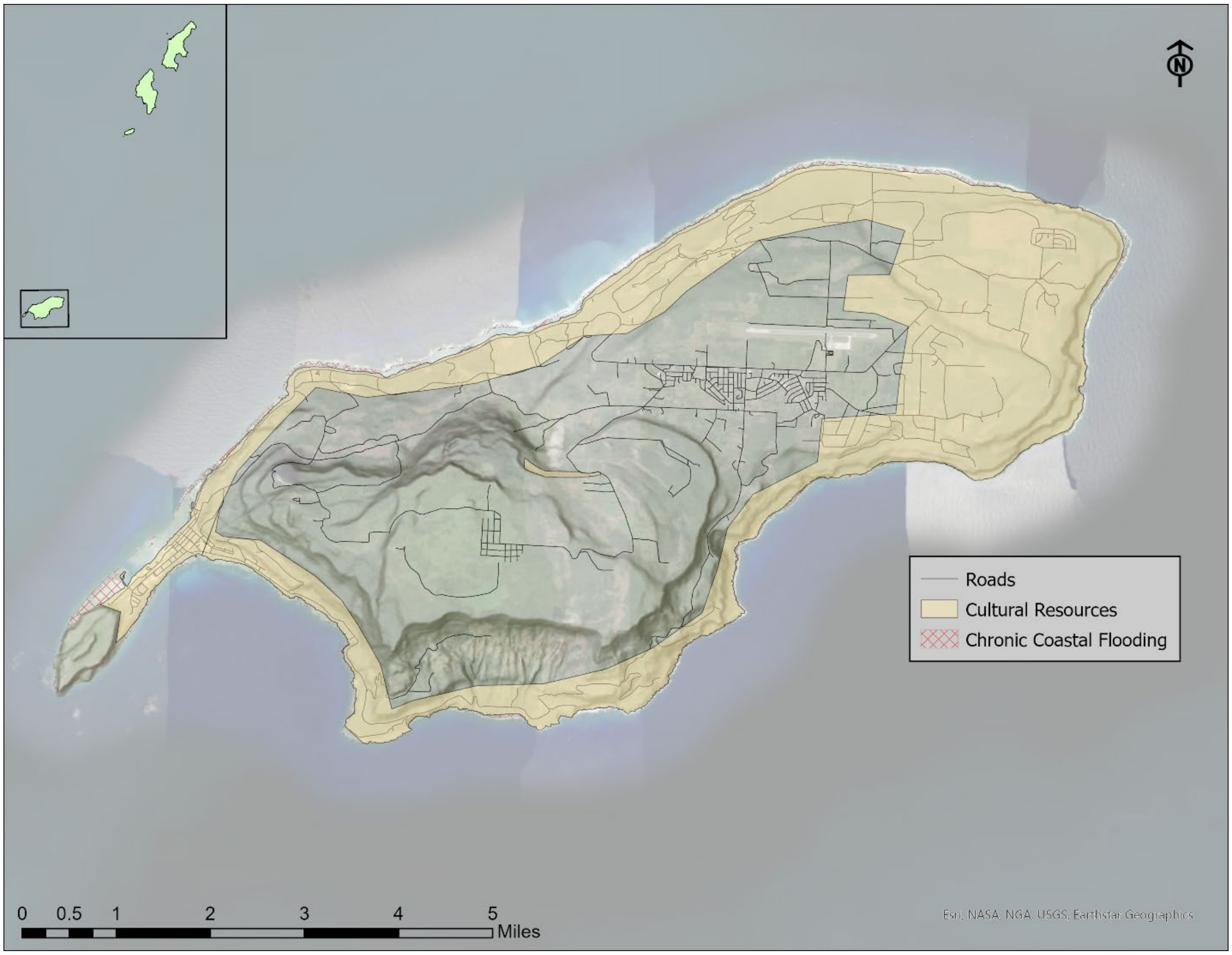


Figure B.5-57. Areas designated for cultural resources and the chronic coastal flood hazard on Rota.

Figure B.5-58. Commonwealth buildings exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-59. Commonwealth buildings exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

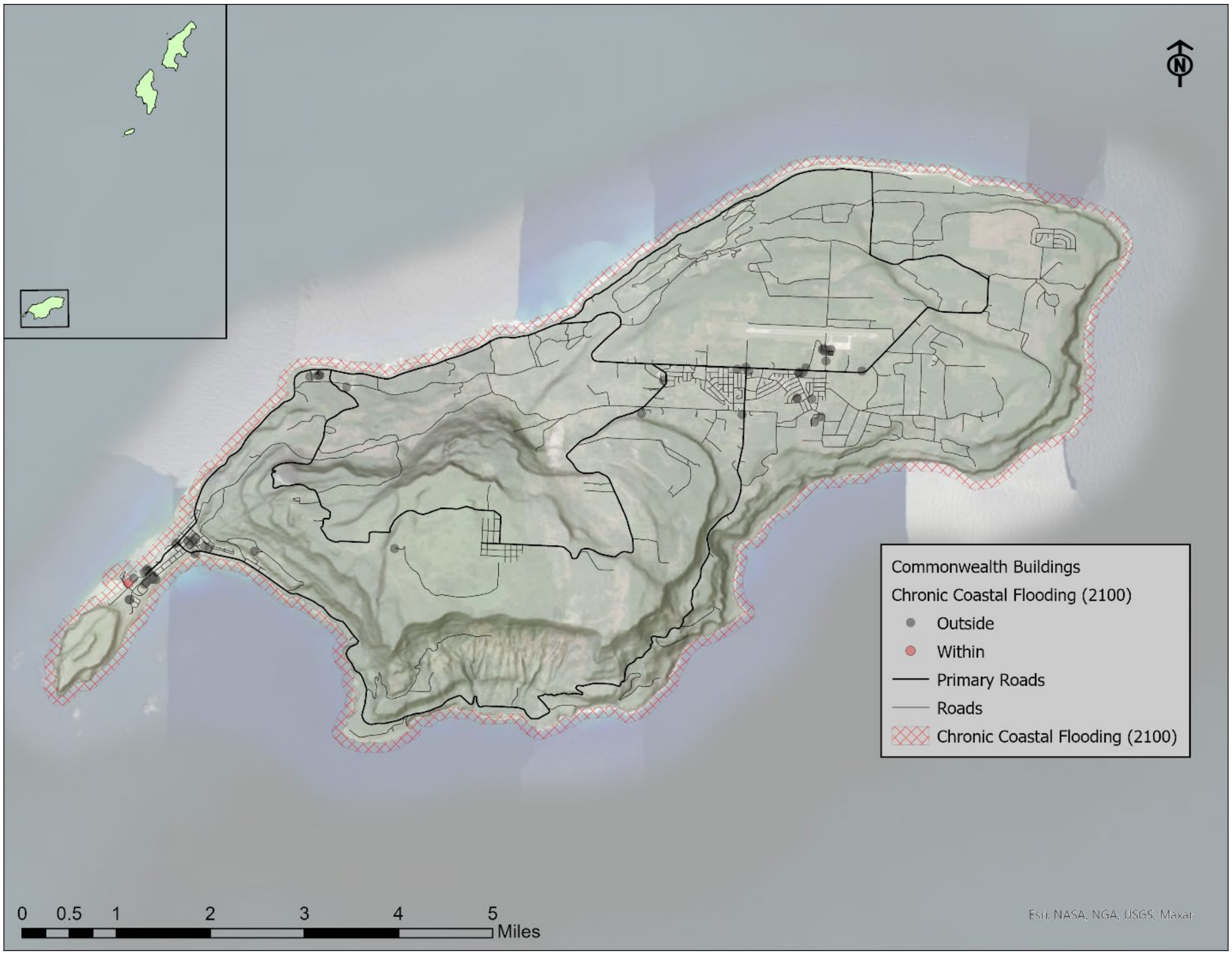


Figure B.5-60. Commonwealth buildings exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

Figure B.5-61. Critical facilities and community lifelines exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-62. Critical facilities and community lifelines exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

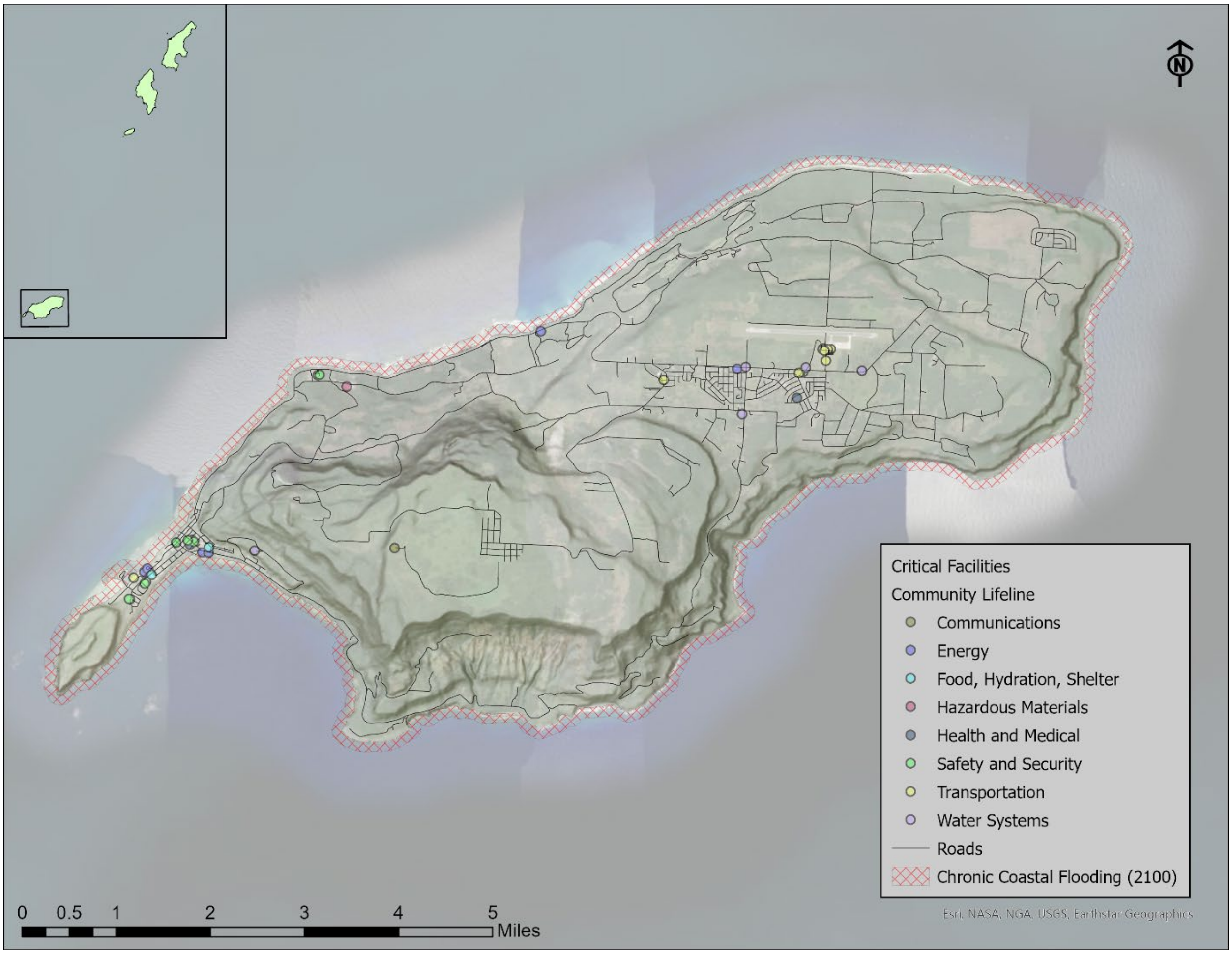


Figure B.5-63. Critical facilities and community lifelines exposed to the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

Figure B.5-64. General building stock exposed the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-65. General building stock exposed the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

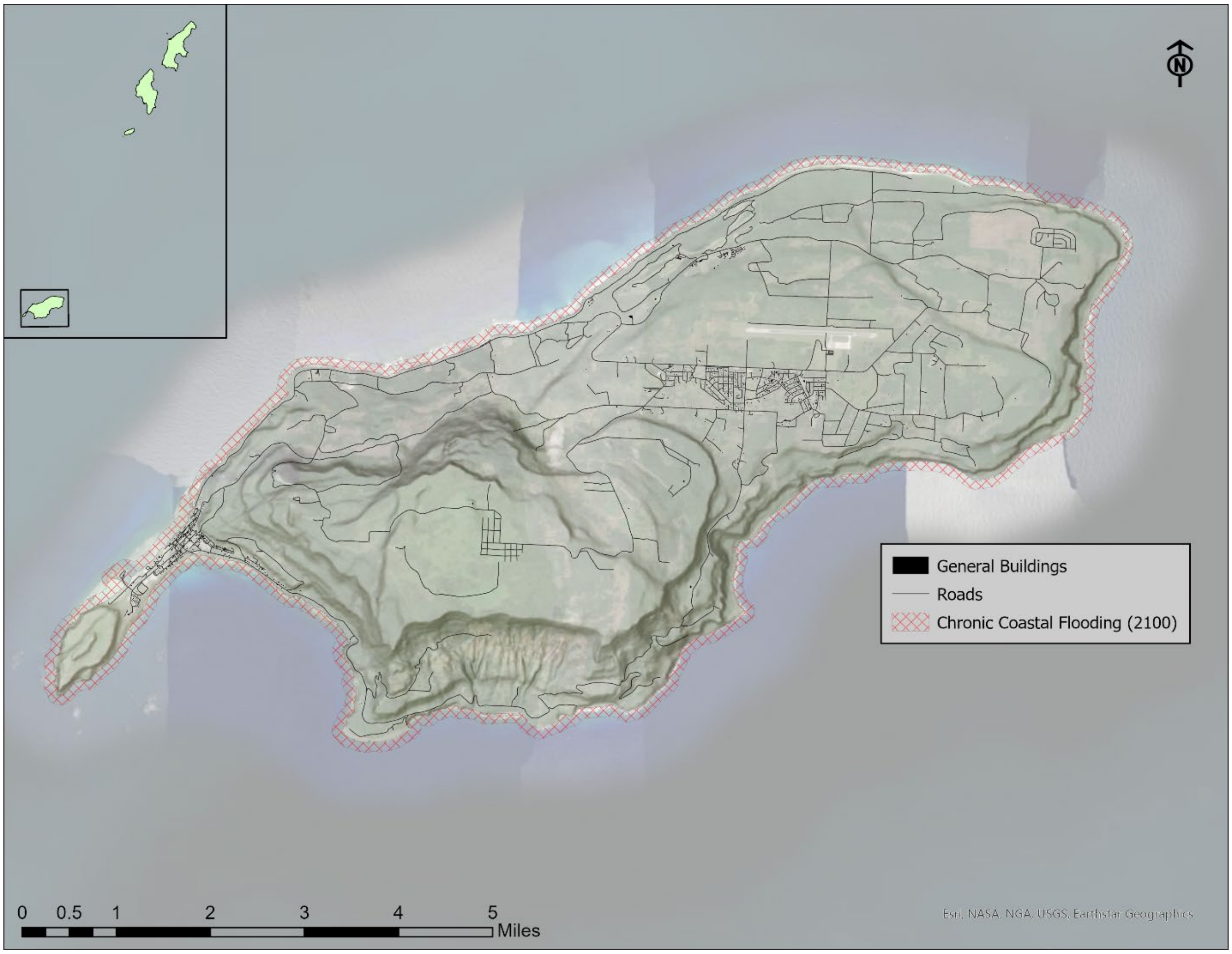


Figure B.5-66. General building stock exposed the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

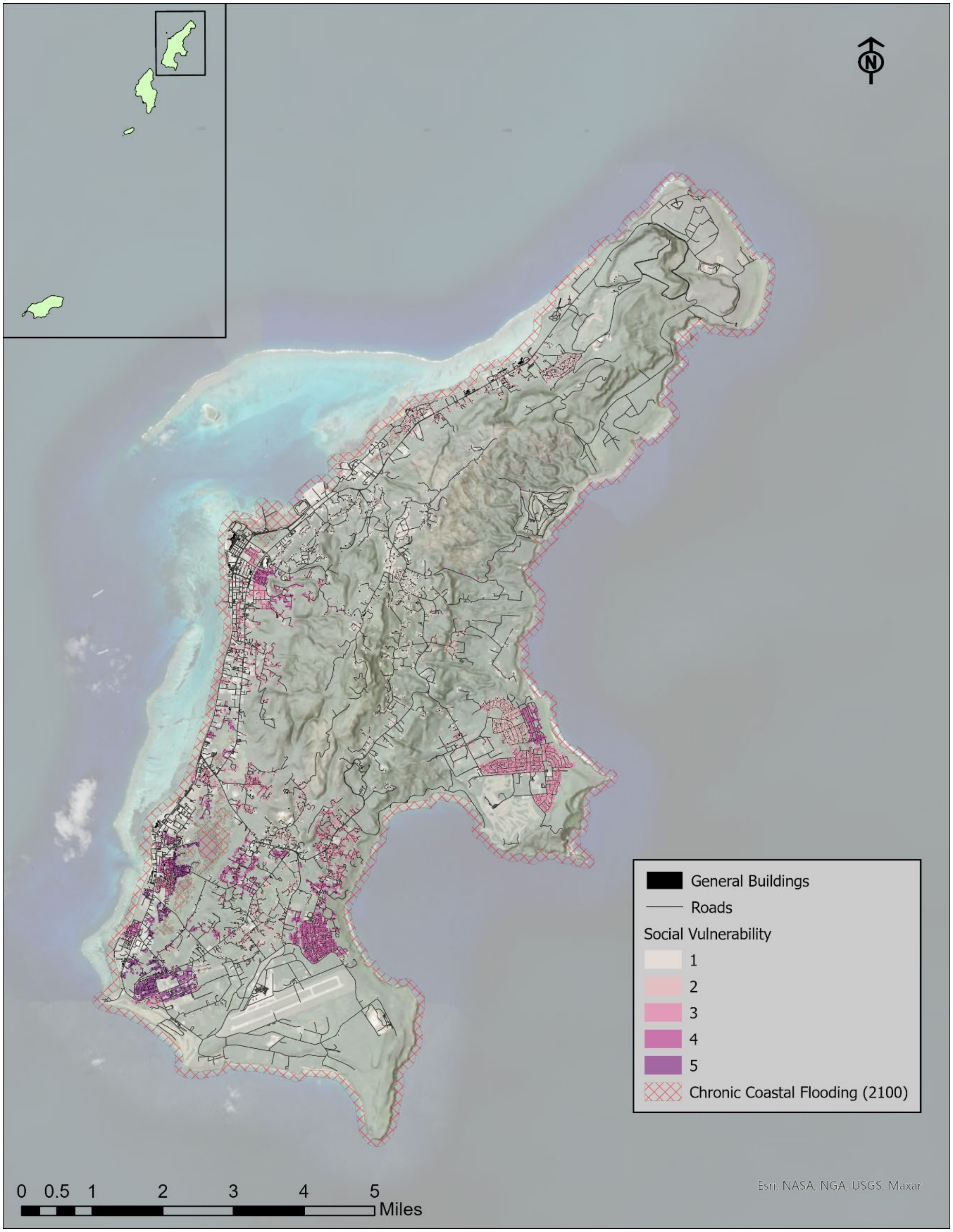


Figure B.5-67. Socially vulnerable index and the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-68. Socially vulnerable index and the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

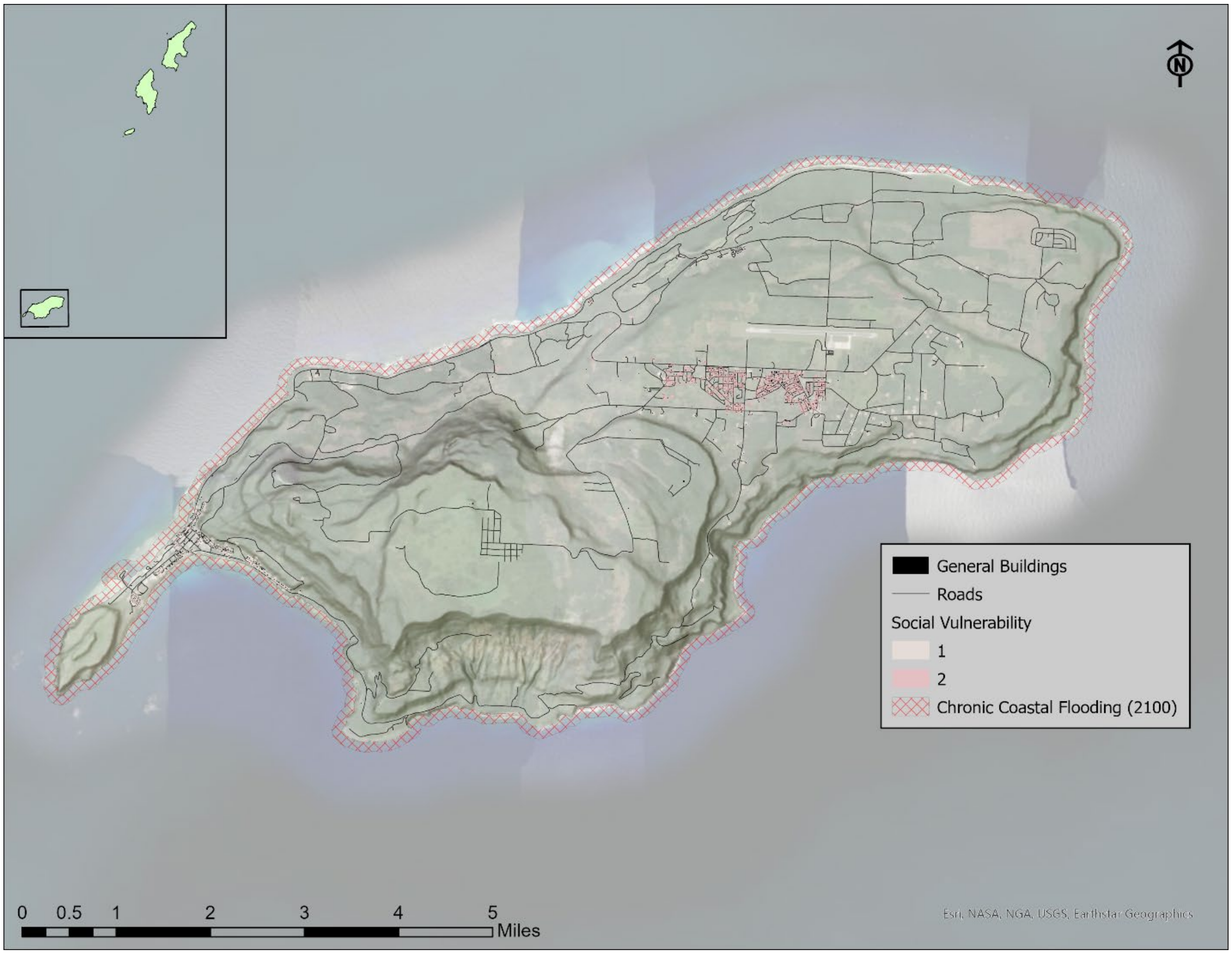


Figure B.5-69. Socially vulnerable index and the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

Figure B.5-70. Natural resource index for suitable habitats for species of conservation concern and the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-71. Natural resource index for suitable habitats for species of conservation concern and the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

Figure B.5-72. Natural resource index for suitable habitats for species of conservation concern and the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

Figure B.5-73. Areas designated for cultural resources and the future chronic coastal flood hazard with 3 ft of sea level rise on Saipan.

Figure B.5-74. Areas designated for cultural resources and the future chronic coastal flood hazard with 3 ft of sea level rise on Tinian.

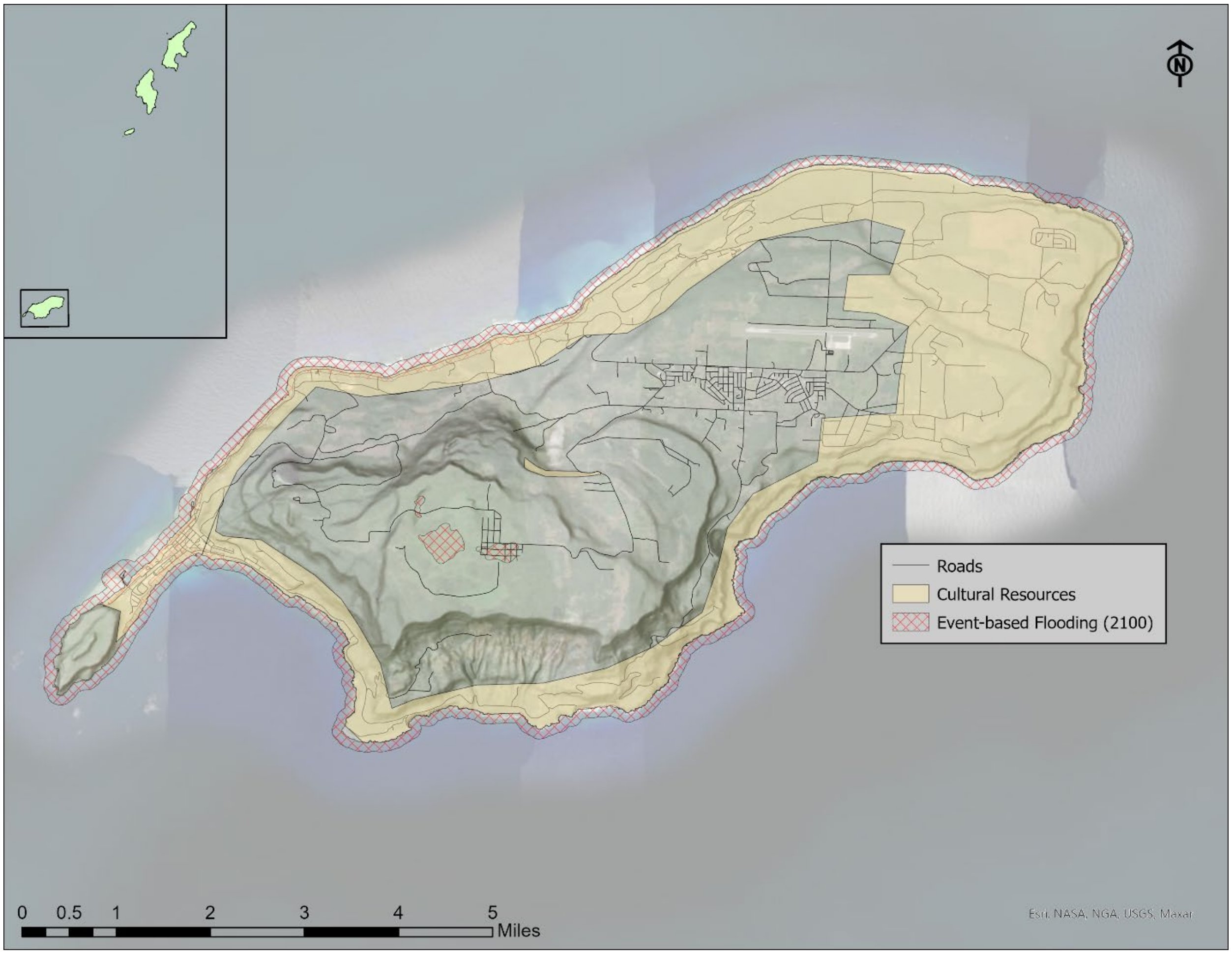


Figure B.5-75. Areas designated for cultural resources and the future chronic coastal flood hazard with 3 ft of sea level rise on Rota.

Figure B.5-76. Parcels designated for future development on Saipan exposure to the future chronic coastal flood hazard with 3 ft of sea level rise.

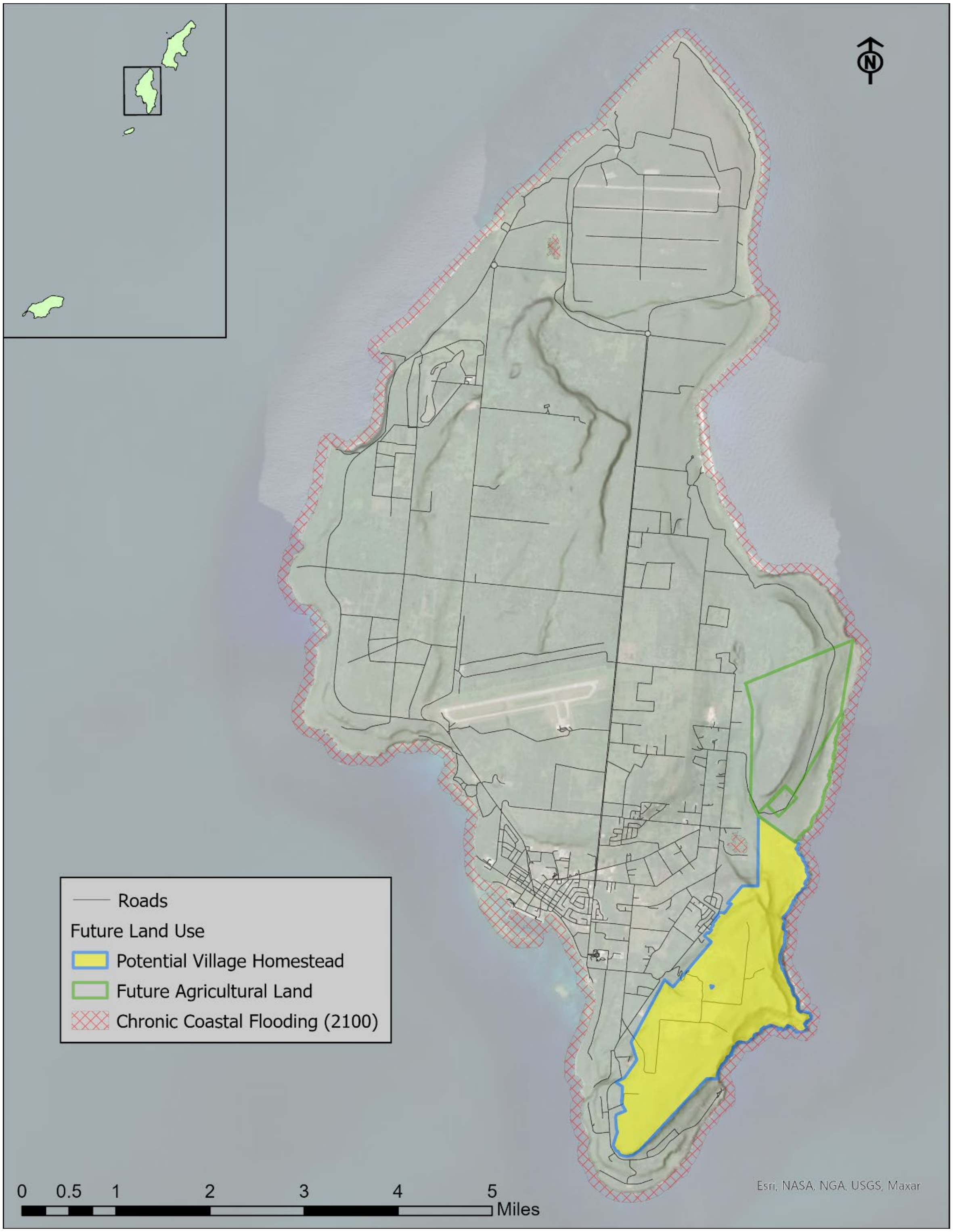


Figure B.5-77. Parcels designated for future development on Tinian exposure to the future chronic coastal flood hazard with 3 ft of sea level rise.

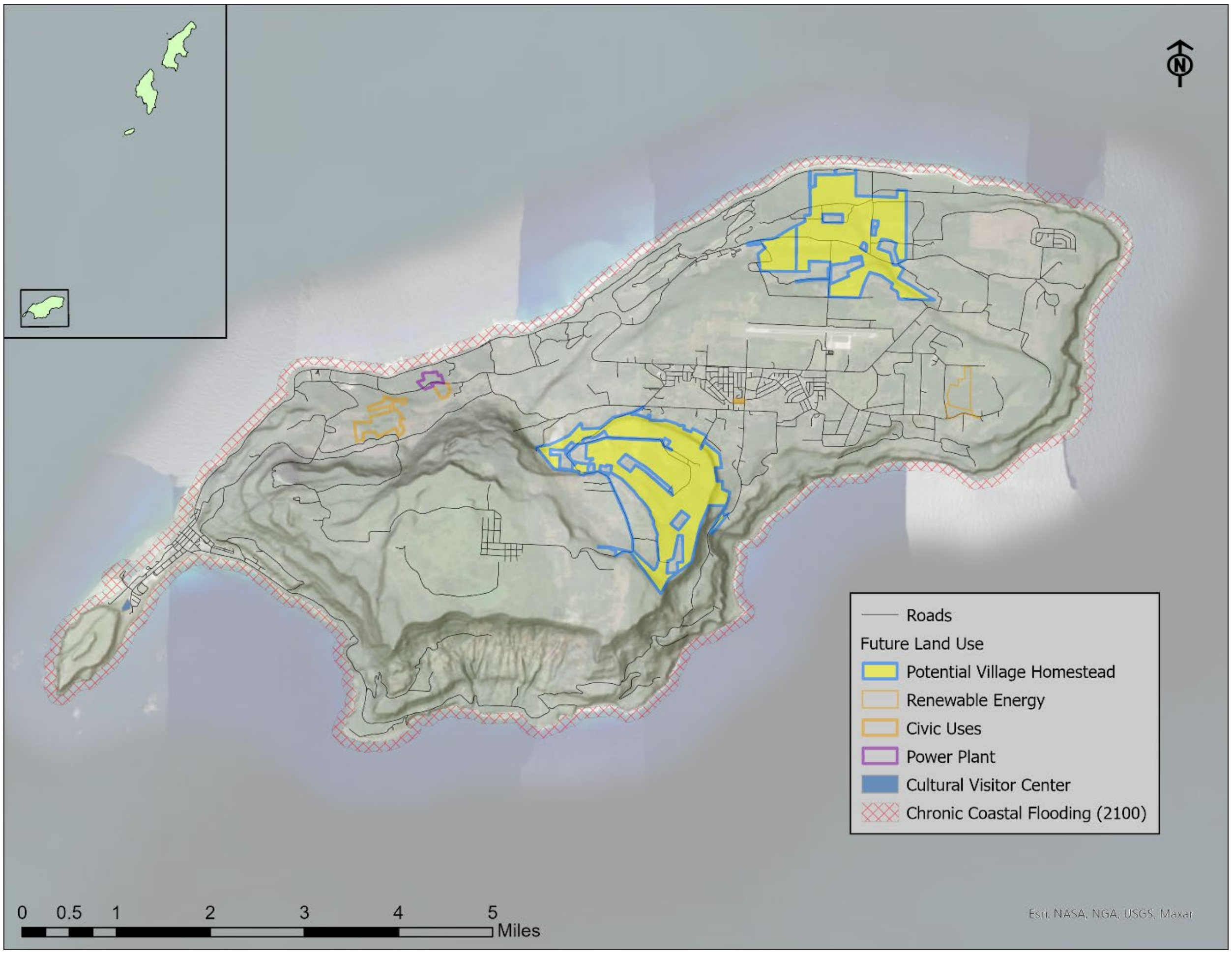


Figure B.5-78. Parcels designated for future development on Rota exposure to the future chronic coastal flood hazard with 3 ft of sea level rise

B.5.3 Coastal Erosion

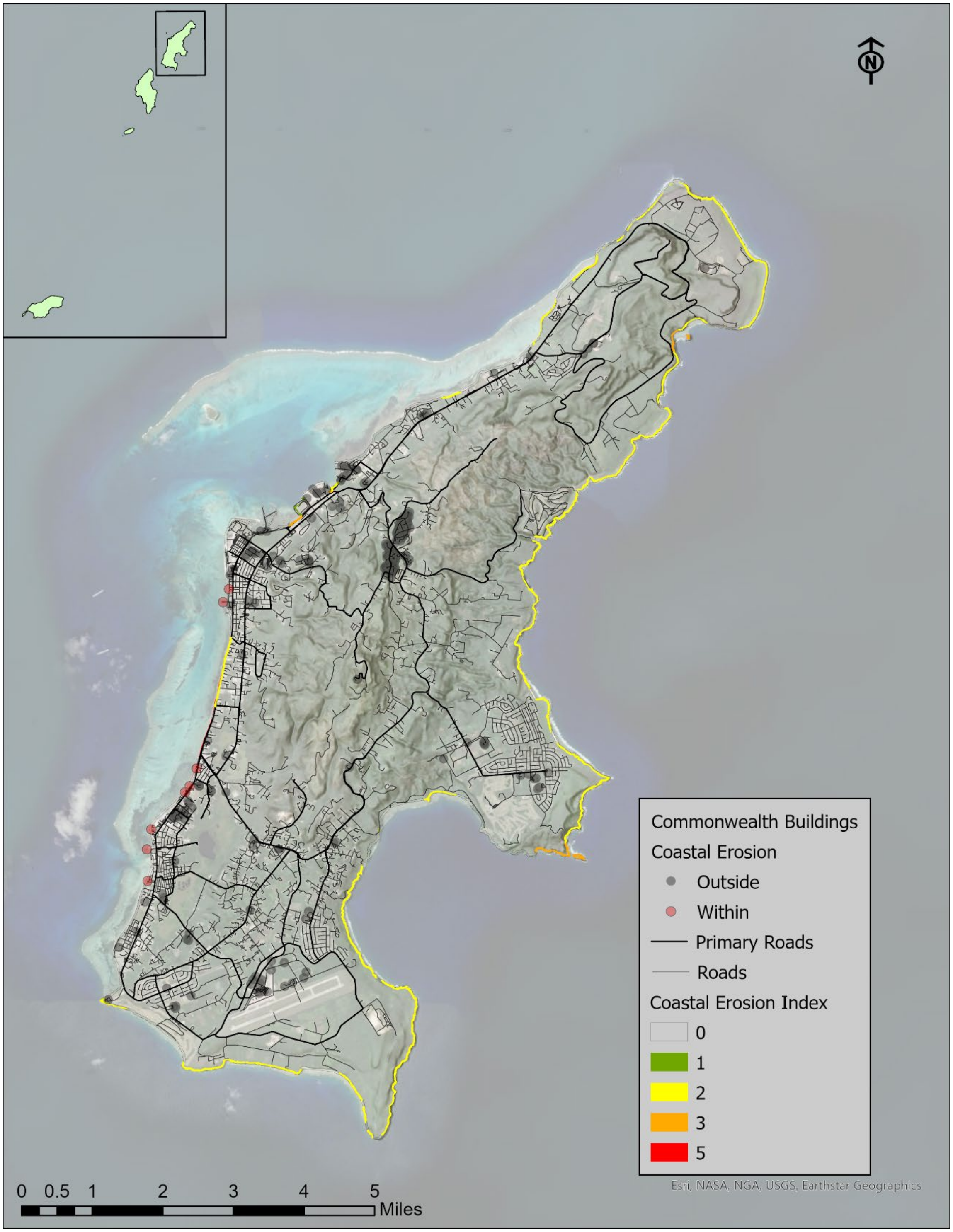


Figure B.5-79. Commonwealth buildings exposed to the coastal erosion hazard on Saipan.

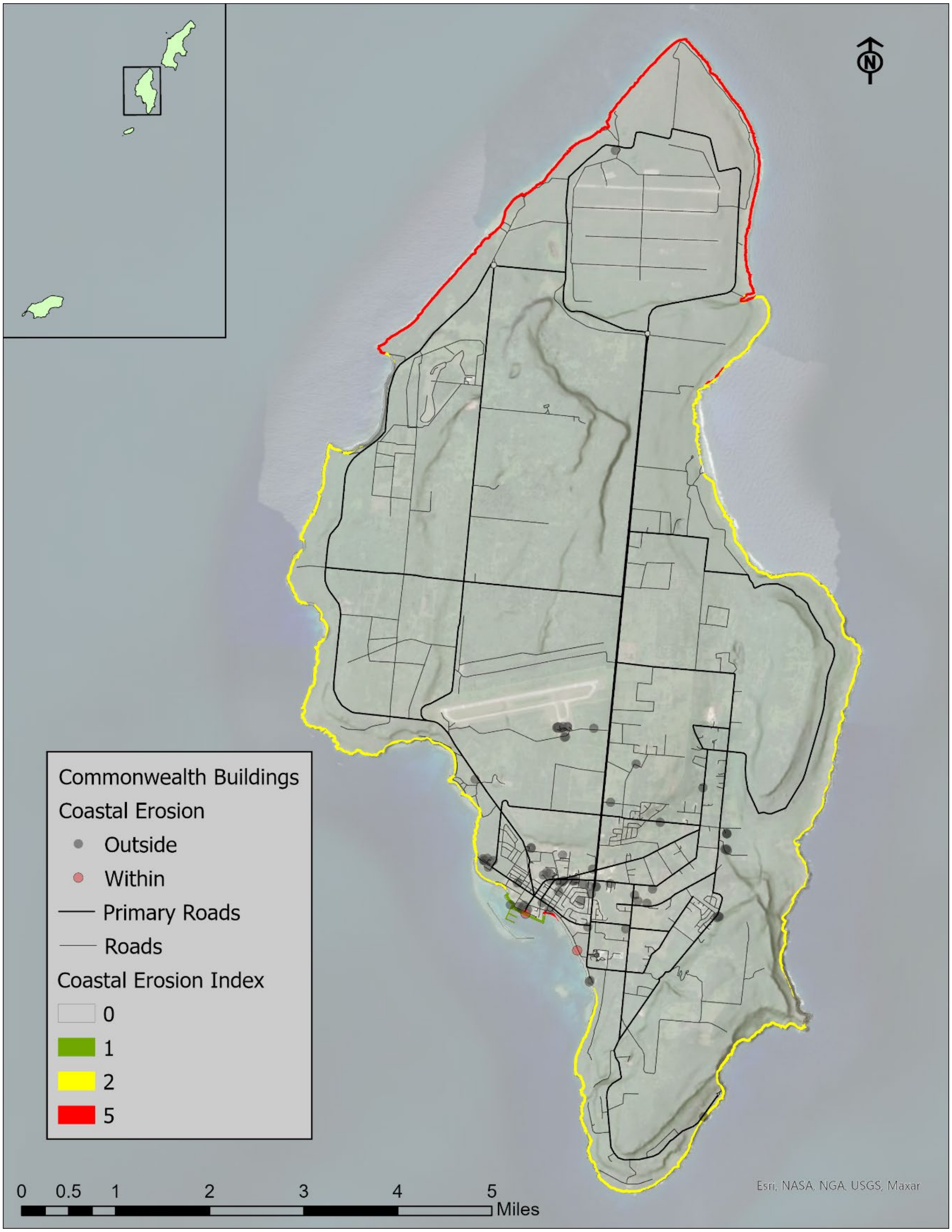


Figure B.5-80. Commonwealth buildings exposed to coastal erosion hazard on Tinian.

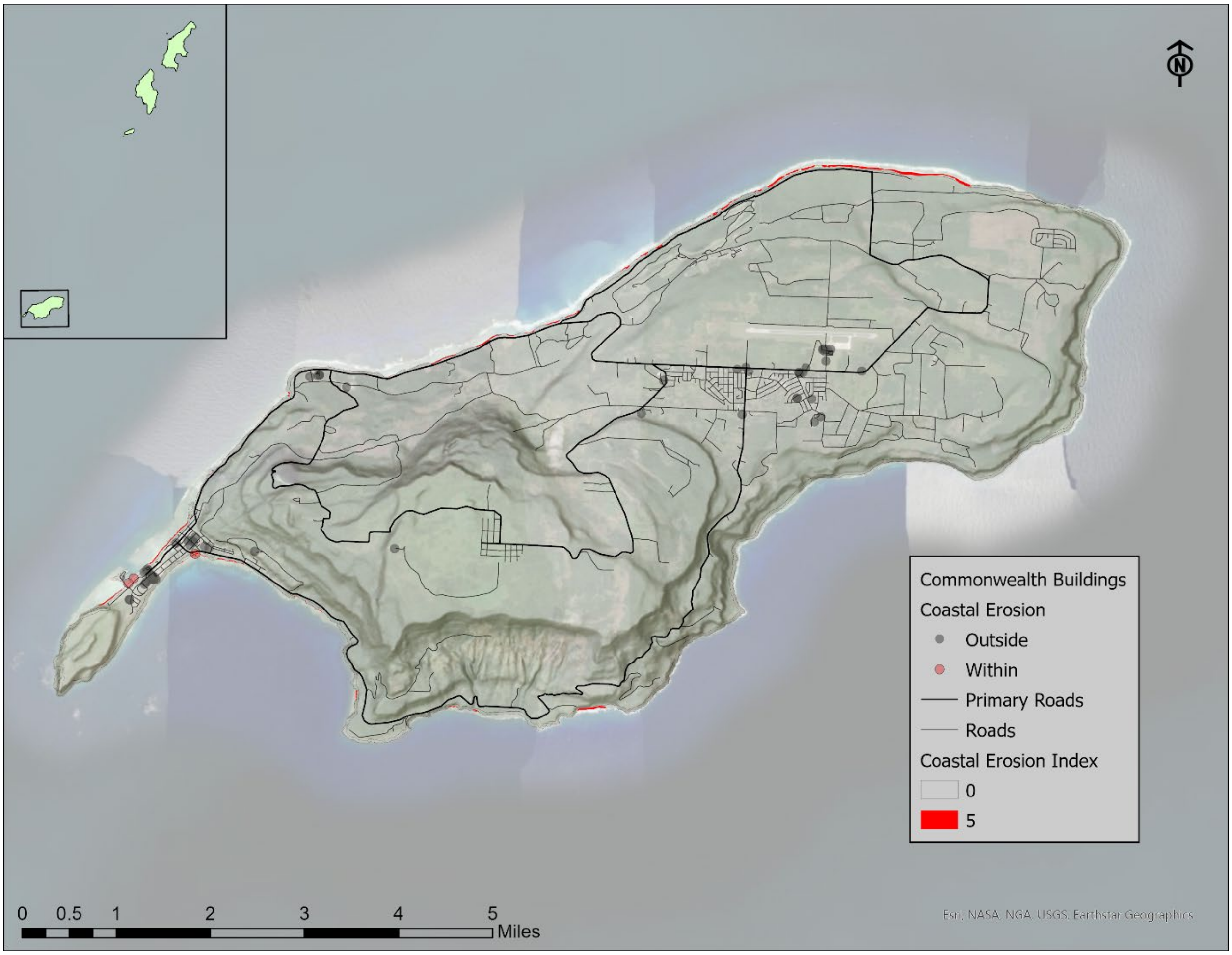


Figure B.5-81. Commonwealth buildings exposed to coastal erosion hazard on Rota.

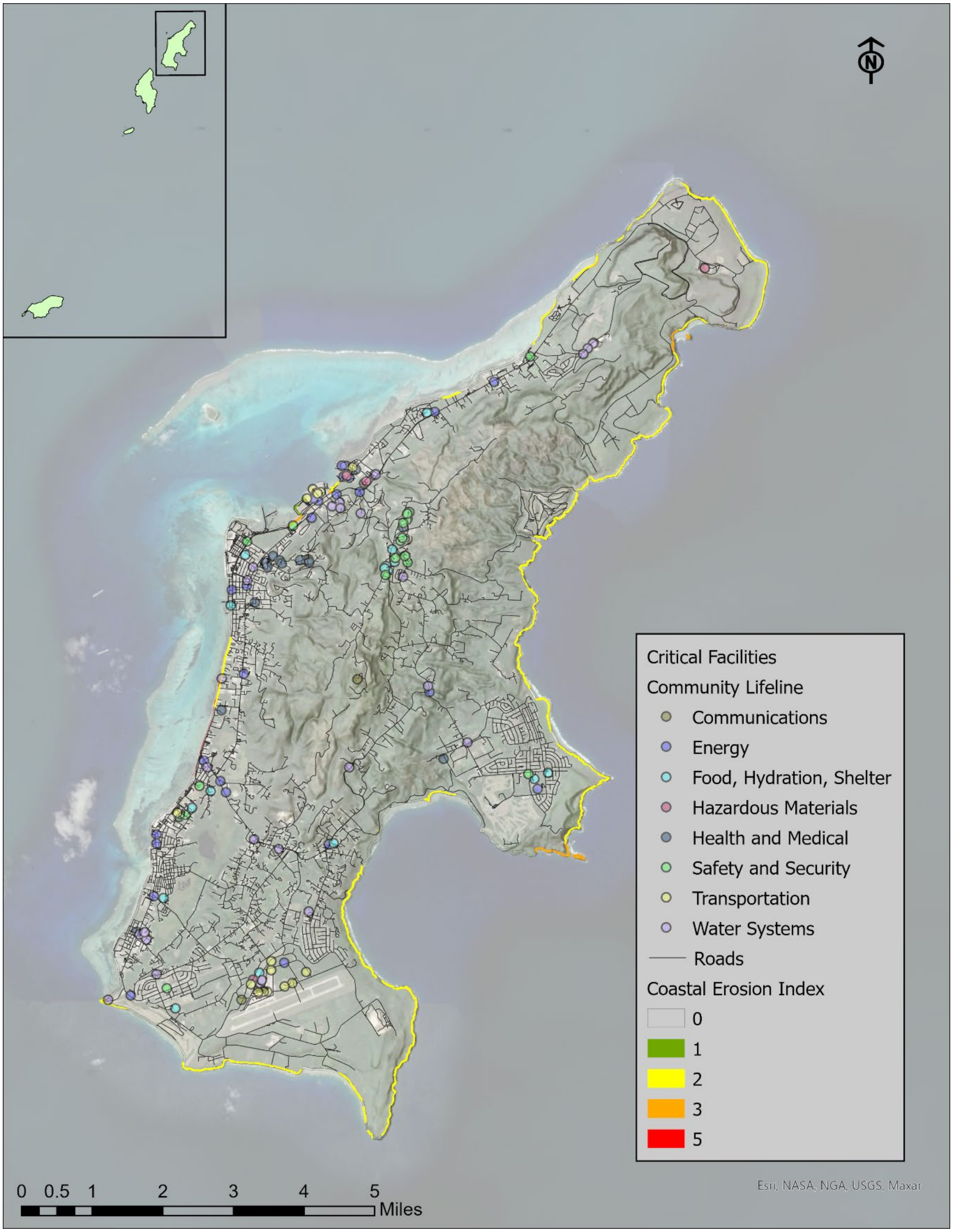


Figure B.5-82. Critical facilities and community lifelines buildings exposed to coastal erosion hazard on Saipan.

Figure B.5-83. Critical facilities and community lifelines buildings exposed to coastal erosion hazard on Tinian.

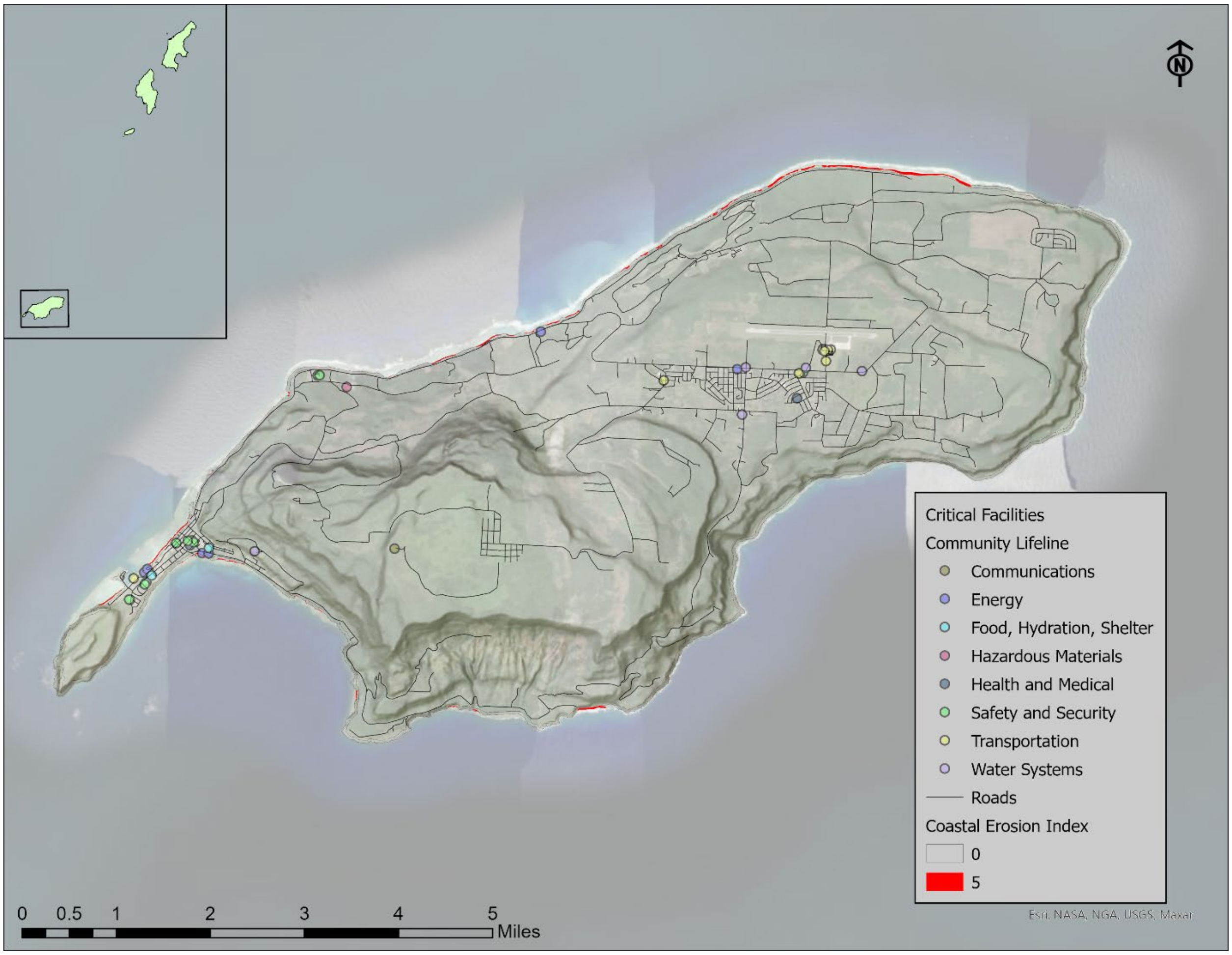


Figure B.5-84. Critical facilities and community lifelines buildings exposed to coastal erosion hazard on Rota.

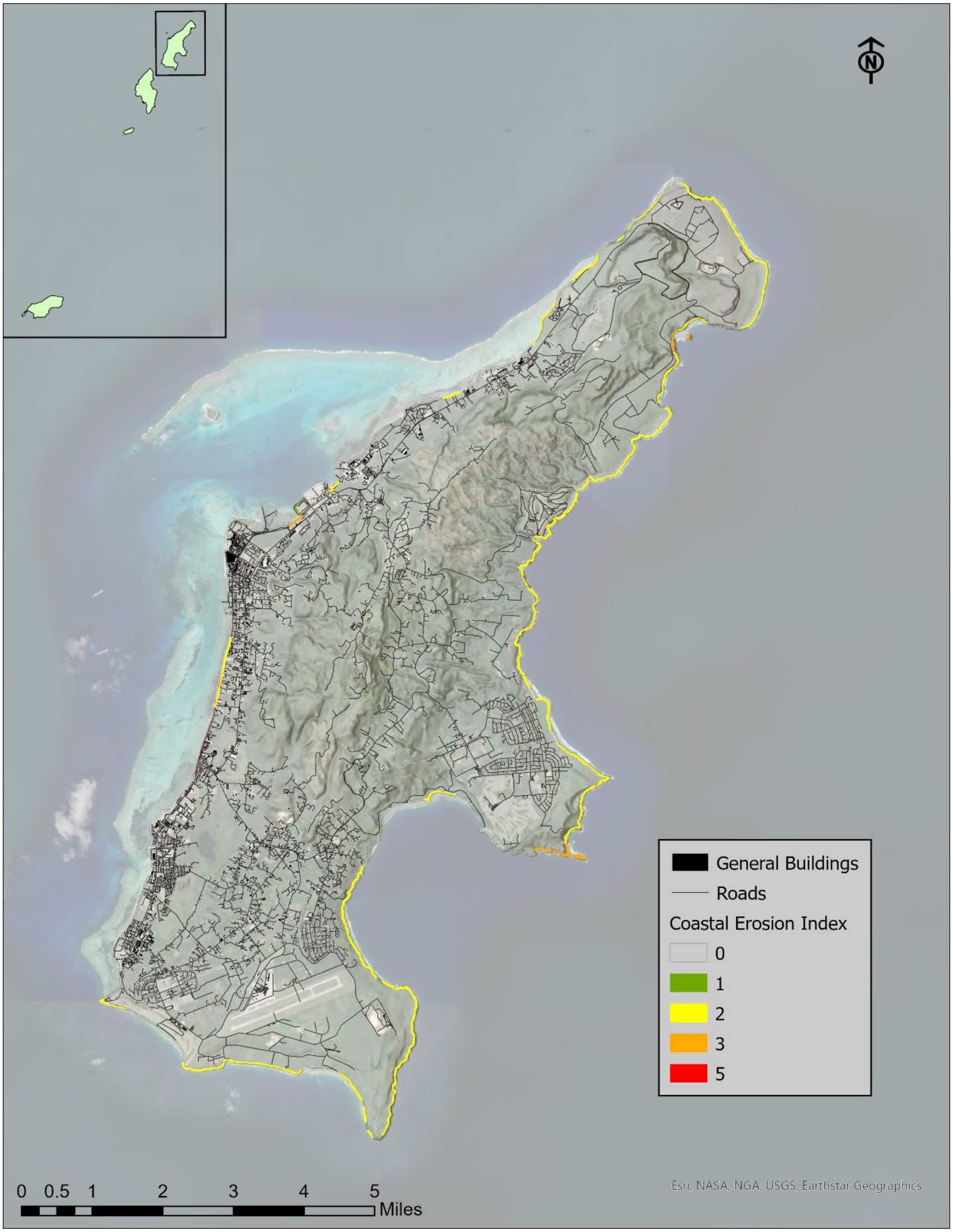


Figure B.5-85. General building stock exposed to coastal erosion hazard on Saipan.

Figure B.5-86. General building stock exposed to coastal erosion hazard on Tinian.

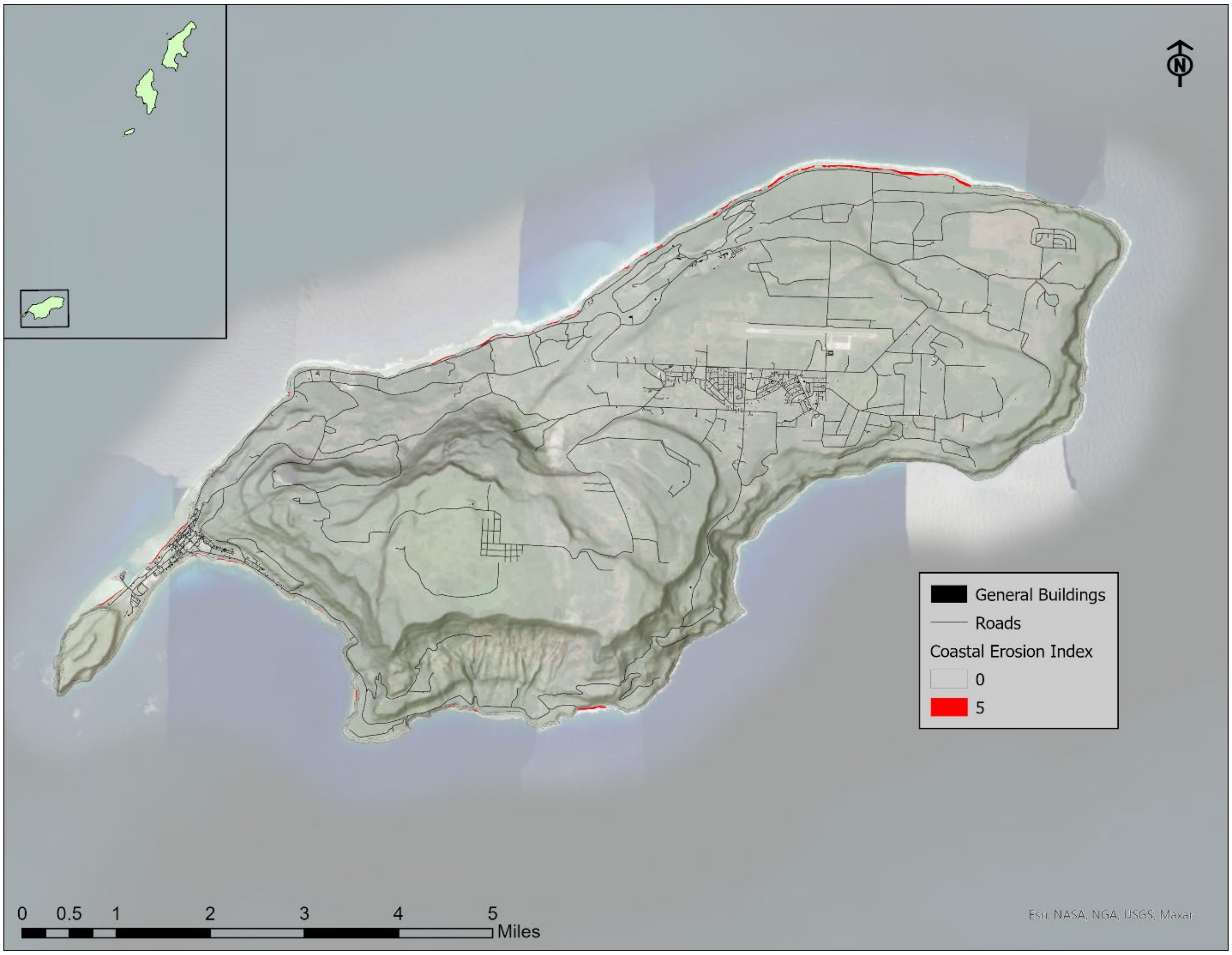


Figure B.5-87. General building stock exposed to coastal erosion hazard on Rota.

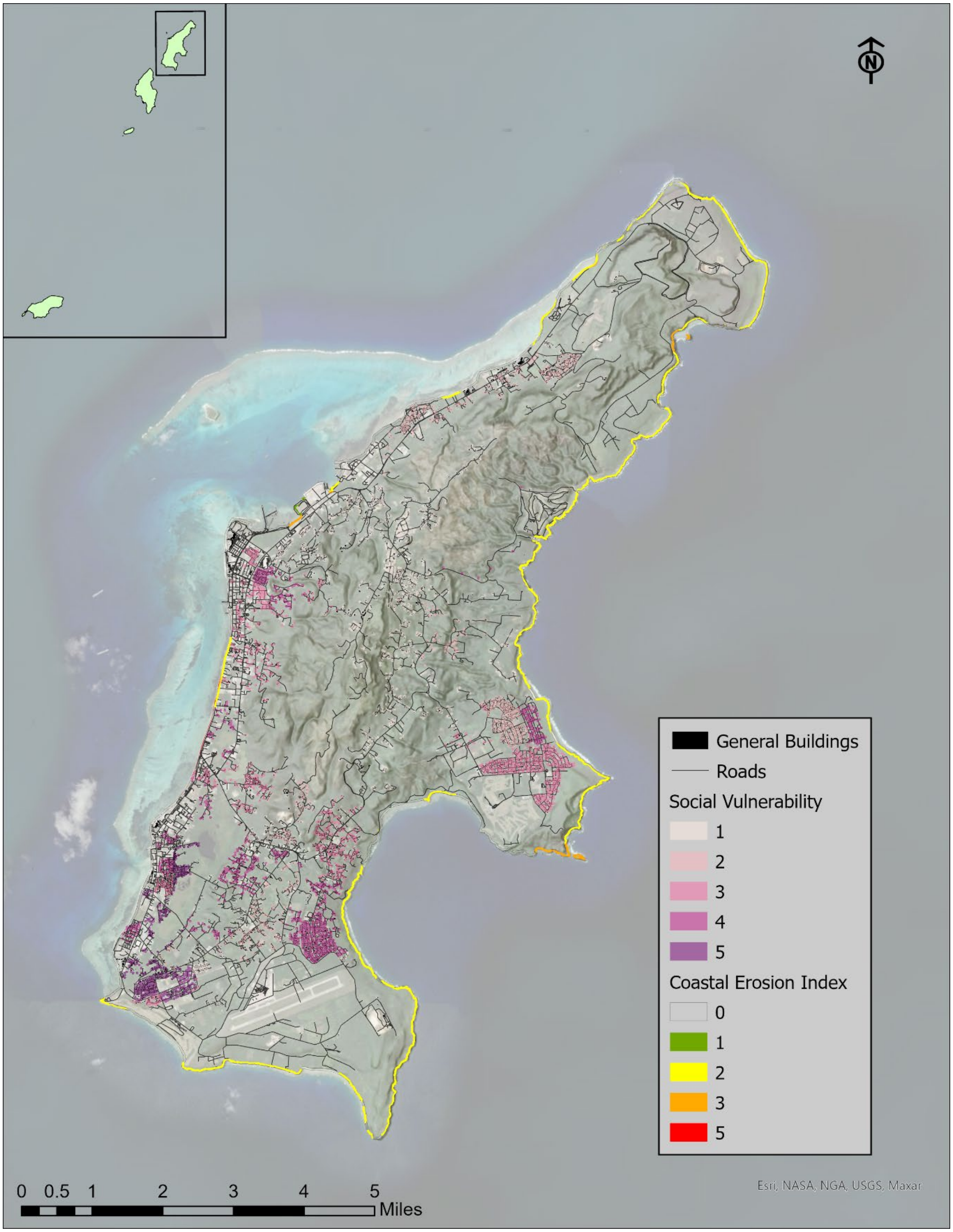


Figure B.5-88. Socially vulnerable index and the coastal erosion hazard on Saipan.

Figure B.5-89. Socially vulnerable index and the coastal erosion hazard on Tinian.

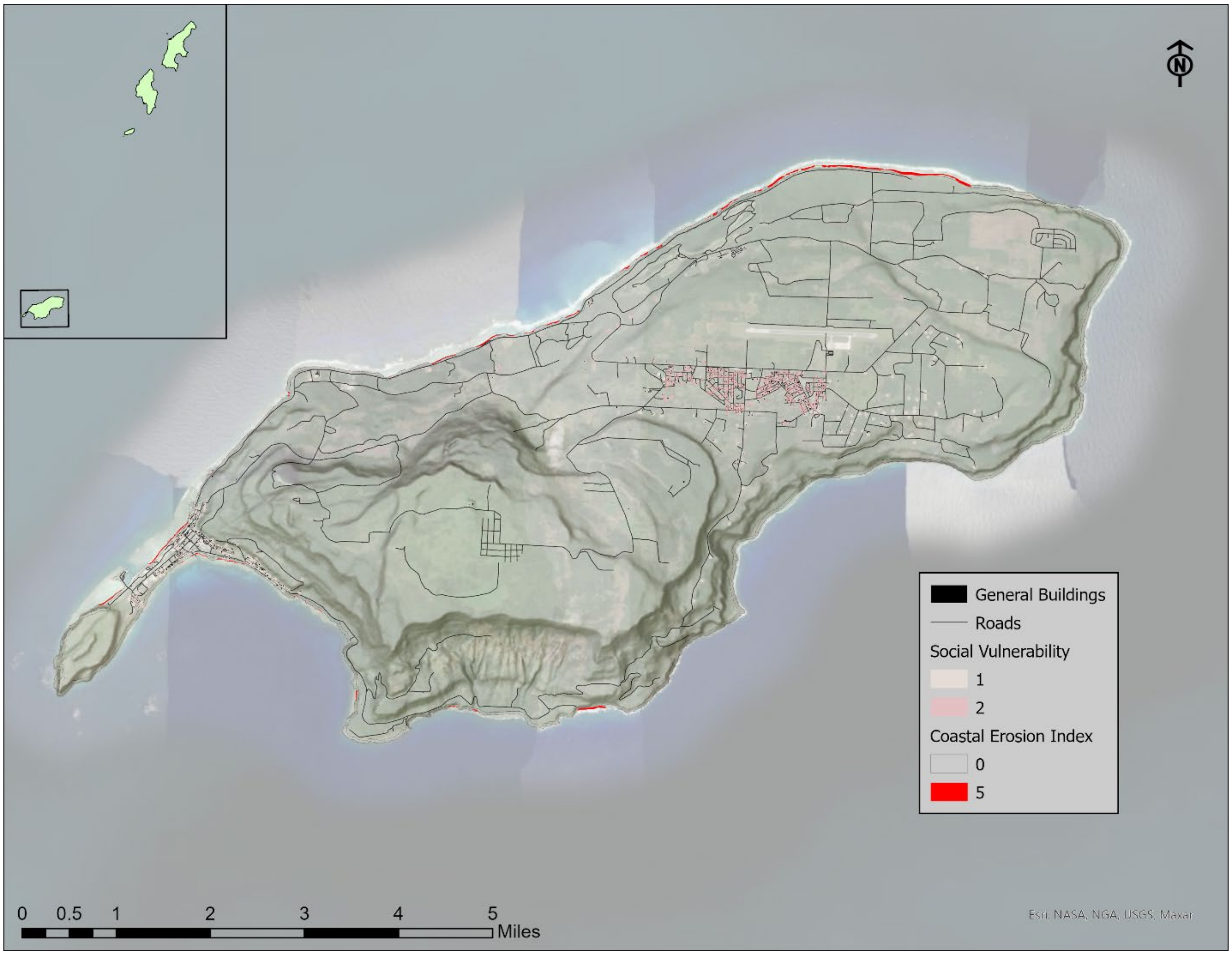


Figure B.5-90. Socially vulnerable index and the coastal erosion hazard on Rota.

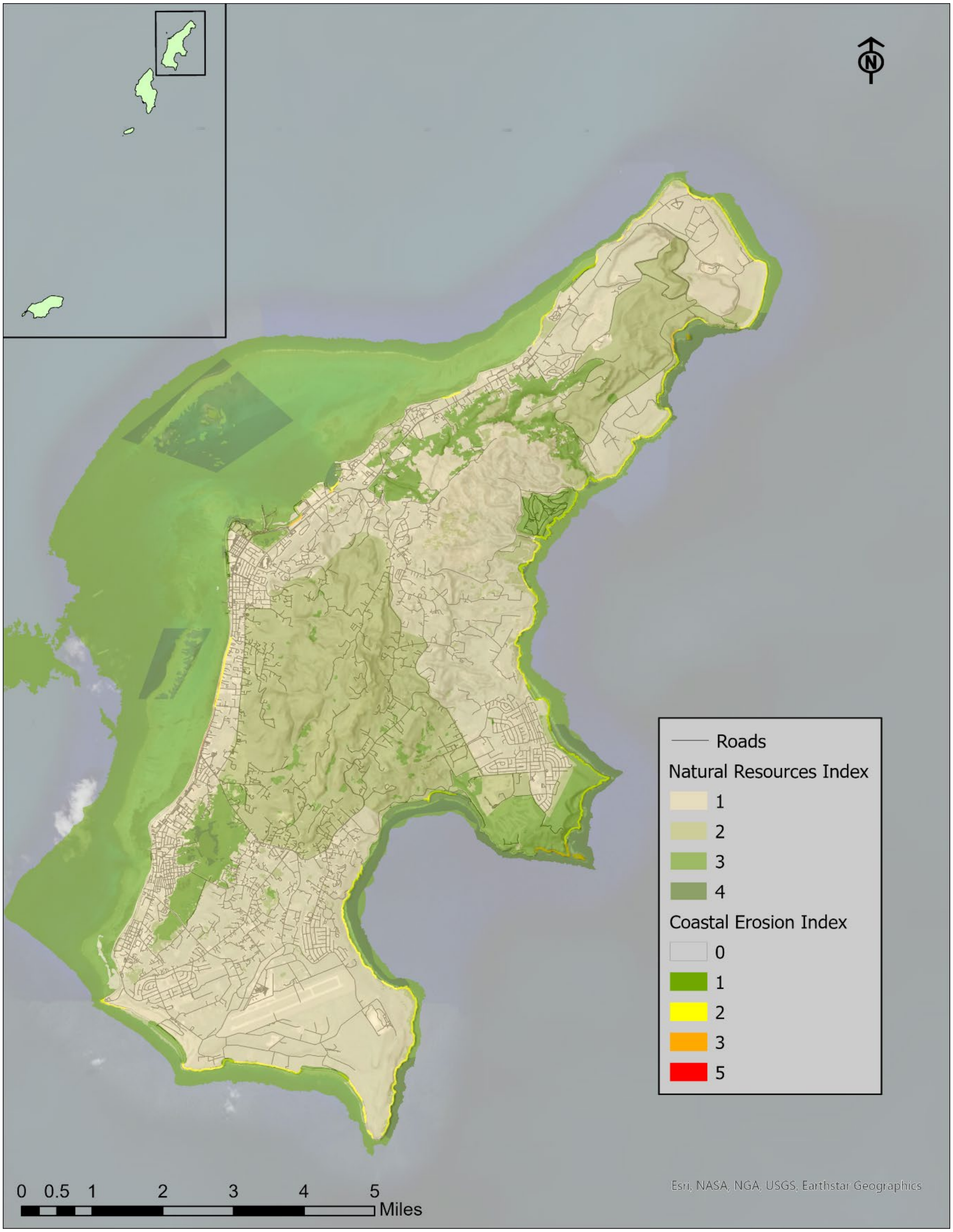


Figure B.5-91. Natural resource index for suitable habitats for species of conservation concern and the coastal erosion hazard on Saipan.

Figure B.5-92. Natural resource index for suitable habitats for species of conservation concern and the coastal erosion hazard on Tinian.

Figure B.5-93. Natural resource index for suitable habitats for species of conservation concern and the coastal erosion hazard on Rota.

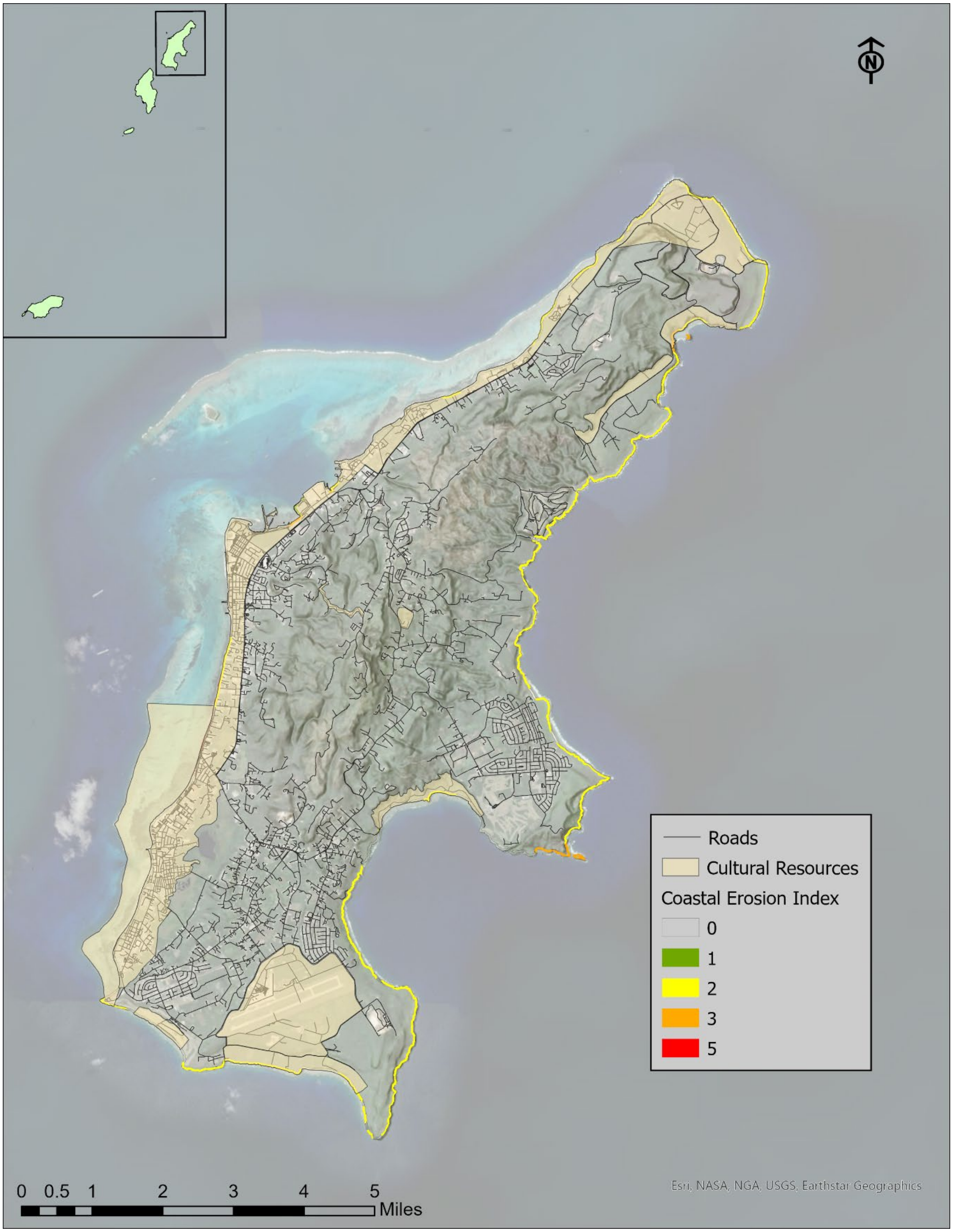


Figure B.5-94. Areas designated for cultural resources and the coastal erosion hazard on Saipan.

Figure B.5-95. Areas designated for cultural resources and the coastal erosion hazard on Tinian.

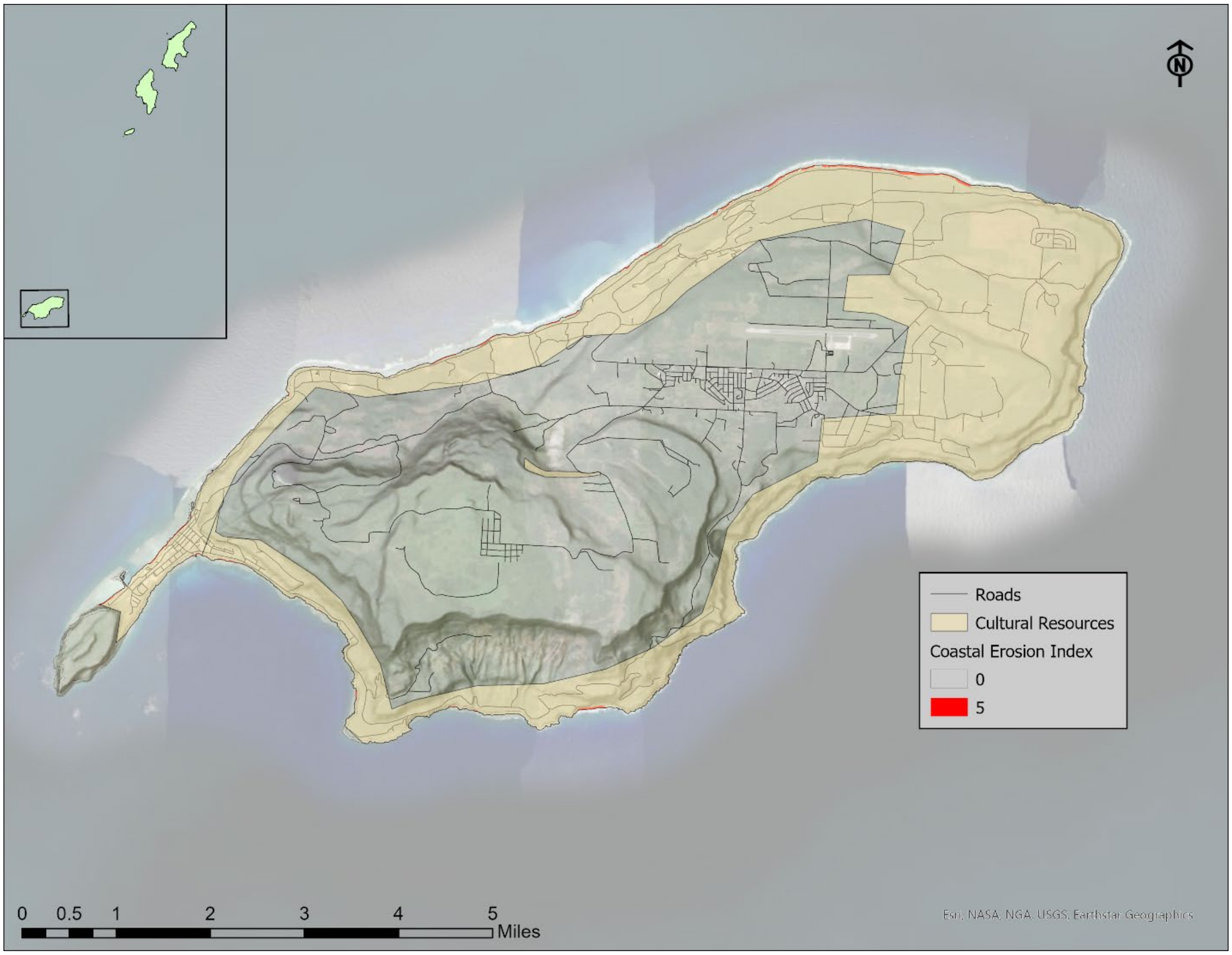


Figure B.5-96. Areas designated for cultural resources and the coastal erosion hazard on Rota.

Figure B.5-97. Parcels designated for future development and the coastal erosion hazard on Saipan.

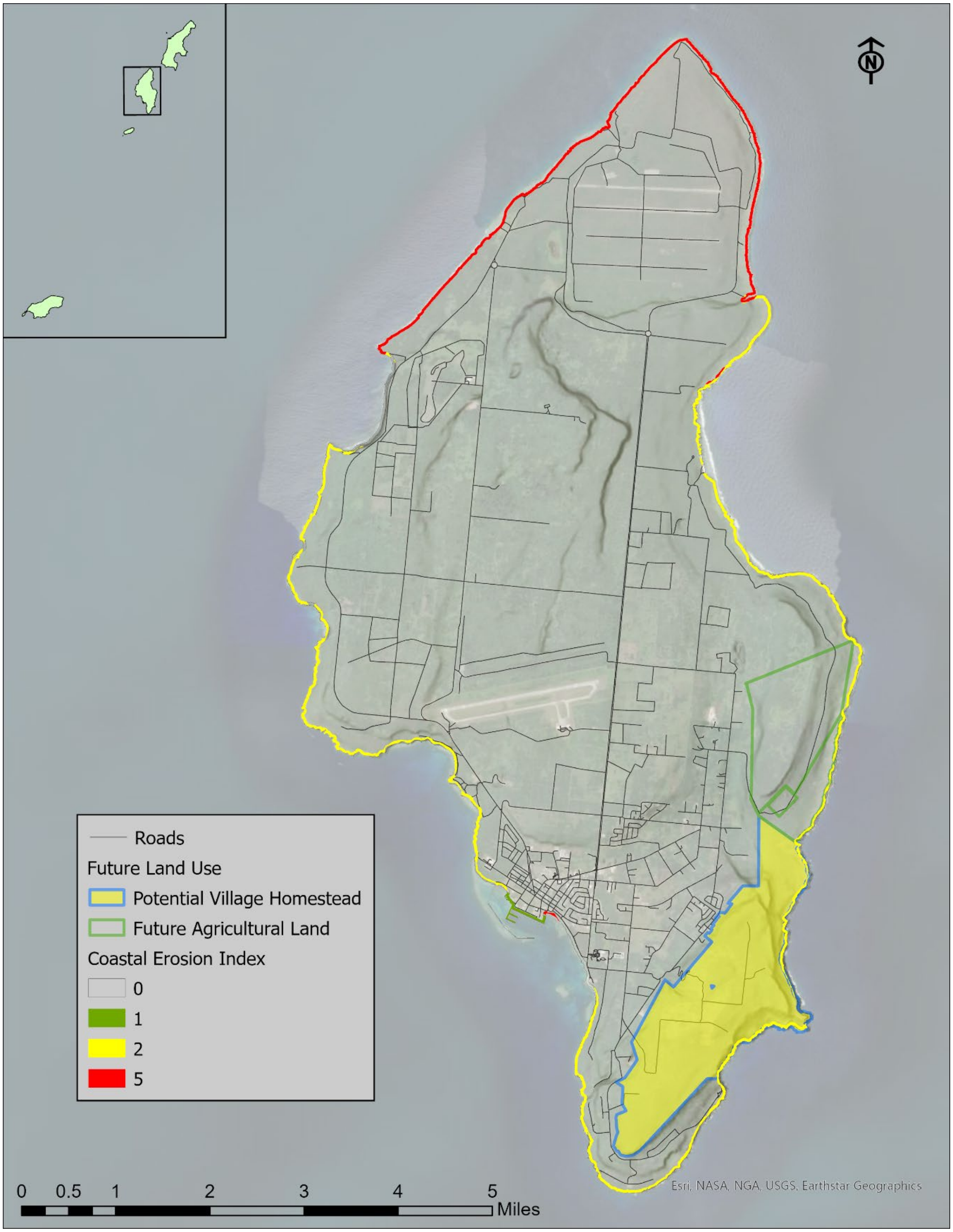


Figure B.5-98. Parcels designated for future development and the coastal erosion hazard on Tinian.

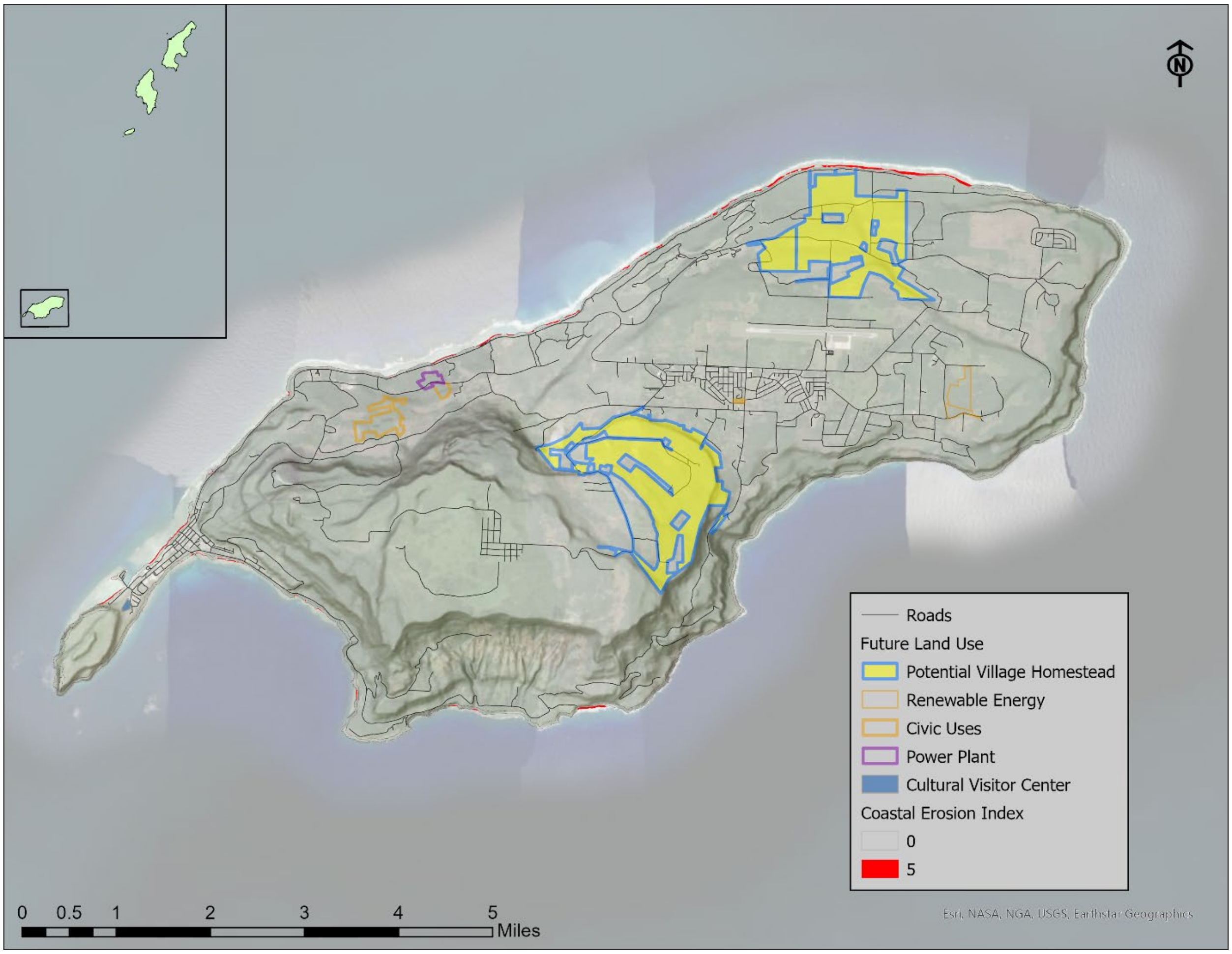


Figure B.5-99. Parcels designated for future development and the coastal erosion hazard on Rota.

B.6 Health Risk

There are no additional maps to support Section 4.6 (Health Risk).

B.7 Extreme Heat and Heatwave

There are no additional maps to support Section 4.3 (Extreme Heat and Heatwaves).

B.8 Wildfire

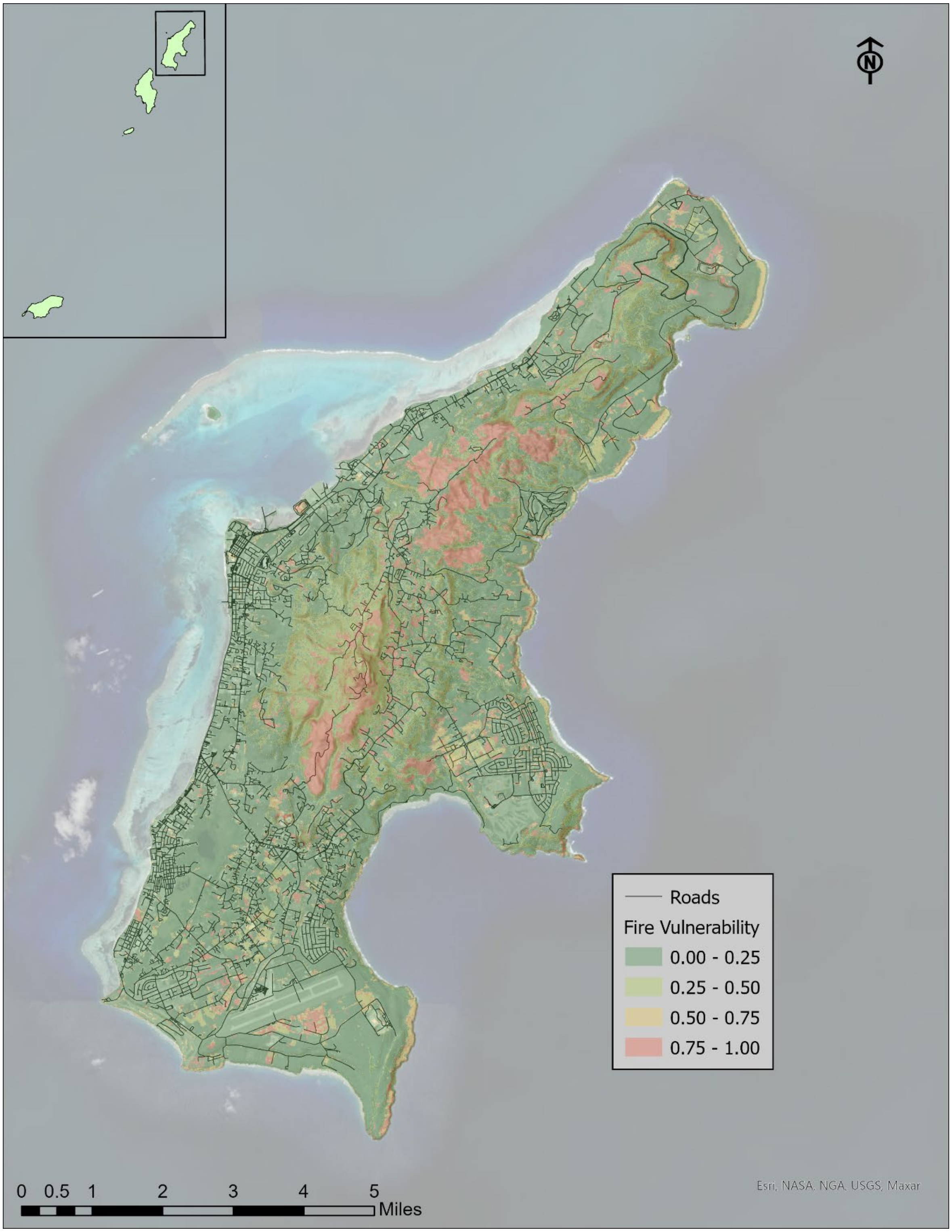


Figure B.8-1. Wildfire vulnerability on Saipan.

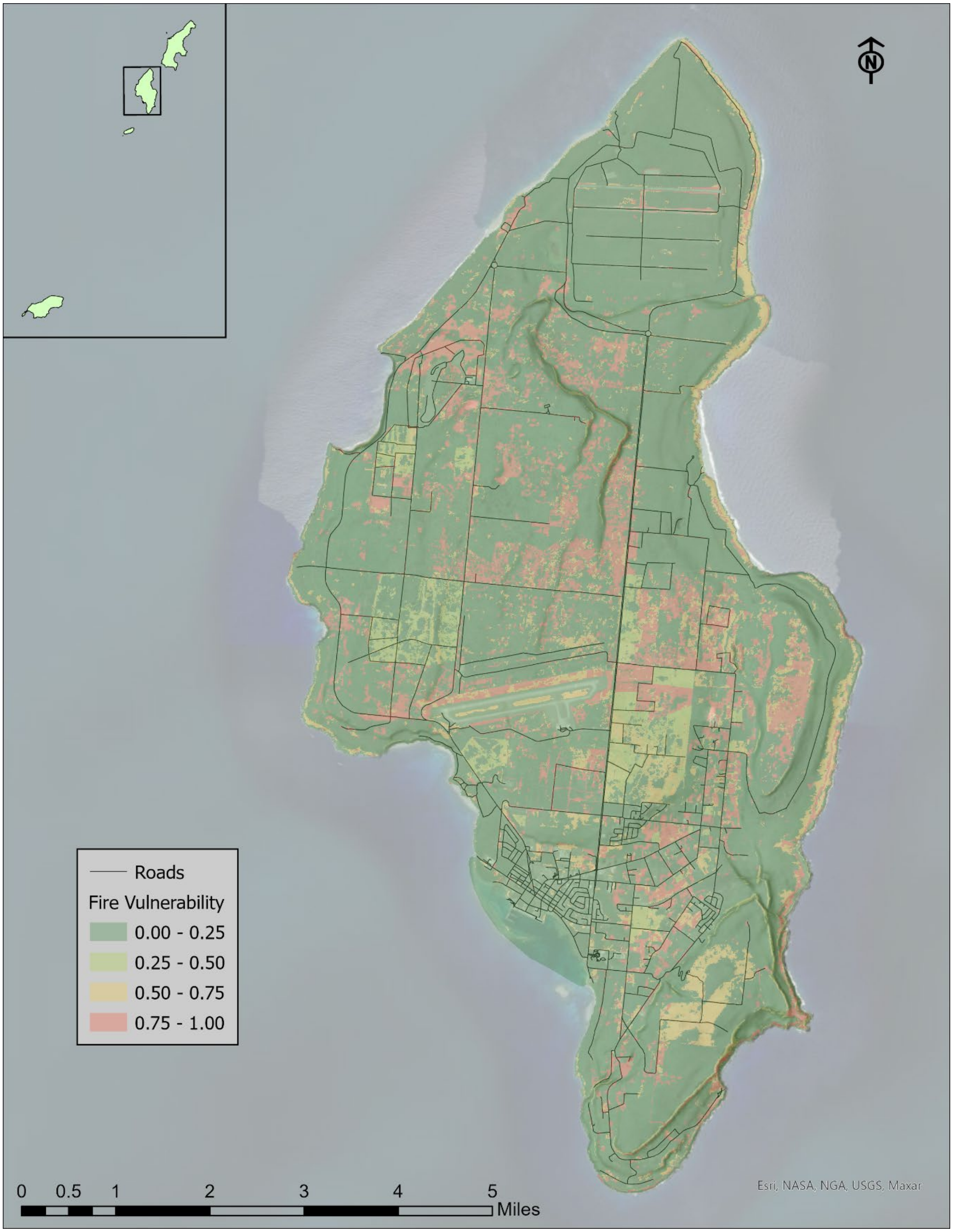


Figure B.8-2. Wildfire vulnerability on Tinian.

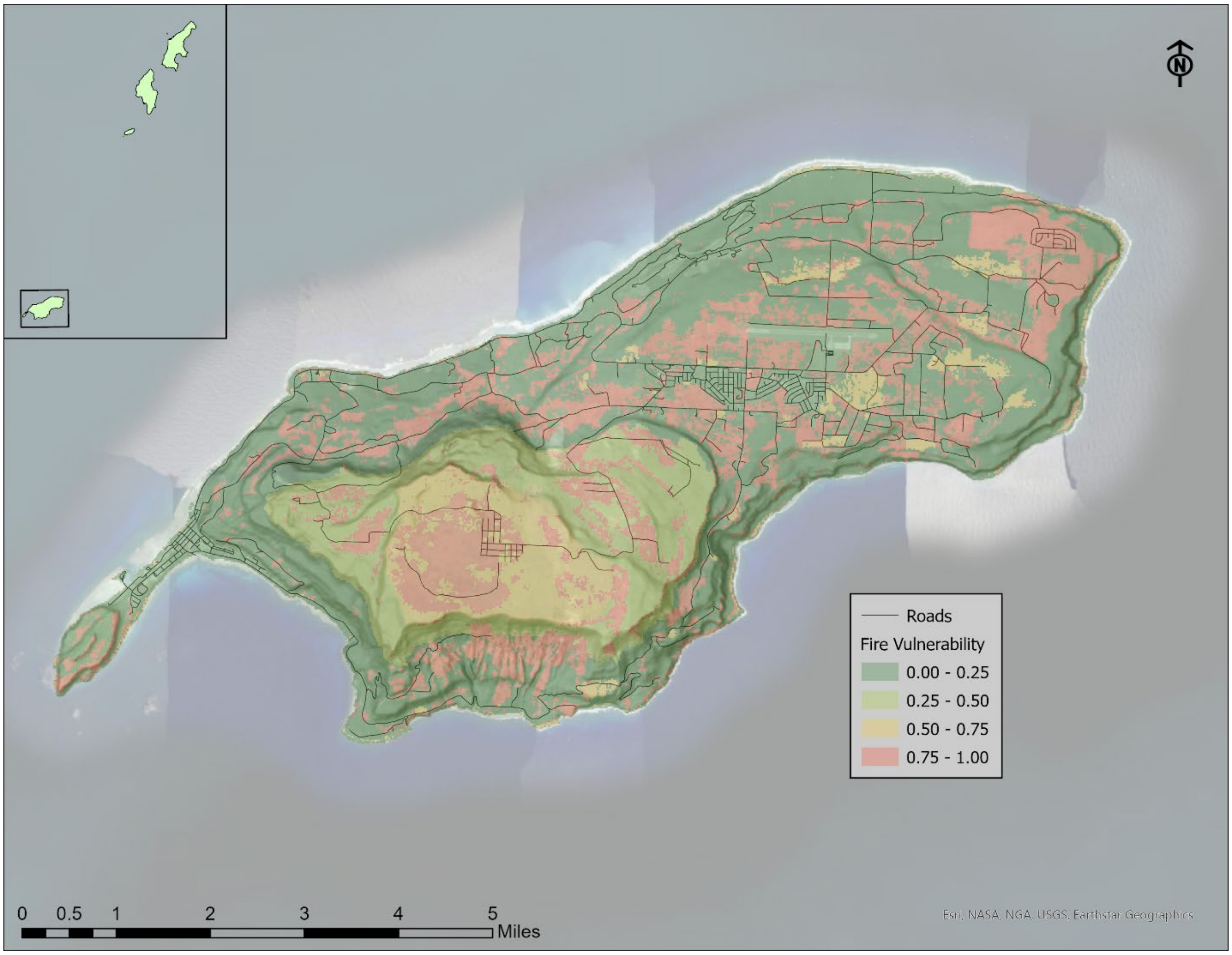


Figure B.8-3. Wildfire vulnerability on Rota.

Figure B.8-4. Commonwealth buildings exposed to the high wildfire probability hazard on Saipan.

Figure B.8-5. Commonwealth buildings exposed to the high wildfire probability hazard on Tinian.

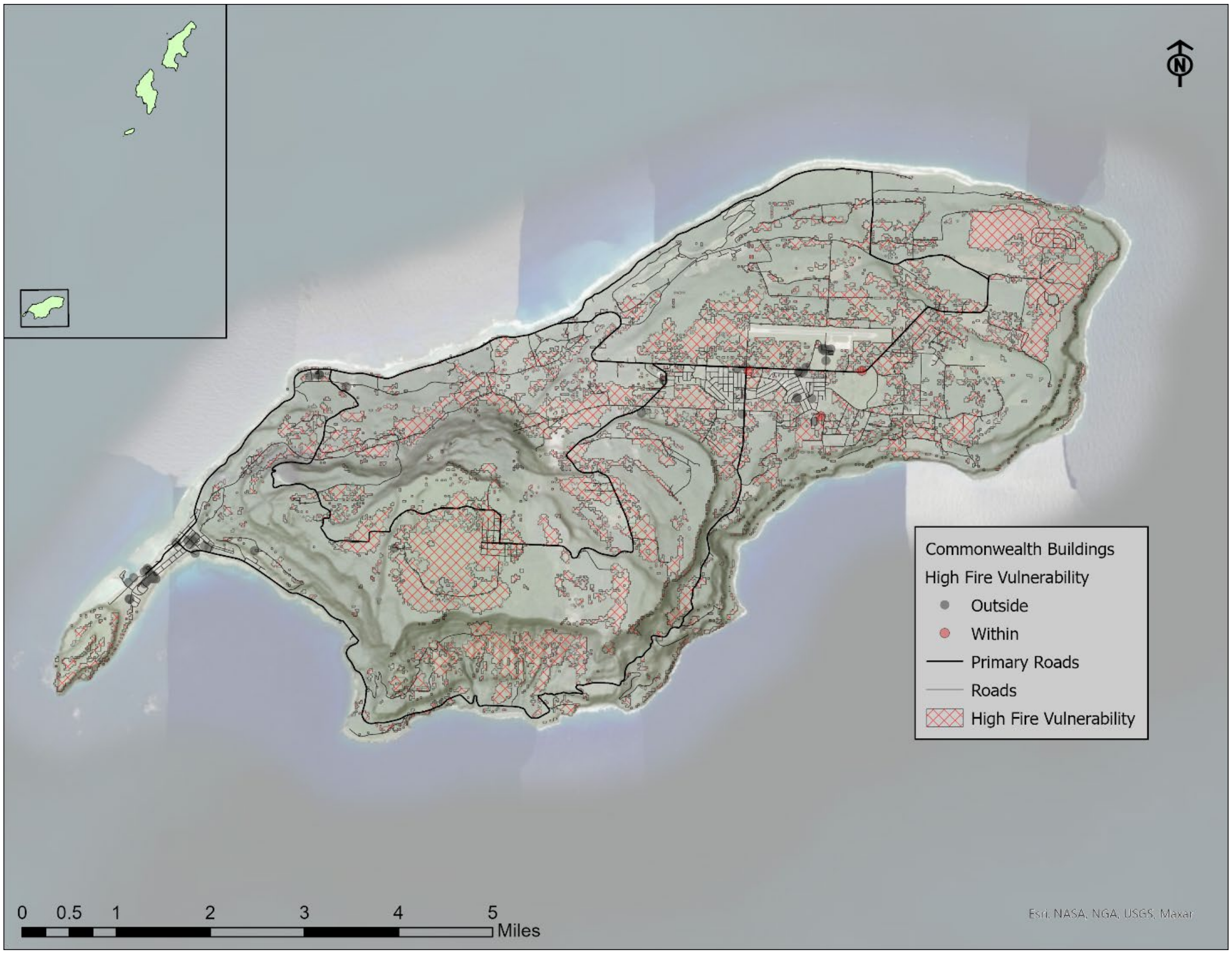


Figure B.8-6. Commonwealth buildings exposed to the high wildfire probability hazard on Rota.

Figure B.8-7. Critical facilities and lifelines exposed to the high wildfire probability hazard on Saipan.

Figure B.8-8. Critical facilities and lifelines exposed to the high wildfire probability hazard on Tinian.

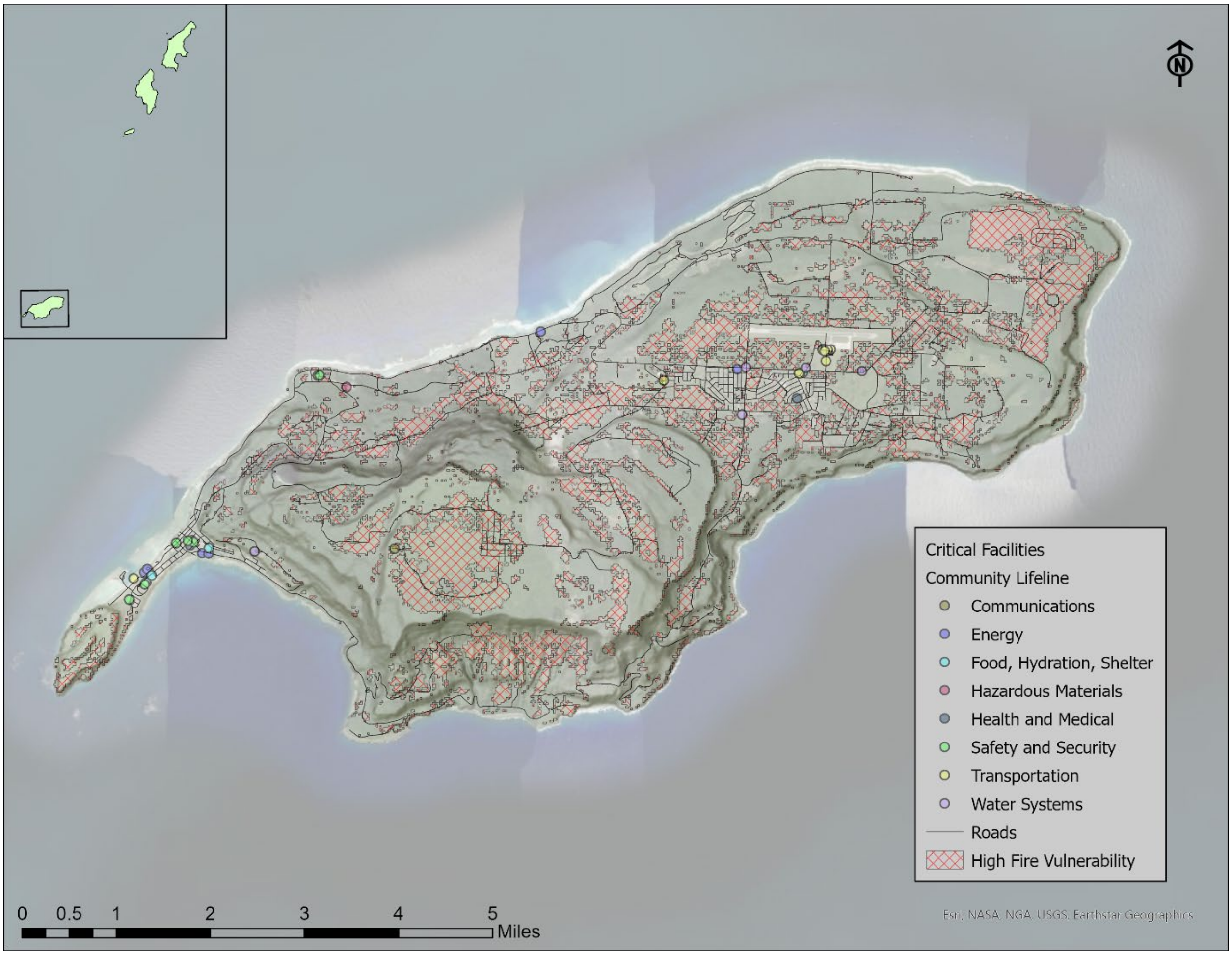


Figure B.8-9. Critical facilities and lifelines exposed to the high wildfire probability hazard on Rota.

Figure B.8-10. General building stock exposed to the high wildfire probability hazard on Saipan.

Figure B.8-11. General building stock exposed to the high wildfire probability hazard on Tinian.

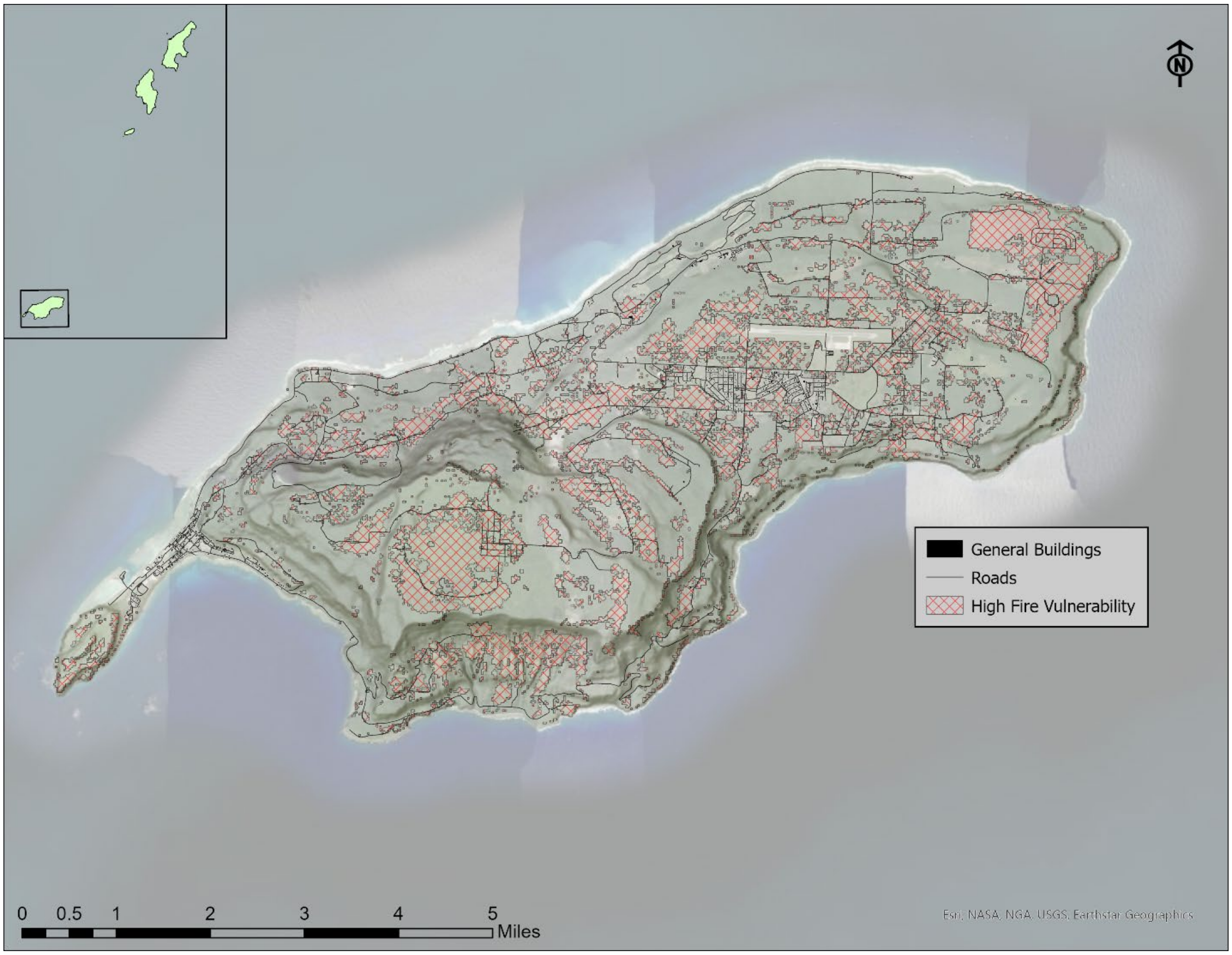


Figure B.8-12. General building stock exposed to the high wildfire probability hazard on Rota.

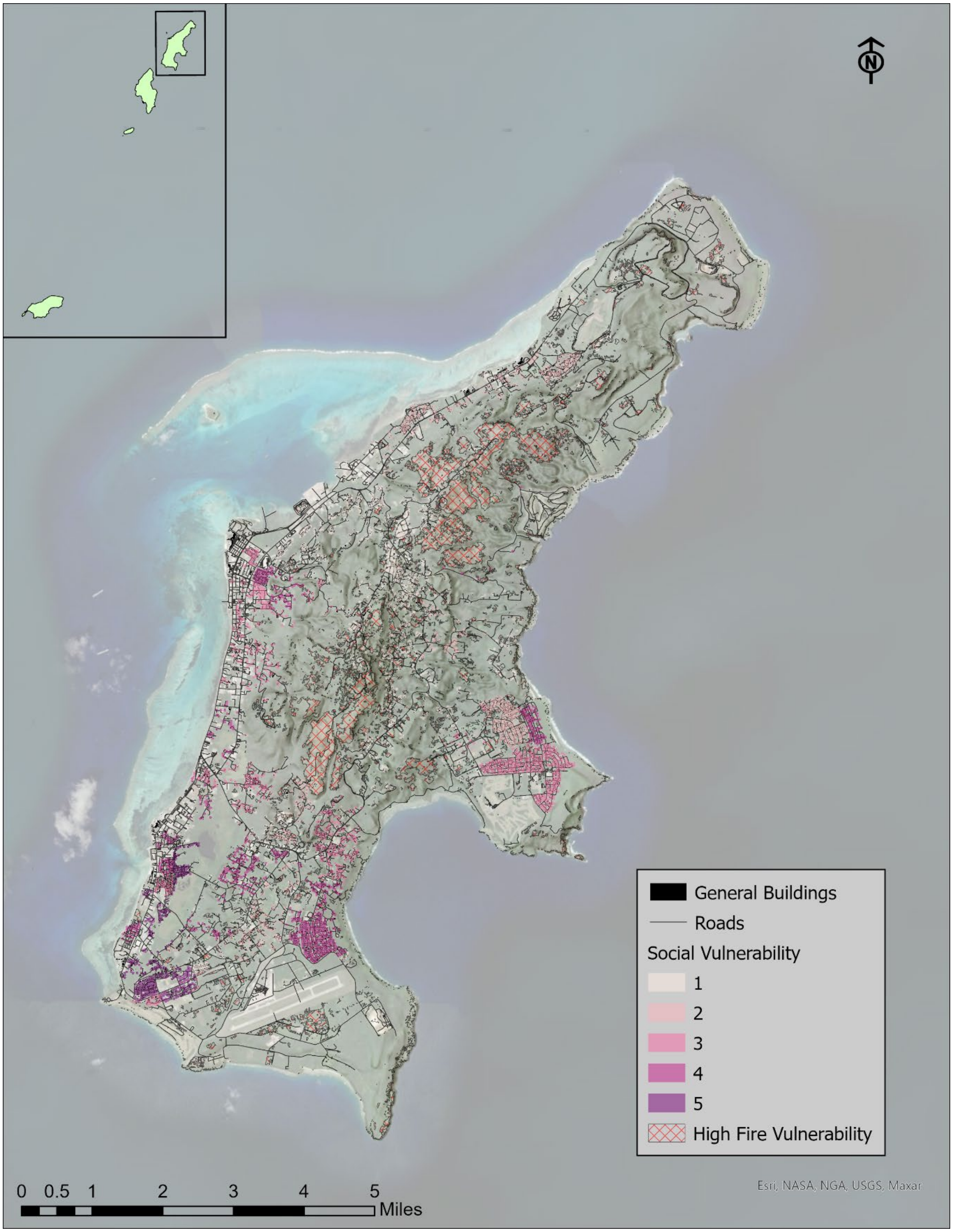


Figure B.8-13. Socially vulnerable index and the high wildfire probability hazard on Saipan.

Figure B.8-14. Socially vulnerable index and the high wildfire probability hazard on Tinian.

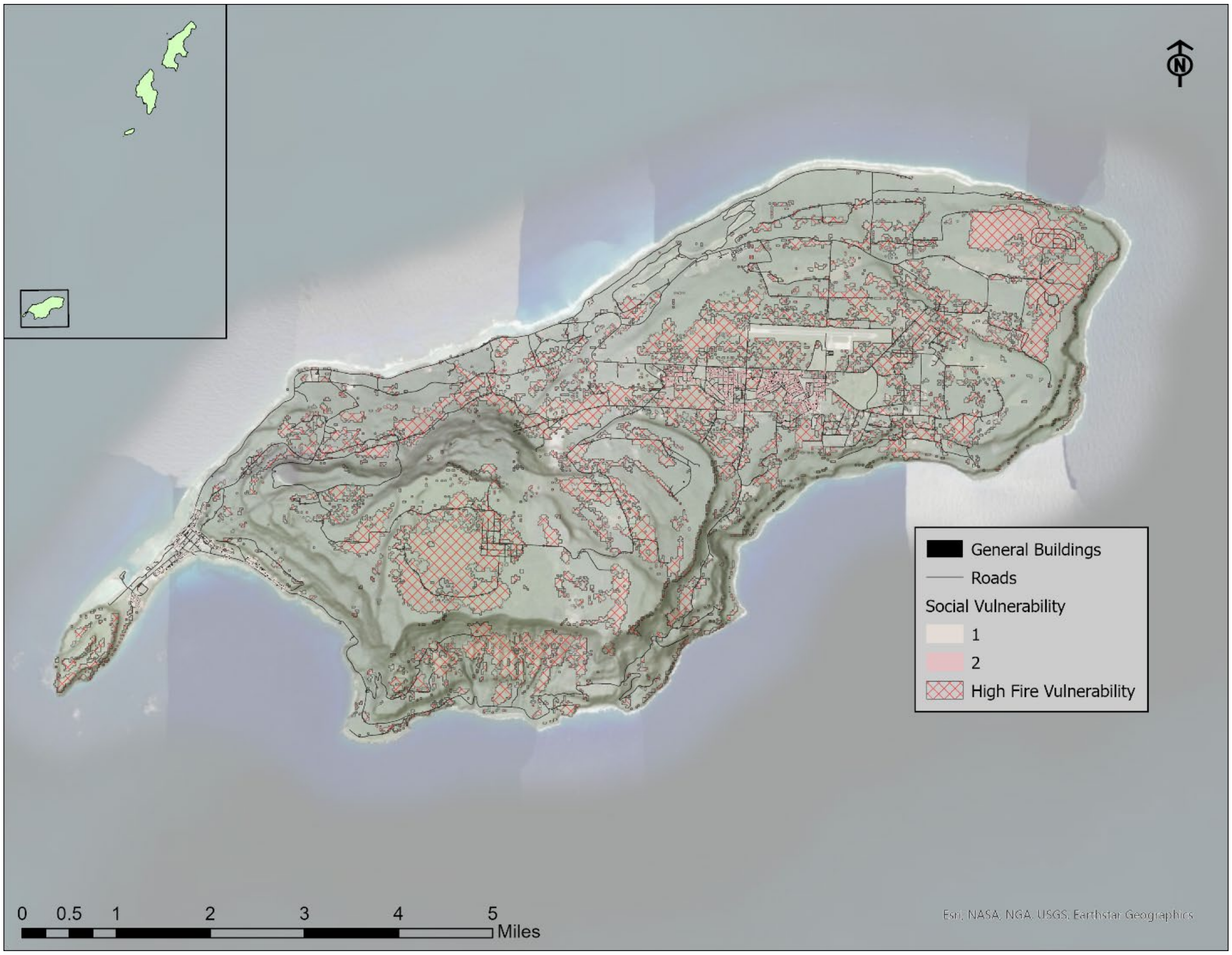


Figure B.8-15. Socially vulnerable index and the high wildfire probability hazard on Rota.

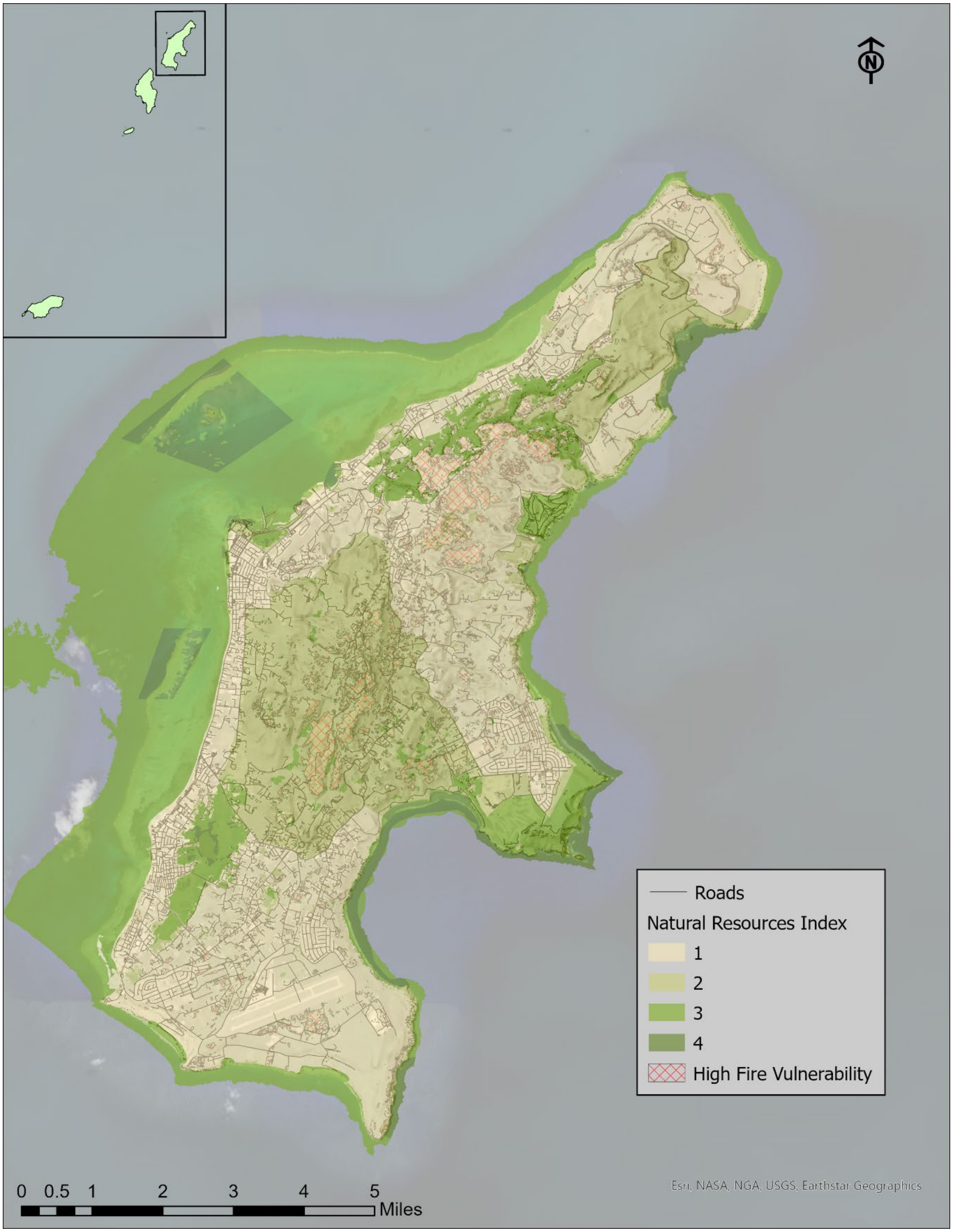


Figure B.8-16. Natural resource index for suitable habitats for species of conservation concern and the high probability wildfire hazard on Saipan.

Figure B.8-17. Natural resource index for suitable habitats for species of conservation concern and the high probability wildfire hazard on Tinian.

Figure B.8-18. Natural resource index for suitable habitats for species of conservation concern and the high probability wildfire hazard on Rota.

Figure B.8-19. Areas designated for cultural resources and the high probability wildfire hazard on Saipan.

Figure B.8-20. Areas designated for cultural resources and the high probability wildfire hazard on Tinian.

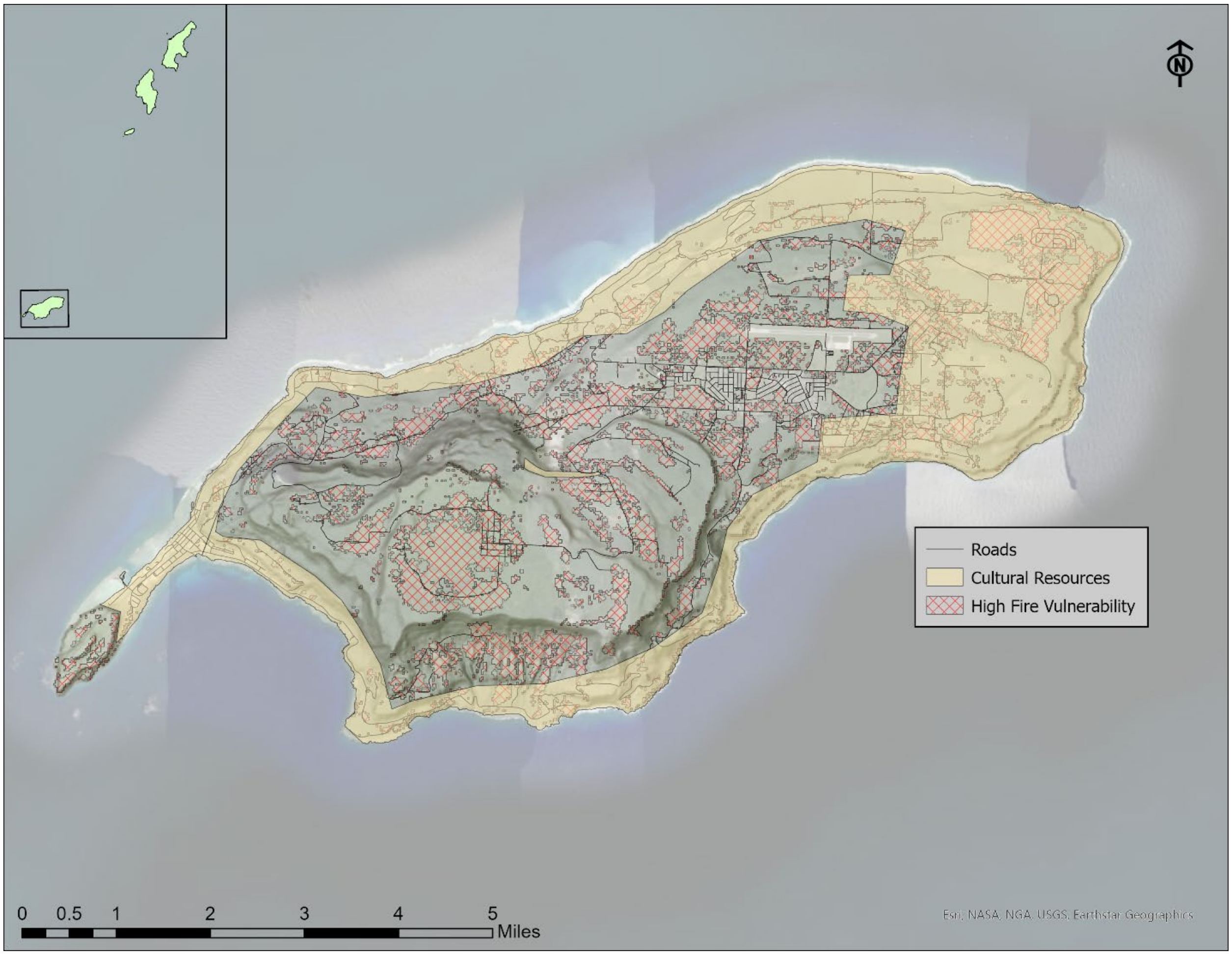


Figure B.8-21. Areas designated for cultural resources and the high probability wildfire hazard on Rota.

Figure B.8-22. Parcels designated for future development and the high probability wildfire hazard on Saipan.

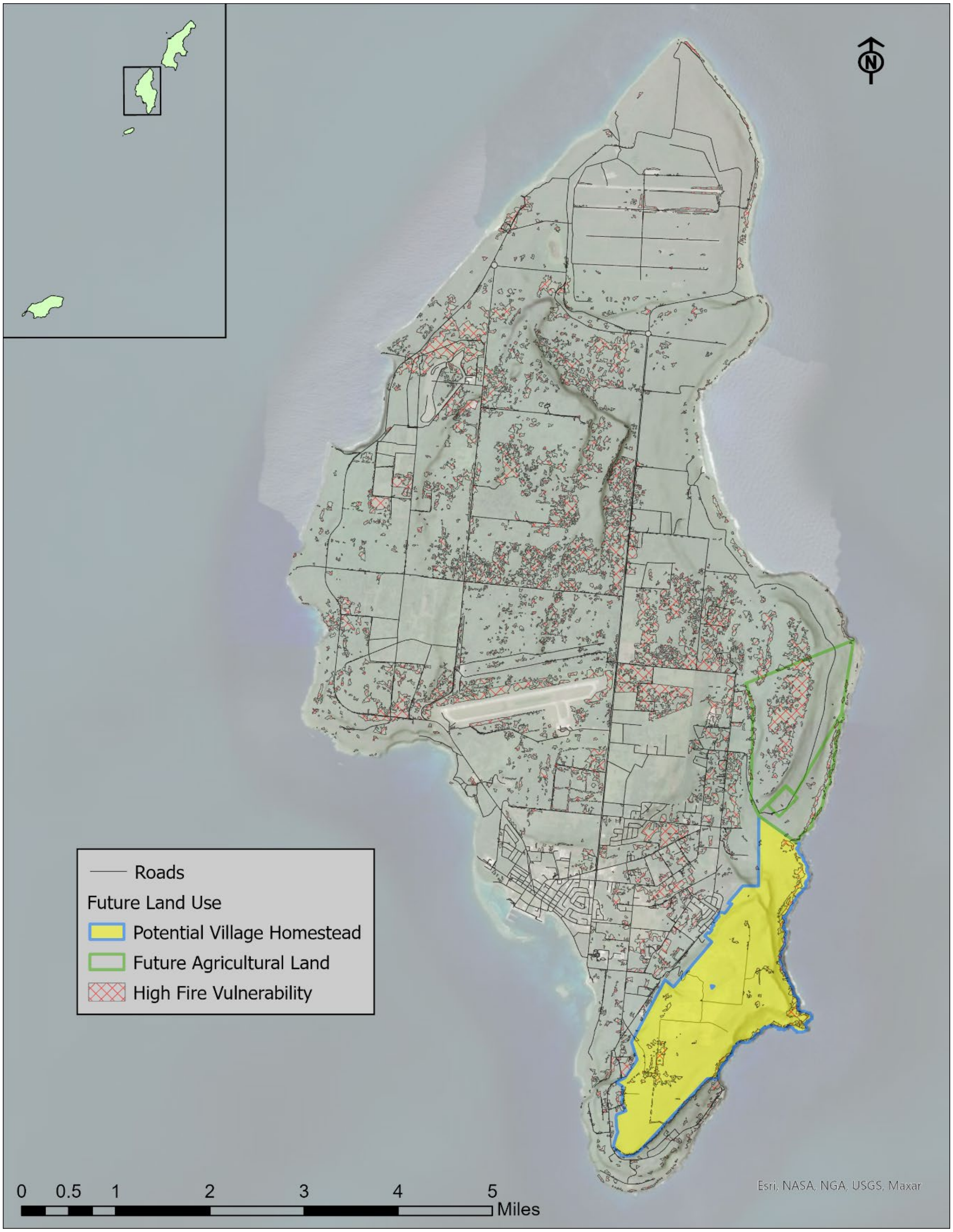


Figure B.8-23. Parcels designated for future development and the high probability wildfire hazard on Tinian.

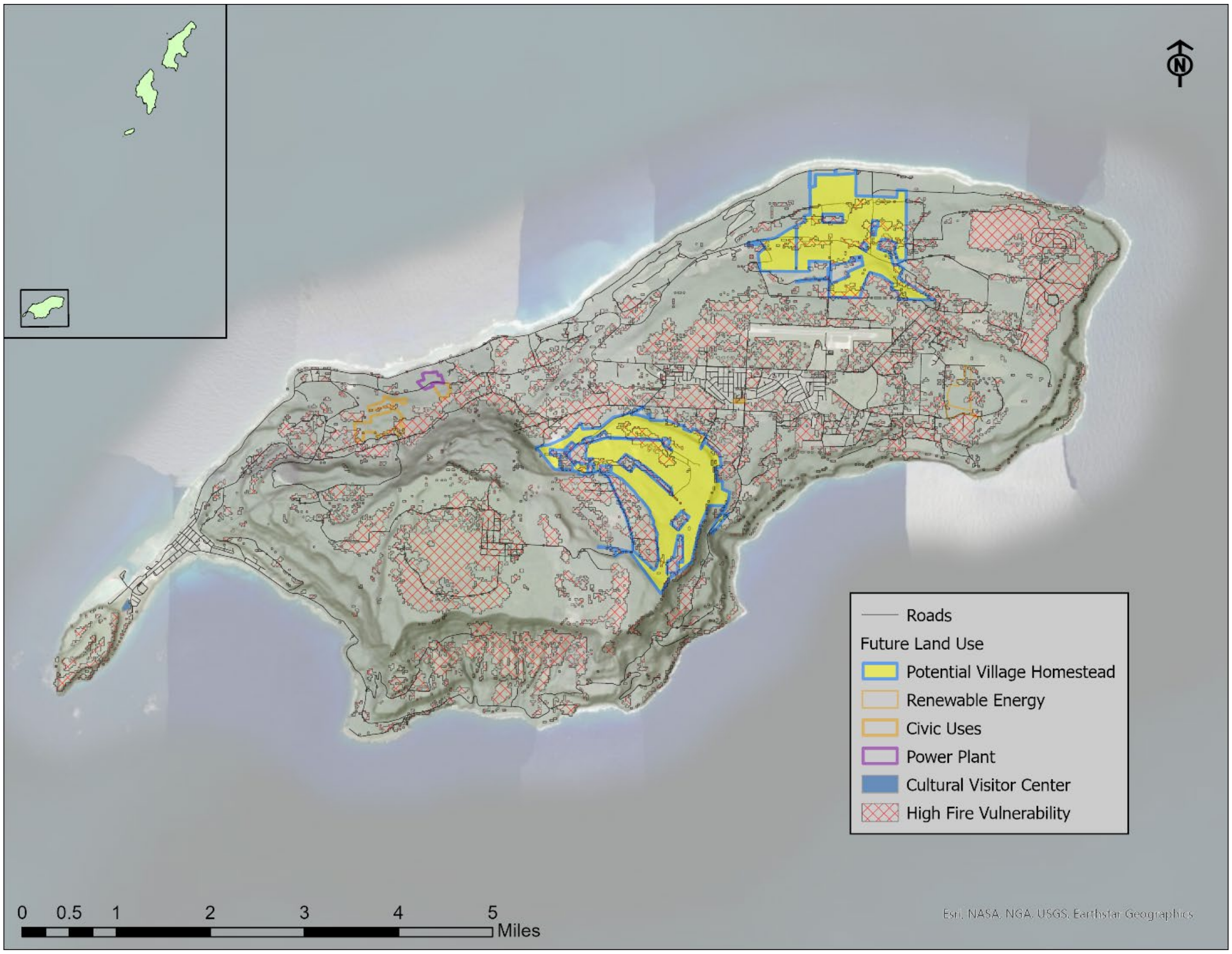


Figure B.8-24. Parcels designated for future development and the high probability wildfire hazard on Rota.

B.9 Earthquake

There are no additional maps to support Section 4.3 (Earthquake).

B.10 Volcanic Activity

Figure B.10-1. Commonwealth buildings exposed to the volcanic activity hazard on Pagan.

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Appendix C Hazard Profile Supplement

28 July 2024

Table of Contents

List of Tables

List of Figures

Appendix C Hazard Profile Supplement

C.1 Introduction

This appendix contains supplemental information regarding hazards.

C.2 Typhoon

Information about tropical cyclones, including typhoons, for the CNMI was retrieved from the *Historical Hurricane Tracks* webpage operated by the National Oceanic and Atmosphere Administration (NOAA) (2024). Information in Table C.2-1 was retrieved in January 2024. Typhoons that resulted in a major disaster declaration are bolded and noted the remarks.

Table C.2-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities.

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Oct 1984	*Thad*	TY H2	NMI/STR	Minor Damage	TS for STR
Oct 1984	*Vanessa*		NMI	No Damage	
Nov 1984	*Bill*		NMI	No Damage	
Jan 1985	*Elsie*	TS	NMI/STR	No Damage	
Jul 1985	*Jeff*	TD	NMI	No Damage	
Aug 1985	*Nelson*		NMI	No Damage	
June 1986	*Peggy*	TS	STR		
Sep 1986	*Ben*	TY H1	NMI	No Damage	Fishing vessel OWOL lost at sea with seven crew members
1986	*Carmen*	TS	STR		
Oct 1986	*Forrest*	TY H2	NMI	No Damage	
Dec 1986	***Kim***	**TY H4**	**NMI/STR**	**$25 Million**	**Presidential Disaster Declaration**
Dec 1986	*Marge*		NMI	No Damage	
Dec 1986	*Norris*		NMI	No Damage	

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Jul 1987	*Wynne*	TY H4	NMI	No Damage	
July 1987	*Thelma*	TS	STR		
Aug 1987	*Dinah*		NMI	No Damage	
Aug 1987	*Ed*	TD	NMI	No Damage	
Sep 1987	*Ian*	TS	NMI		
Sep 1987	*Freda*		NMI	No Damage	
Oct 1987	***Lynn***	**TY H1**	**STR**	**$426,757**	**Presidential Disaster Declaration**
Jun 1988	*Vanessa*		NMI	No Damage	
Jul 1988	*Warren*		NMI	No Damage	
Sep 1988	*Hal*	TY H3	NMI	No Damage	
Oct 1988	*Ruby*		NMI	No Damage	
Jan 1989	*Winona*	TS	STR	No Damage	
Apr 1989	*Andy*		NMI	No Damage	
Oct 1989	*Colleen*	TY H1	NMI	No Damage	
Oct 1989	*Forrest*	TS	STR	No Damage	
Dec 1989	*Jack*	TS	STR	No Damage	
Jan 1990	***Koryn***	**TY H1**	**NMI/STR**	**$2.2 Million**	**Presidential Disaster Declaration**
Apr 1990	*Lewis*	TD	NMI	No Damage	
Aug 1990	*Steve*	TY H2	NMI		
Aug 1990	*Zola*	TS	NMI		
Aug 1990	*Abe*		NMI	No Damage	
Oct 1990	*Hattie*	TS	NMI	No Damage	
Oct 1990	*Kyle*	TS	STR	No Damage	
Nov 1990	*Page*		NMI	No Damage	
Nov 1990	*Owen*		NMI	No Damage	
Dec 1990	*Russ*		NMI	No Damage	
May 1991	*Walt*		NMI	No Damage	
Sep 1991	*Ivy*	TY	NMI	No Damage	

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
		H2			
Nov 1991	*Mireille*	TY H1	NMI/STR	$ 1.2 Million	Request for Declaration Denied
Nov 1991	*Seth*	TY H4	NMI/STR	No Damage	
Nov 1991	*Verne*	TS	Agrighan	Crop Damage	
Nov 1991	*Yuri*		NMI	Crop Damage	
Aug 1992	*Omar*		Rota	Minor Damage	Crops & 7 structures destroyed
Aug 1992	*Janis*		NMI	No Damage	
Aug 1992	*Kent*		NMI	No Damage	
Sep 1992	*Ryan*	TY H1	Agrighan	Minor Damage	Crops destroyed
Oct 1992	*Brian*		NMI	No Damage	
Nov 1992	*Gay*		NMI	Minor Damage	
Nov 1992	*Hunt*		NMI	No Damage	
Nov 1992	*Elsie*		NMI	No Damage	
Mar 1993	*Irma*		NMI	No Damage	
Jul 1993	*Nathan*	TS	NMI/STR	No Damage	
Aug 1993	*Steve*	TS	NMI/STR	$ 1.4 Million	Request for Declaration Denied
Sep 1993	*Cecil*	TY H2	NMI	No Damage	
Oct 1993	*Hattie*		NMI	No Damage	
Sep 1994	*Melissa*		NMI	No Damage	
Sep 1994	*Nat*	TS	STR		
Oct 1994	*Verne*	TS	STR	Minor Damage	Crops destroyed
Oct 1994	*Wilda*		NMI	$ 1.1 Million	Request for Declaration Denied
Nov 1994	*Zelda*	TY H3/2	NMI/STR	$ 2.0 Million	Request for Declaration Denied
Dec 1994	*Bobbie*	TS	NMI/STR		
Sep 1995	*Oscar*	TS	NMI		
Jul 1996	*Dan*	TS	NMI		

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Jul 1996	*Herb*	TS	NMI		
Sep 1996	*Tom*	TY H1	NMI		
Sep 1996	*Yates*	TY H4	NMI/STR		
Oct 1996	*Carlo*	TY H3	NMI		
Dec 1996	*Fern*	TS	NMI		
Dec 1996	*Unnamed*	TS	NMI		
Jun 1997	*Nestor*	TY H4	NMI	Minor Damage	
Aug 1997	*Winnie*	STY H5	NMI	Major Damage	17 homes destroyed ships run aground
Sep 1997	*Oliwa*	STY H5	NMI		
Oct 1997	*Joan*	STY H5	NMI/STR	Minor Damage	
Nov 1997	***Keith***	**STY H5**	**RST**	**Major Damage**	**Presidential Disaster Declaration; total of 670 homes damaged 98 homes destroyed.**
Dec 1997	***Paka***		**Rota**	**Major Damage**	**Presidential Disaster Declaration**
Jul 1998	*Unnamed*	TS	NMI		
Oct 1998	*Alex*		NMI	No Damage	
Oct 1998	*Unnamed*	TS	STR		
Aug 2000	*Saomai*	TS	NMI/STR		
Jul 2001	*Manyi*	TY He	NMI		
Aug 2001	*Pabuk*	TS	NMI		
Agu 2001	*Wutip*	TY H2	NMI		
Oct 2001	*Krosa*		NMI	No Damage	
Dec 2001	*Faxai*	TY H4	NMI	No Damage	

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Jul 2002	***Chata'an***	**TY**	**Rota**	**$ 3.5 Million**	**Presidential Disaster Declaration**
Jul 2002	*Halong*		NMI	No Damage	
Aug 2002	*Phanfone*		NMI	No Damage	
Sep 2002	*Higos*	TT H1	NMI		
Dec 2002	***Pongsona***	**TY H3**	**NMI**	**Major Damage**	**Presidential Disaster Declaration**
Jan 2003	*Yanyan*		NMI	No Damage	
Aug 2003	*Krounah*		NMI	No Damage	
Jun 2004	*Ting Ting*	Ty H1/TS	NMI/STR	$ 1.4 Million	
Aug 2004	***Chaba***	**STY H5**	**STR**	**$14.4 Million**	**Presidential Disaster Declaration**
Sep 2004	*Songda*	TY H4	NMI	No Damage	
Sep 2004	*Sarika*	TS	NMI		
Oct 2004	*Nock-Ten*		NMI	No Damage	
Dec 2004	*Noru*	TS	NMI/STR		
Jul	*2005*	TY H1	NMI		
Sep 2005	*Nabi*	TY H2	NMI/STR	Minor Damage	
Aug 2006	*Saoma*		NMI	No Damage	
Sep 2006	*Longwave*	TS	CNMI		
Apr 2007	*Kong-Rey*	TY H2	NMI/STR	No Damage	
Aug 2007	*Usagi*	TS	`CNMI		
Jul 2008	*Nakri*	TS	Rota	No Damage	
Sep 2009	*Choi-wan*	TY H4	NMI	No Damage	
Oct 2009	*Melor*	TY H4	STR	No Damage	
Oct 2009	*Nepartak*	TS	Mariana chain	No Damage	
Oct 2009	*Mirinae*	TS	STR	No Damage	
Sep 2010	*Malakas*	TS	NMI	No Damage	

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Oct 2010	*Maria*	TS	NMI	No Damage	
Jul 2011	*Ma-on*	TY H2	NMI	No Damage	
May 2012	*Sanvu*	TS	Rota	No Damage	
Sep 2012	*Maliksi*	TS	NMI	No Damage	
Oct 2012	*Maria*	TS	NMI	No Damage	
Jul 2013	*Soulik*	TS	NMI	No Damage	
Oct 2013	*Pabuk*	TS	NMI	No Damage	
Oct 2013	*Danas*	TS	Marianas chain	No Damage	
Oct 2013	*Wipha*	TS	Marianas chain	No Damage	
Oct 2013	*Lekima*	TY	NMI	No Damage	
Mar 2014	*Faxai*	TS	Saipan	No Damage	
Apr 2014	*Tapah*	TS	NMI	No Damage	
14-Jul	*Halong*	TS	Rota	Minor Damage	
Sep 2014	*Phanfone*	TS	Marianas chain	No Damage	
Oct 2014	*Vongfong*	TY H2	STR	No Damage	
Mar 2015	*Bavi*	TS	Saipan, Tinian, Rota	$150 thousand estimated	Ffive homes destroyed, power disrupted
Jun 2015	*Dolphin*	TY	Rota, Tinian, Saipan	2.5 Million reported on Rota	Disaster declaration for Guam
Jul 2015	*Chan-hom*	TS	Rota	No Damage	
Jul 2015	*Nangka*	TY H4	Saipan	No Damage	
Aug 2015	***Soudelor***	**STY H3**	**STR**	**$21 Million**	**Presidential Disaster Declaration**
Aug 2015	*Goni*	TS	STR	No Damage	Tropical Storm
Aug 2015	*Atsani*		NMI	No Damage	Typhoon
	Krovanh	TY H1	NMI	No Damage	
Oct 2015	*Kopu*	TS	NMI/STR	No Damage	

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Oct 2015	*Champi*	TS	STR	Minor Damage (Tinian water disruption)	
Aug 2016	*Omais*	TS	NMI/STR	No Damage	
Aug 2016	*Mindulle*	TS	STR	No Damage	
Sep 2016	*Chaba*	TS	STR	No Damage	
Aug 2017	*Sanvu*	TS	STR	No Damage	
Sep 2017	*Talim*	TD	STR	No Damage	
Mar 2018	*Jelawat*	TY	NMI	No Damage	
Jul 2018	*Maria*	TS	Rota	No Damage	
Aug 2018	*Leepi*	TS	NMI	No Damage	
Aug 2018	*Cimaron*	TS	NMI	No Damage	
Aug 2018	*Jebi*	STY H5	NMI	No Damage	Did not make landfall
Sep 2018	***Mangkhut***	**TY H3**	**STR**	738 residences were affected with 17 destroyed and 53 with major damage.	**Presidential Disaster Declaration**
Sep 2018	*Trami*	TS	Rota	No Damage	
Oct 2018	*Yutu*	STY H5	STR	Total damage estimated by FEMA reached $800 million.	Presidential Disaster Declaration
Aug 2019	*Kosa*	TD	NMI	No Damage	
Sep 2019	*Peipah*	TD	NMI	No Damage	
Oct 2019	*Hagibis*	STY H5	NMI	No Damage	Did not make landfall
Oct 2019	*Bualoi*	TY H4/H3	NMI/RTS	No Damage	Did not make landfall
Nov 2019	*Fenghsen*	TY 2019	NMI	No Damage	Did not make landfall
Aug 2020	*Haishen*	TS	NMI	No Damage	
Sep 2021	*Mindulle*	TS			
May 2023	***Mawar***	**TY**	**RTS**		**Presidential Disaster Declaration**

Table C.1-1. Named storms from 1984 through 2022 for Northern Marian Island municipalities (*cont'd*).

Date	Storm Name	Type	Location	Estimated Damage	Remarks
Oct 2023	*Bolaven*	TS	RTS		

Note. TY, typhoon; TS, tropical storm, TD, tropical depression; STY, super typhoon; NMI, Northern Mariana Islands, STR, Saipan, Tinian, Rota.
Sources: 2018 State Standard Mitigation Plan and http://coast.noaa.gov/hurricanes/. Searched storms for the following municipalities: Northern Mariana Islands (NMI), Saipan, and Rota.

C.3 Tsunami

No additional information at this time.

C.4 Drought

No additional information at this time.

C.5 Flood

C.5.1 2018 SSMP Projected Sea Level Rise Scenarios

The following information is supplied for reference and continuity to the 2018 Standard State Mitigation Plan (SSMP). This information was re-organized to fit this documents template, but the information is largely unchanged from the 2018 SSMP.

Coastal inundation can result from a variety of scenarios that occur at varying temporal scales. While long-term sea level rise (SLR) caused by climate change has the potential to impact Pacific Islands with varying severity, the combination of extreme events (storms, king tides, etc.) and long-term SLR will have more damaging and widespread effects (Chowdhury et al., 2010). The mapping approach taken here acknowledges this range of coastal flooding threats and attempts to integrate a variety of scenarios that represent them. This analysis covers only the island of Saipan, as the necessary data inputs to conduct the analysis (high resolution Lidar) could not be obtained for other islands in the Commonwealth of the Northern Mariana Islands (CNMI). Future updates to the CNMI SSMP should include additional sea level rise and coastal flooding analyses as Lidar or other elevation data becomes available.

C.5.1.1 Mapping Approach

Nine coastal flooding and inundation scenarios were chosen for analysis. These scenarios included long-term sea level shifts corresponding to *the U.S. Army Corps of Engineers (USACE) SLR curve calculations for civil works projects* (USACE, 2011), and additional short-term adjustments to sea level due to 10 and 50-year storms (storms with a 1 in 10 or 1 in 50 chance of occurring in a given year).

Sea level rise curve calculations are based on methods developed by National Oceanic and Atmospheric Administration (NOAA), US Geological Survey (USGS), and USACE to calculate future *local* mean sea level, and include adjustments that factor in vertical land movement and regional sea level variation.

The 10 and 50-year storm sea levels were modeled by the USACE for the Saipan lagoon (Chou, 1989) and accounted for a total water level increase during typhoons of varying severity.

These total water levels and SLR calculations were assessed separately and in combination to identify the degree to which climate change might exacerbate naturally occurring inundation due to storms.

Geographic Information System (GIS) layers were developed to represent two flooding extents and associated depths for each of the nine scenarios. These layers included flooding extents that were either 1) hydraulically connected to the shoreline, or 2) a result of an expansion of Lake Susupe and the Susupe wetland area.

While Lake Susupe's water surface elevation may not change at the same rate as sea levels (particularly during short-term events), there is evidence of changing water chemistry and salinity due to shifts in past sea levels (Carruth, 2003). Therefore, the area that could be potentially *affected* by changes in sea level was calculated, albeit separately from coastal flooding. This area is termed "wetland flooding" in summary maps and statistics, whereas flood extents that are connected to the shoreline are termed "coastal flooding". In situations where both *coastal* and *wetland* flooding are considered, the term "combined inundation" is used.

GIS data for land parcels and land cover were clipped to the boundaries of the flooded areas for each of the nine *coastal* inundation extents. Frequency and summary statistics were calculated for the clipped land uses and land cover, showing the occurrence and acreage of impacted land uses and types of vegetation/land cover.

The following pages summarize the results of the mapping process and analysis.

Note:
A coding scheme was developed to represent the SLR/SLC scenarios. The scenario codes used for different sea levels and flooding extents (e.g. A1, C2, etc.) do not reference any future CO_2 *or*

emissions scenarios from SRES or IPCC assessment reports (see AR4), and were used simply as a naming convention to keep numerous data layers organized and packaged.

Table C.5-1. Summary of Inundation Scenarios

Scenario	Rise (Ft.)	Rise (Meters)	Scenario Code	Inundated Area - Coastal (km²)	Inundated Area - Coastal (acres)	Wetland Flood (km²)**	Wetland Flood (acres)	Combined Inundation Area (km²)	Combined Inundation Area (acres)
10 year Storm; no Sea Level Change	4.89	1.49	A1	0.93	229.81	1.27	313.83	2.2	543.64
USACE Curve Intermediate - 50 yrs. + 10 yr. Storm	5.10	1.554	A2	1.23	303.95	1.36	336.07	2.59	640.01
USACE Curve Intermediate - 100 yrs.	0.89	0.27	B1	0.11	27.18	0.02	4.94	0.13	32.12
USACE Curve Intermediate - 100 yrs. + 10 yr. Storm	5.77	1.76	B2	1.78	439.86	1.92	474.45	3.7	914.31
USACE Curve High - 50 yrs.	1.64	0.5	C1	0.2	49.42	0.06	14.83	0.26	64.25
USACE Curve High - 50 yrs. + 10 yr. Storm	6.53	1.99	C2	2.49	615.30	2.27	560.94	4.76	1176.24
USACE Curve High - 100 yrs.	5.02	1.53	D1	1.2	296.53	1.31	323.71	2.51	620.25
USACE Curve High - 100 yrs. + 10 yr. Storm*	9.91	3.02	D2	9.7	2396.97			9.7	2396.97
USACE Curve High - 100 yrs. + 50 yr. Storm*	11.91	3.63	D3	11.27	2784.93			11.27	2784.93

* Coastal Inundation in scenarios D2 and D3 extends into wetland area, Wetland flood extent is included in coastal inundation calculation.

** The area of existing surface water in Susupe wetlands is subtracted from flood extent area (i.e. Wetland flood area = (wetland inundation area - 0.19 km²))

The areas of inundation vary widely depending on the scenario used. If sea level changes (SLC) due to a storm is factored in, these areas expand greatly. An important consideration is that some of the less-extreme SLR scenarios, while not visually striking in figures or the maps on the following pages, will still have a significant impact on the island. Because these maps adopted a "bathtub" approach to inundation mapping, the models do not account for additional coastal flooding factors such as wave run-up, erosion, and other dynamic coastal forces. These forces will have an impact on all the areas that are directly adjacent to the coastal flood extent, and if taken into account in a model, would likely increase the area of inundation.

A good example of this is Scenario B1, which is a somewhat conservative estimate of SLR by the end of this century (at the low end of IPCC AR5 RCP 8.5 projections). In this scenario, only a small margin of shoreline is inundated (27 acres). However, this is the same part of the shoreline that currently reduces the energy of waves and bears the brunt of erosive processes from long-shore currents and seasonal adjustments in sea level. With this shoreline rendered inadequate as far as coastal protection is concerned, the areas directly adjacent to the shoreline are placed within a new zone of erosion and/or wave run-up. On Saipan, this means features such as Beach Road, the Beach Pathway, tourism facilities in Garapan, American Memorial Park, and Port Facilities will have increased threat levels, and suffer impacts from minor wave and storm events at greater frequencies.

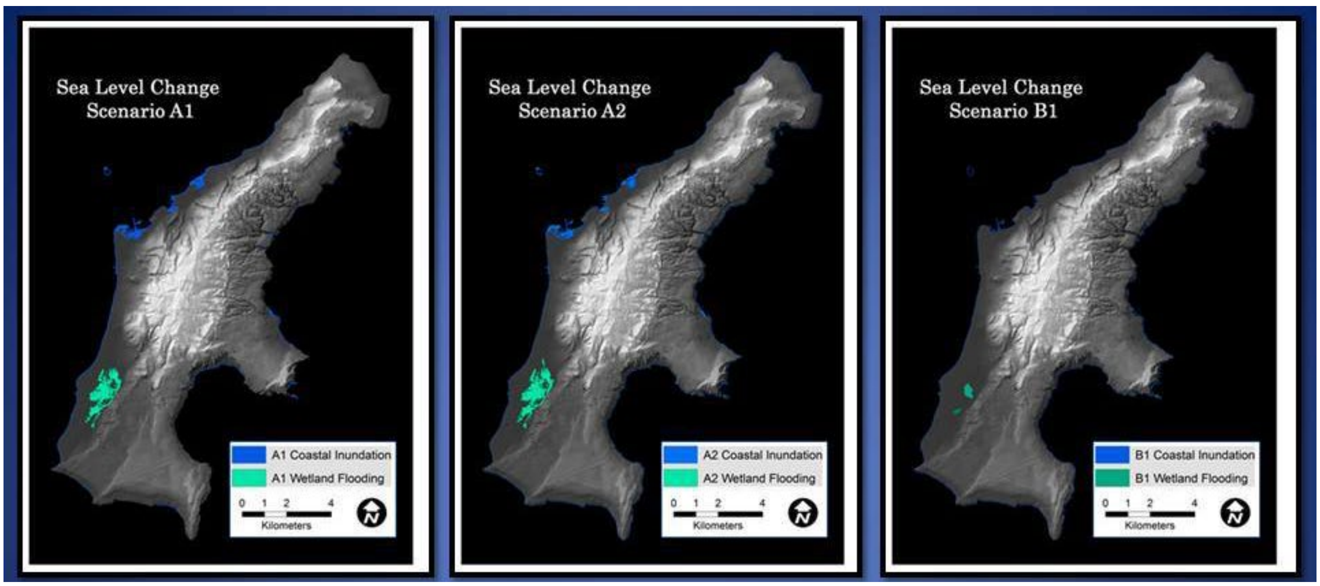


Figure C.5-1 Inundation Scenarios 1.

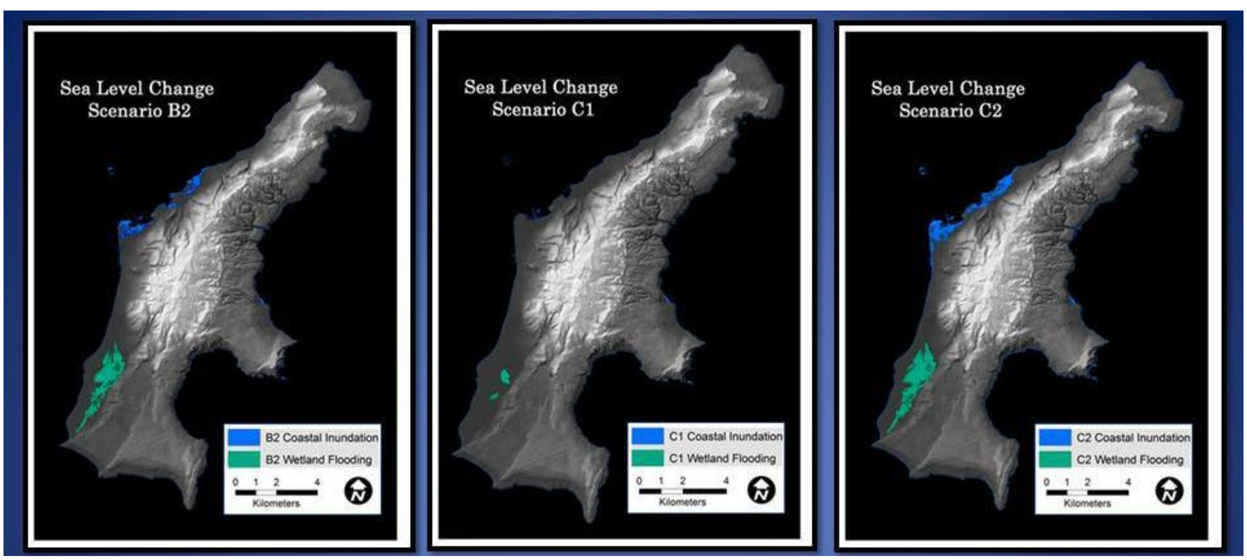


Figure C.5-2. Inundation Scenarios 2.

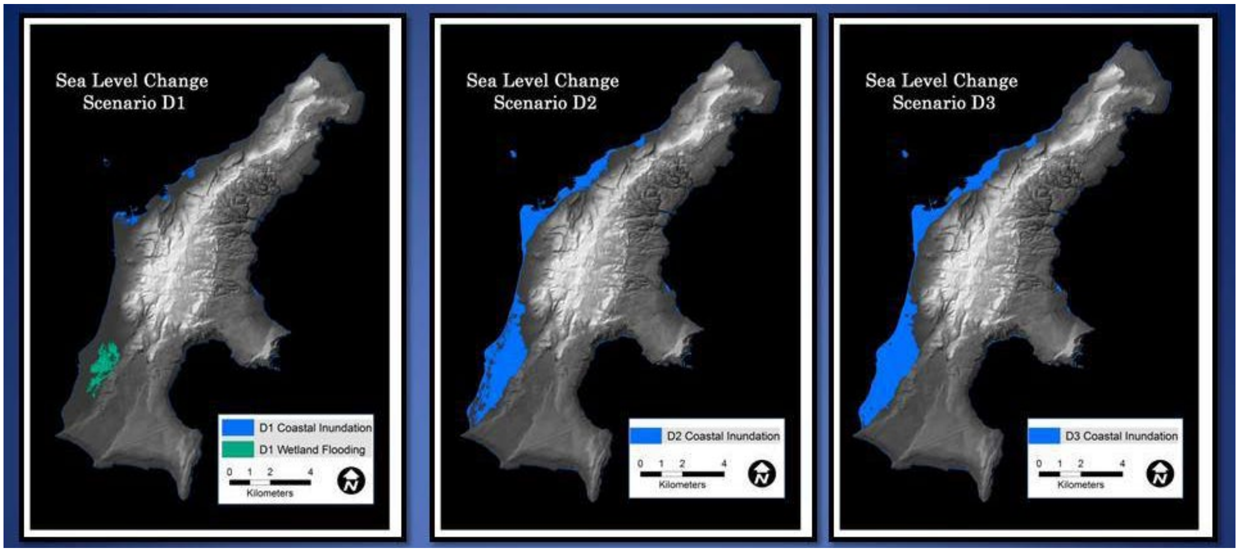


Figure C.5-3. Inundation Scenarios 3.

Taking a look at the basic flood extent calculations, it is apparent how rapidly the area of *storm-induced* flooding expands when *climate-induced* SLR is brought into the picture. Along Saipan's lagoon shoreline there is generally 4-8 feet of gentle-moderate sloping beach and shoreline vegetation before the land levels off into the coastal plain and low-lying developed areas. The top of this slope forms a sort of inundation thresh hold for the low-lying communities on Saipan's west side. In the more extreme scenarios explored in the VA, sea level overtops a critical elevation contour along the shoreline, and coastal flooding expands inland to cover a much greater area as the inundation threshold is breached.

Climate change-induced SLR simply enables the 10-year storm to breach a critical point at which the sea moves beyond the beach and into populated areas. The last column in the table below shows the percent increase in coastal flooding area that occurs during a 10-year storm as a result of climate-induced increases in sea level. If the USACE high curve is used to calculate 50 years of SLR (Scenario C2), a 10-year storm in 2063 might flood over twice the area that it currently would. This increase in flooded areas is not proportionate to the increase in water level. In that particular scenario, increasing sea level by approximately 30% leads to a 116% increase in coastal inundation.

Table C.5-2. Sea Level Rise Changes

Scenario Code	Scenario	Combined Inundation Area (km²)	Combined Inundation Area (acres)	Increase in Flooded Area from 10 year storm baseline (km²)	Increase in Flooded Area from 10 year storm baseline (acres)	Percent Increase in Flooded Area from 10 year storm baseline
A1	10 year storm without sea level rise (SLR)	2.2	543.64	0	0.00	0.00
A2	10 year storm with 50 years of SLR (intermediate curve)	2.59	640.01	0.39	96.37	17.73
B2	10 year storm with 100 years of SLR (intermediate curve)	3.7	914.31	1.5	370.67	68.18
C2	10 year storm with 50 years of SLR (high curve)	4.76	1176.24	2.56	632.60	116.36
D2	10 year storm with 100 years of SLR (high curve)	9.7	2396.97	7.5	1853.33	340.91

The significant changes that SLR can make to naturally-occurring SLC are also evident in the following detail figures. These figures illustrate the land uses and land cover that could potentially be inundated by a given scenario and provide some detailed maps at a larger spatial scale to highlight impacts. Scenarios A1, C2 and D1 are shown within this section of the document to illustrate three possible states of sea level:

The ten-year storm, which would be similar to a moderately sized typhoon, places a large amount of stress on parcels and land use directly adjacent to the shoreline, but flooding extent does not extend inland for more than 100 meters or so in most locations. The most heavily impacted parcel, labeled USGOV Park in the CNMI land use coding scheme, is American Memorial Park, and has over 50 acres inundated. The remaining parcels that are heavily impacted or that experience flood depths greater than a few tenths of a meter are publicly accessible shoreline areas, parks, and undeveloped sites, as well as a few parcels of private land.

It is important to note that a few key features identified by stakeholders in a community-based vulnerability assessment (Greene & Skeele, 2014) [sic] are marginally impacted. This is the case in almost all the scenarios as these are directly adjacent to the lagoon waters. These features are shown in the following figure.

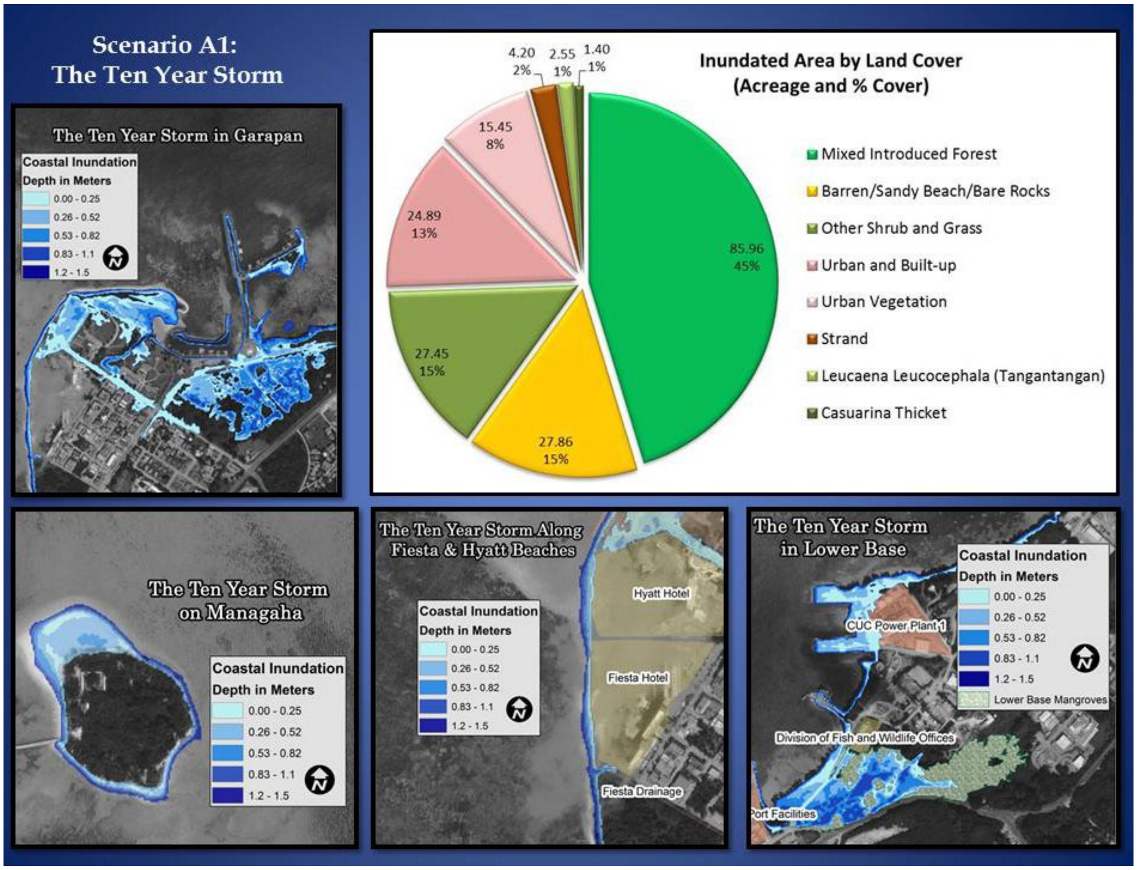


Figure C.5-4. Scenario A1 Land Inundation.

Here we see several key features impacted by severe flooding. Most of American Memorial Park's wetlands are completely inundated, while flooding occurs along the streets separating the Park from Garapan's core business area and the Hyatt Resort. On the shoreline side of Hyatt and Fiesta Hotel, the sea level is raised to a point just below the elevation contour that marks the top of the beach slope. Along this line wave over-topping and run-up would impact the recreational features along the resorts' beaches, but they would likely avoid permanent flooding. More severe flooding of these features is demonstrated in scenario C2.

The mangroves and wetlands present in Lower Base are also completely inundated in this scenario. This would likely create a backwater effect in which any run-off or drainage from precipitation in the Capitol Hill area would build up behind the wetlands, creating additional inland flooding.

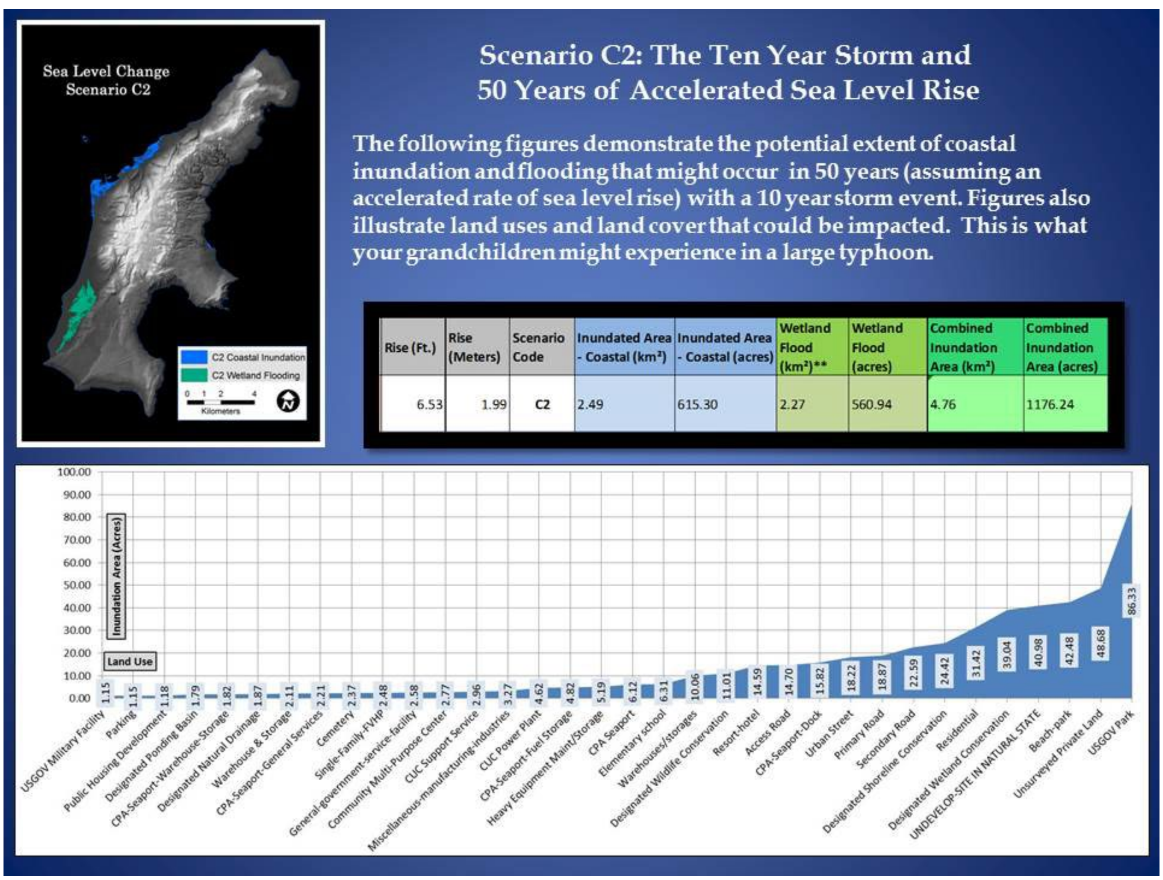
The detailed map of Lower Base also illustrates multiple threats to industrial and government facilities. Notably, primary access to the CUC Power Plant and DFW Offices is cut off near the Port, and the Power Plant itself is partially inundated along the shoreline.

The percentage of impacted land cover types also demonstrates the *composition* of inundated land. The primary area of "mixed introduced forest" in the figure above is actually the land cover class assigned to the flooded vegetation in American Memorial Park. Next to this the major impacts occur on beaches and strand vegetation located along the shoreline. About 20% of the impacted area is characterized by urban and impervious surfaces, posing additional flooding threats within more developed villages.

C.5.1.2 C2: The 10 Year Storm in 50 Years

In scenario C2, 50 years of accelerated SLR are added to the 10-year storm from scenario A1. The results from a simple analysis of this scenario demonstrate the great potential of climate change to amplify the impacts of natural climate stressors such as storms.

In the context of land use, the major parcels suffering from flooding remain largely the same as in scenario A1; however, roughly twice the area is inundated. Perhaps what is most significant in this scenario is a change in the second tier of impacted parcels (between ~4 and ~20 acres) from A1. The land uses that are now impacted due to the addition of 50 years SLR include more critical infrastructure, such as primary, secondary and access roads, the CPA Seaport, and CUC Power Plant. Tourist facilities, residential areas in Garapan and Tanapag, and Garapan Elementary School also experience flooding.



Rise (Ft.)	Rise (Meters)	Scenario Code	Inundated Area - Coastal (km²)	Inundated Area - Coastal (acres)	Wetland Flood (km²)**	Wetland Flood (acres)	Combined Inundation Area (km²)	Combined Inundation Area (acres)
6.53	1.99	C2	2.49	615.30	2.27	560.94	4.76	1176.24

Figure C.5-5. 10-Year Storm in 50 Years (Scenario C2).

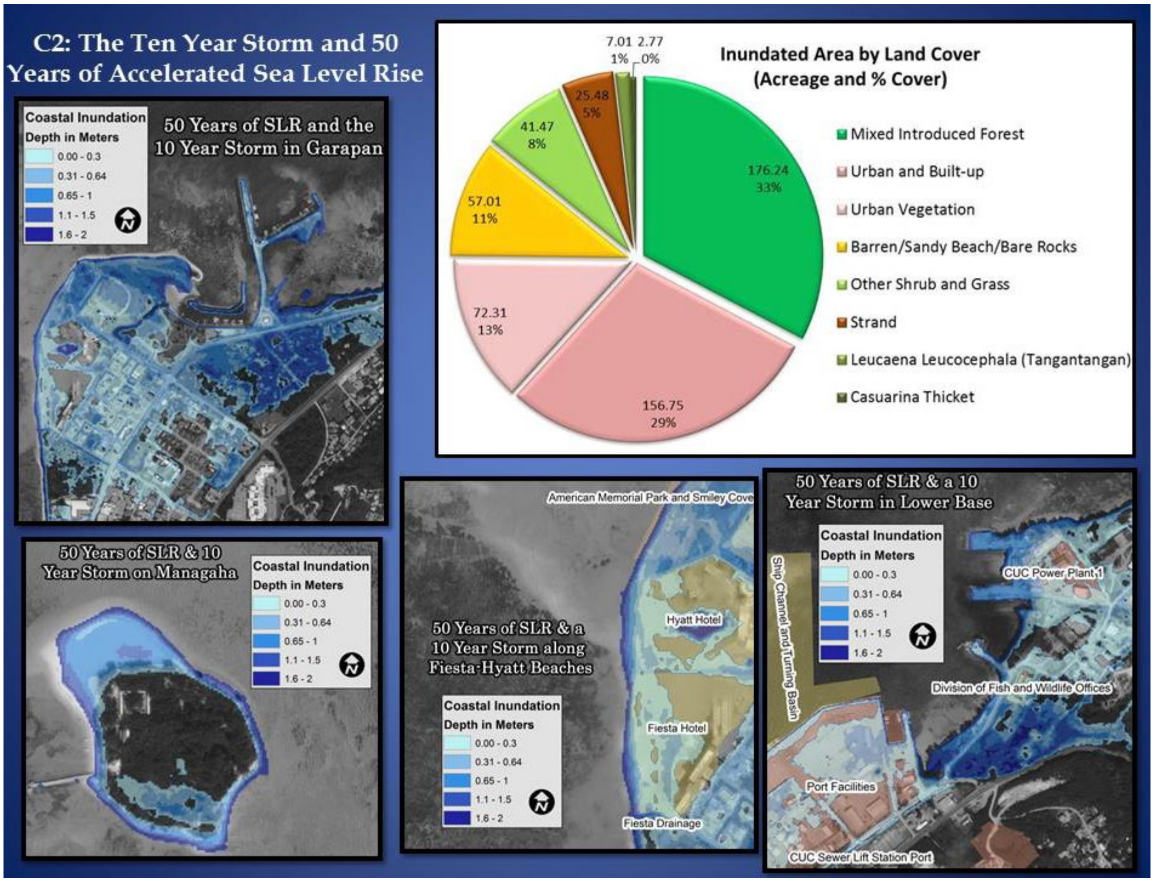


Figure C.5-6. Scenario C2 Land Inundation.

The composition of impacted land cover also changes drastically from scenario A1 to C2. While the mixed-introduced forest of AMP still constitutes the largest percentage of flooded area, over 40% of additional inundated area is either part of an urban core, or a developed space within a village. This reflects flooding through Garapan, the Lower Base industrial area, and Tanapag. In the detail maps we see that the safety of Port Facilities, DFW offices, and the CUC Power Plant are fully compromised. The core of Garapan is thoroughly flooded, with some notable flood depths along the Fiesta drainage. The primary tourism facilities in Garapan also become flooded.

Mañagaha Island also suffers inundation. Compared to scenario A1, flooding in C2 has overcome a critical contour line along the shore and inundated a significant portion of the developed area on the island, not to mention cut off tourist access via the docking facility. While there is no chance that tourists or staff would be on the island in a storm such as this, the combined short-term action of increased sea levels, currents, and waves on the island's unstable shoreline would likely alter the shape and volume of the island in a manner that would require serious physical modification to continue tourist activities.

C.5.1.3 D1: Normal Conditions in 100 Years

Scenario D1 is an extreme scenario built upon the upper end of SLR projections for the 21st century, but regardless of probability, such an increase in sea level remains within the realm of possible futures, and therefore merits consideration. The scenario is also of interest due to the similarities it shares with scenario A1. D1 illustrates conditions in which the extent of coastal inundation during high tide by the end of the century (D1) exceeds that of a large typhoon at the beginning of the century (A1). The axiom "today's flood is tomorrow's high tide" is embodied in this scenario.

Examining the impacts of flooding on parcels, American Memorial Park faces a flood extent similar to that of A1, though this time the park is compromised permanently (as opposed to short-term flooding via a typhoon). Saipan's publicly accessible shoreline is inundated, although by the end of the century the shoreline is more likely to be re-arranged or retreated after decades of gradually increasing sea levels. In this scenario a significant amount of physical modification over a span of many decades would be required to maintain existing public shoreline access or park facilities.

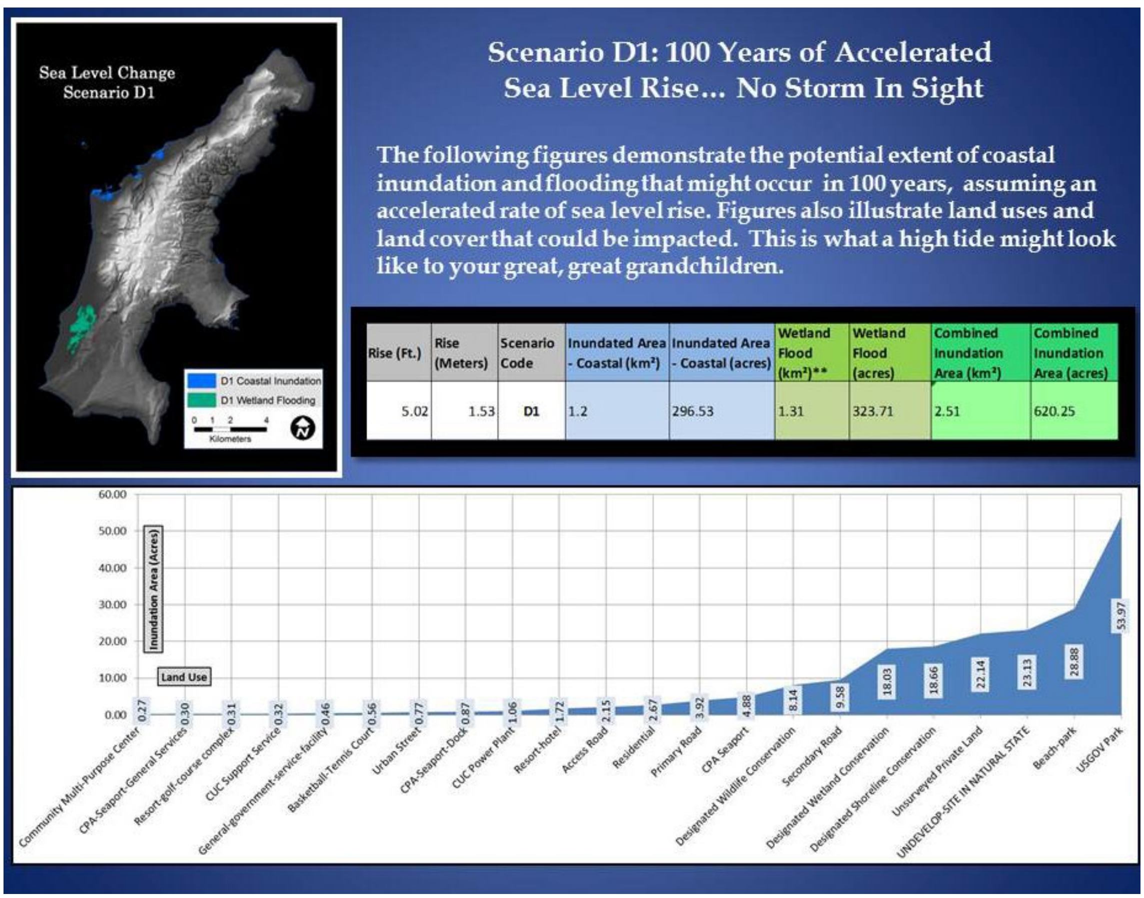


Figure C.5-7. Normal Conditions in 100 Years.

A similar level of physical alteration to infrastructure and the shoreline would be necessary to maintain the Seaport and Power Plant facilities at their current locations, and a relocation of the Lower Base Power Plant might be a viable option in the face of permanent inundation. Conservation areas and wetlands would also be permanently inundated, necessitating new restoration priorities.

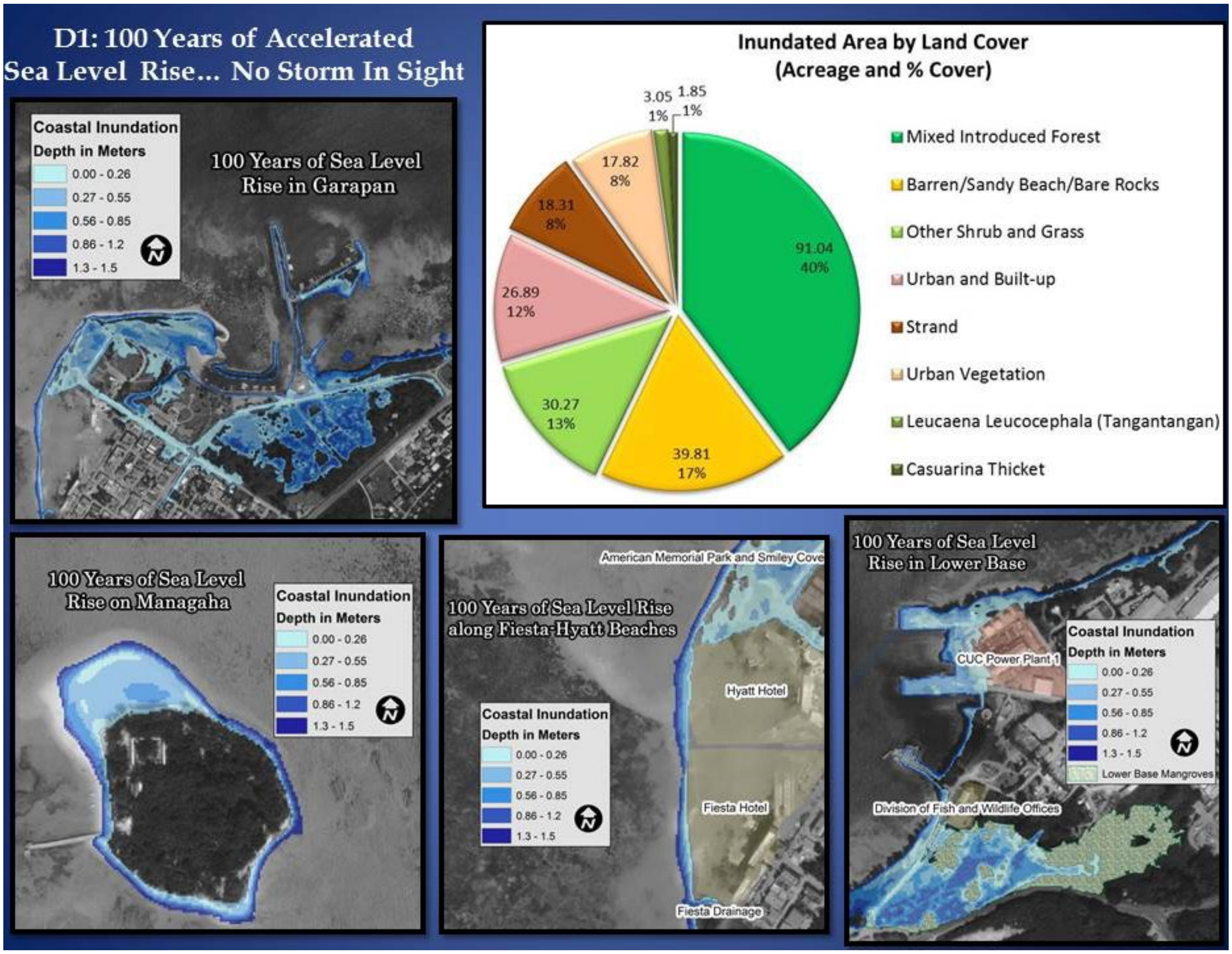


Figure C.5-8. 100 Year Land Inundation.

The detail maps for scenario D1 further highlight the implications of an extreme, long-term SLR scenario. While Mañagaha's current tendency toward instability and re-shaping would lead to a different configuration of the island by 2100, any areas currently susceptible to erosion would certainly be exacerbated. If vegetation is not allowed to establish in areas that are currently accreting (e.g., the northwest section of beach), there would be a major loss of the island's ability to migrate and adapt to natural coastal processes.

Resort facilities would also face a retreating and re-arranged shoreline (provided significant hardening and modification of the shoreline was not implemented), and the DFW Offices would certainly require relocation. While the maps do not illustrate permanent inundation of Garapan's core *at the surface*, there would likely be chronic flooding of the low-lying stormwater and wastewater infrastructure due to a back-water effect within drainage systems. Lift stations and any non-pressurized sewer mains could face permanent impairment as a result of this effect.

The following section explores the severity of flood scenarios in two of the most vulnerable focus areas: Garapan and Lower Base.

C.5.1.4 Flood Severity and Focus Areas

The cumulative potential impact of coastal flooding in Garapan and Lower Base is a result of both the extent and depth of flood waters. This combination can be thought of as flood severity. Figures 5-9 and 5-10 focus on coastal flood severity in Scenario C2 by examining the mean depth of flood waters within individual land parcels. While flood depths vary greatly over large parcels, visualization of average depths allow for a quick assessment of spatial variation in flood impacts.

Both Garapan and Lower Base exhibit significant susceptibilities to flooding. The physical configuration of the landscape allows for a great degree of hydraulic connectivity, especially where storm water drainages and impervious surfaces occupy low-lying areas. In these situations, a primary or secondary road (or its parallel drainage) may act as a conduit for coastal flooding, connecting basins or *sinks* that are critically impacted.

Ultimately, this connectivity enhances the ability of flood waters to move inland and impact properties and facilities that were previously set back a sufficient distance from the shoreline.

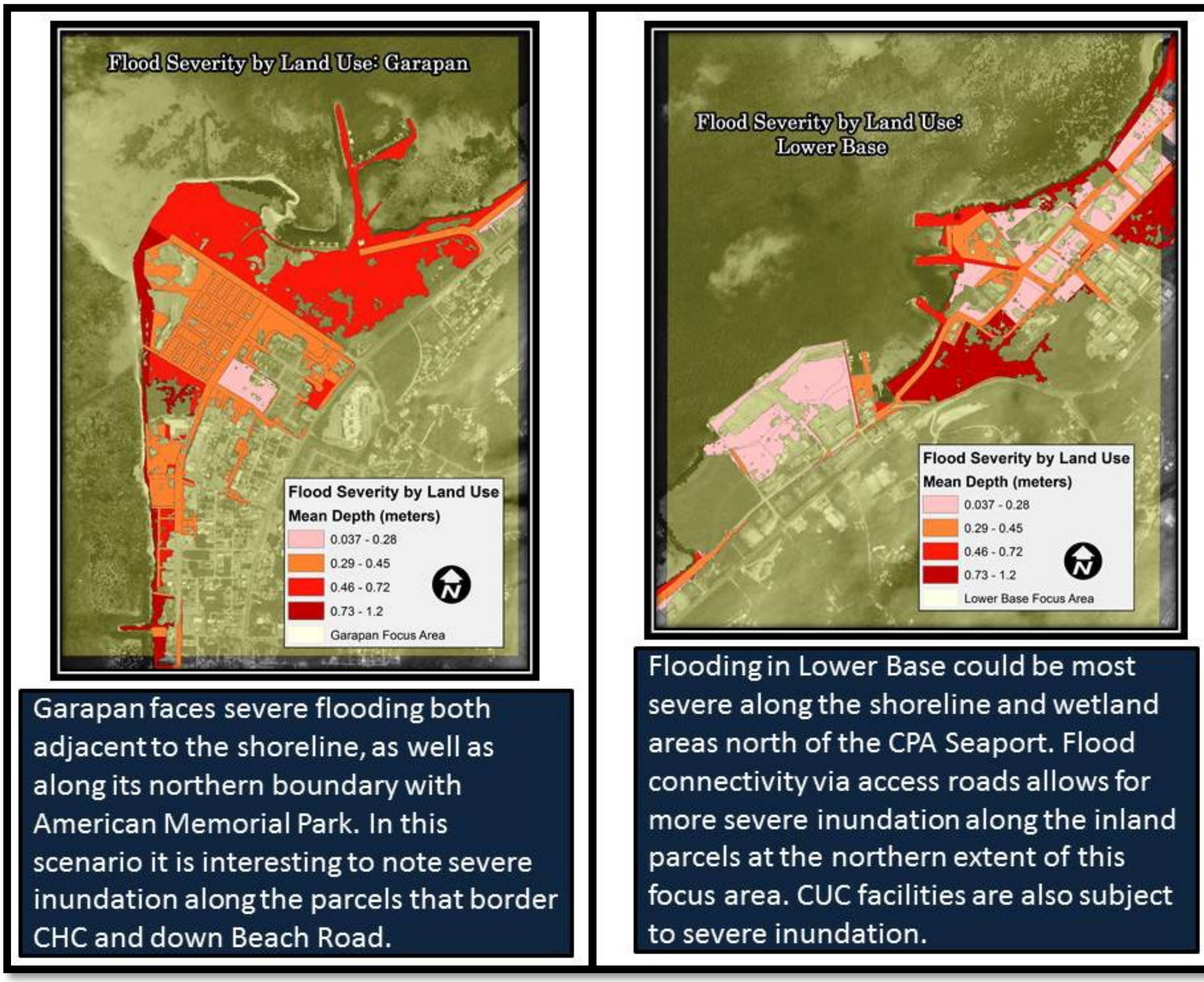


Figure C.5-9. Flood Severity in Garapan and Lower Base, Saipan.

C.6 Health Risk

No additional information at this time.

C.7 Extreme Heat and Heatwave

Weather data was retrieved from the National Oceanic and Atmosphere Administration (NOAA) Global Historical Climatology Network daily (GHCNd) website (*Global Historical Climatology Network Daily (GHCNd)*, 2021). Weather data was retrieved using the following method.

1. Climate Data
    a. Access Methods
        i. Click on Climate Data Online
2. Climate Data Online Search
    a. Select Weather Observation Type/Dataset–select Daily Summaries
    b. Select Date Range–for the 2024 State Hazard Mitigation Plan Update, 10 years was selected (2003–2023)
    c. Search for–Stations
    d. Enter Search Term–Enter Saipan
    e. Click the search button
    f. When the search is completed, Saipan International Airport, US will be at the left of screen– click *Add to Cart*.
    g. Click the cart to check out (free of charge)
        i. Choose file output option, select CSV to use data in excel.
        ii. Station Detail and Flag Options–check Station name
        iii. Select data types for custom output
            1. Select Air temperature
                a. Select Maximum temperature (TMAX)
                b. Click Continue
        iv. Enter email address and verify
3. The file will be delivered as a zipped file to your email address.
4. Open the file in Excel.

Table C.7-1. Number of days 2003–2023 over 90°F at the Franscisco D. Ada Internation Airport, Saipan.

Year	Days over 90°F at Fransisco C. Ada International Airport
2013	10
2014	28
2015	11
2016	80
2017	117
2018	7
2019	88
2020	173
2021	134
2022	84
2023	40

C.8 Wildfire

No additional information at this time.

C.9 Earthquake History

Earthquake history for the CNMI was retrieved from the USGS Search Earthquake Catalog webpage, https://earthquake.usgs.gov/earthquakes/search/. Earthquake history was selected using the following parameters:

1. Basic Options
    a. Magnitude—custom, greater than 5.0
    b. Date & Time—January 2013 through January 2024
    c. Geographic Region>Custom>Draw a rectangle on a map.
2. Advanced Options
    a. Geographic Regions
        i. CNMI Region including Northern Islands
            1. Latitude—North 20.5; South 12.5
            2. Longitude—East 143; West 147
            3. Figure C.9-1
        ii. CNMI Main Islands
            1. Latitude—North15.5; South 13.5
            2. Longitude
            3. Figure C.9-2
    b. Event Type—Earthquake
    c. No other advanced options selected.
3. Output Options
    a. Format
        i. Map and List
        ii. CSV file

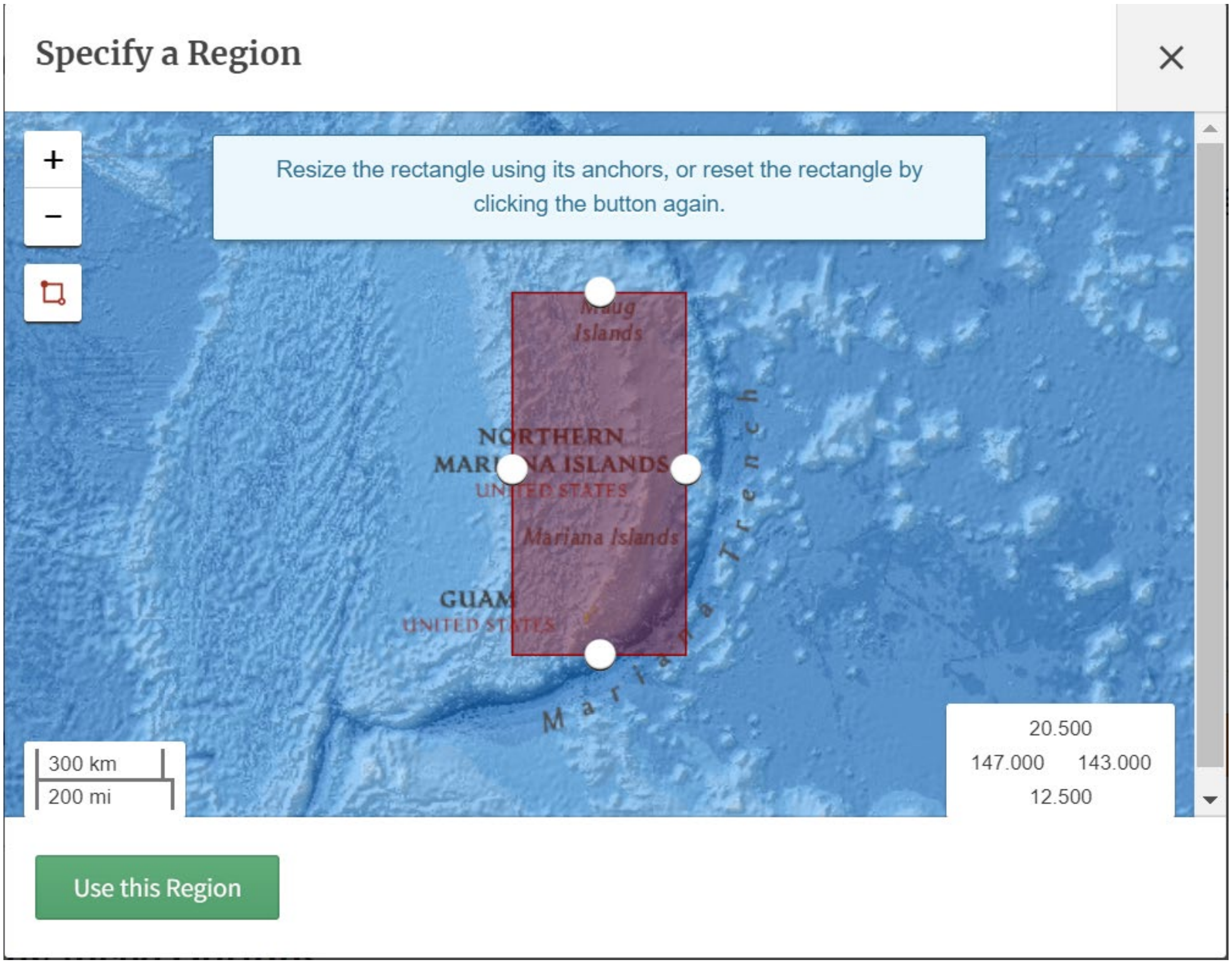


Figure C.9-1. Geographic selection for earthquake history in the CNMI Region. Latitude and longitude inputs are located in the lower right of the figure.

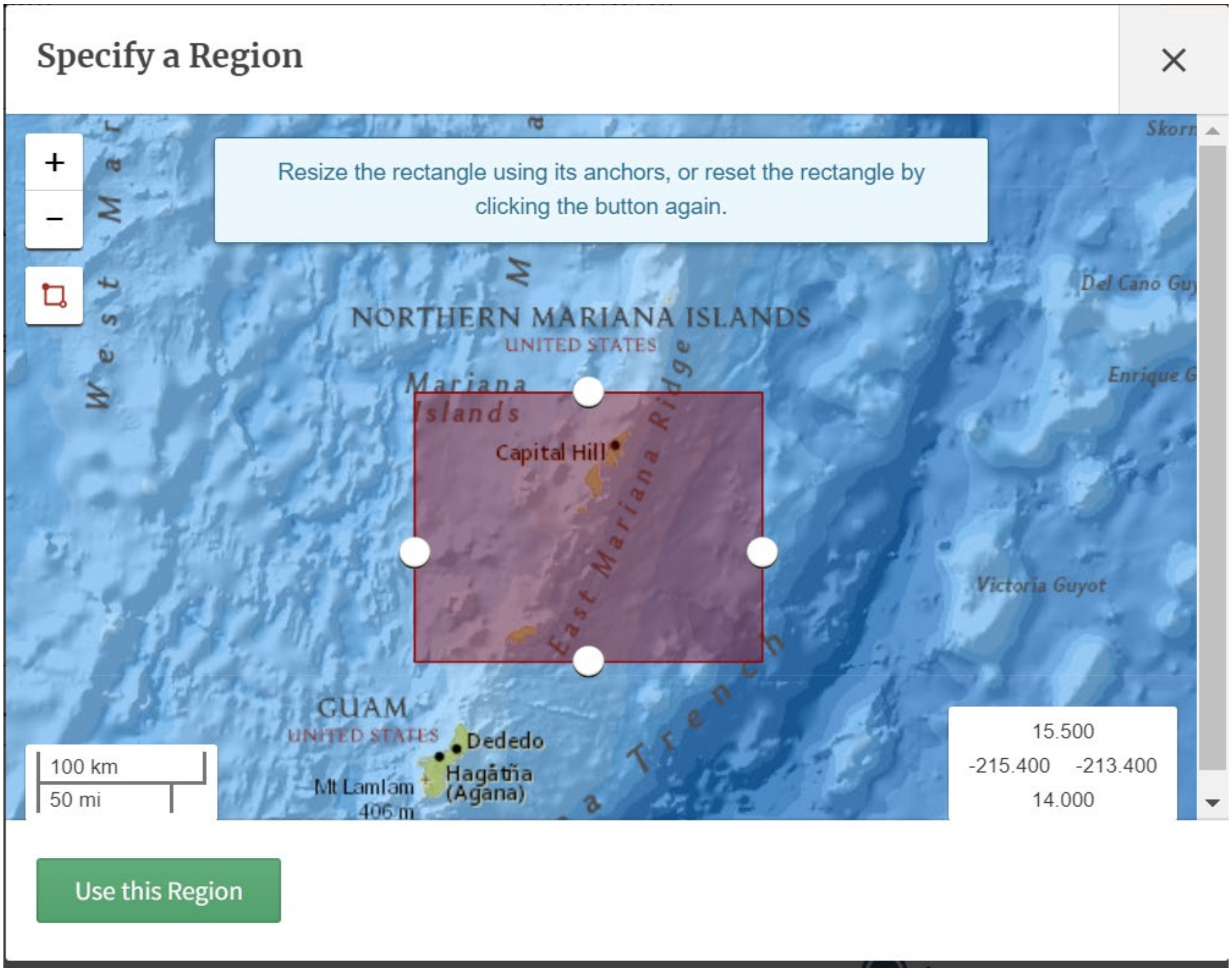


Figure C.9-2. Geographic selection for earthquake history focused on Rota, Saipan, and Tinian. Latitude and longitude inputs are located in the lower right of the figure.

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold.

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2024-01-20	18.5273	145.6391	184	6.1	Pagan region	us6000m50e	IV
2024-01-17	17.1758	145.9771	143	5.0	218 km N of Saipan	us6000m46a	
2024-01-12	18.9599	144.8079	10	5.0	Pagan region	us6000m38b	
2024-01-08	20.1982	145.3365	10	5.0	Maug Islands region	us6000m2fk	
2024-01-03	19.9265	145.3765	10	5.0	Maug Islands region	us6000m1j9	
2023-12-16	20.0602	145.4500	10	5.0	Maug Islands region	us7000ljj5	

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2023-12-16	20.0946	145.5889	10	5.0	Maug Islands region	us7000ljhs	
2023-12-16	20.2452	145.6855	10	5.7	Maug Islands region	us7000ljhg	IV
2023-12-14	19.9470	145.4364	22	5.0	Maug Islands region	us7000lj40	
2023-12-10	18.8214	146.0987	95	5.6	Pagan region	us7000lhxd	IV
2023-12-02	19.9061	145.3452	10	5.2	Maug Islands region	us7000lfcq	
2023-11-27	20.1580	145.4878	10	5.0	Maug Islands region	us6000lr0x	
2023-11-27	20.2649	145.3442	10	5.0	Maug Islands region	us6000lr01	
2023-11-25	19.9451	145.4157	10	5.6	Maug Islands region	us6000lqqc	V
2023-11-25	20.0637	145.5349	10	5.6	Maug Islands region	us6000lqpw	IV
2023-11-25	20.0854	145.4646	10	5.0	Maug Islands region	us6000lqmy	
2023-11-25	20.1232	145.2760	10	5.1	Maug Islands region	us6000lqlk	
2023-11-24	18.4517	145.6331	231	5.3	Pagan region	us6000lqkm	
2023-11-24	20.2156	145.4086	10	5.0	Maug Islands region	us6000lqjz	
2023-11-24	20.2293	145.5723	10	5.1	Maug Islands region	us6000lqii	
2023-11-24	19.9896	145.3566	10	5.1	Maug Islands region	us6000lqhw	
2023-11-24	20.1684	145.3876	10	5.0	Maug Islands region	us6000lqg4	
2023-11-24	20.0893	145.4446	10	5.1	Maug Islands region	us6000lqg3	
2023-11-24	20.0360	145.4477	10	5.1	Maug Islands region	us6000lqfw	
2023-11-24	20.1655	145.4784	10	5.1	Maug Islands region	us6000lqfv	
2023-11-24	20.1387	145.2906	10	5.2	Maug Islands region	us6000lqfm	
2023-11-24	20.0957	145.4625	10	5.1	Maug Islands region	us6000lqfr	
2023-11-24	20.1336	145.1921	10	5.4	Maug Islands region	us6000lqfi	V
2023-11-24	20.1319	145.5195	22	6.9	Maug Islands region	us6000lqf9	VI
2023-11-19	18.7980	145.3216	585	5.9	Pagan region	us6000lpe6	II
2023-11-07	18.7786	145.2812	623	5.4	Pagan region	us7000l9eg	I

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2023-10-28	18.1617	145.9463	125	5.3	Pagan region	us7000l750	
2023-10-18	13.4286	146.2842	10	5.2	151 km E of Yigo Village, Guam	us6000lgbq	
2023-09-21	**13.8086**	**144.6809**	**152**	**5.0**	**36 km NNW of Dededo Village, Guam**	**us7000kx26**	
2023-09-08	19.0392	145.8277	134	5.2	Maug Islands region	us7000ku6k	
2023-08-29	13.1887	143.8269	144	5.2	91 km W of Umatac Village, Guam	us7000kruj	
2023-08-19	14.8785	144.3949	10	5.4	132 km W of San Jose Village	us7000kpiw	III
2023-08-09	13.3986	144.1398	439	5.7	Guam region	us6000kytu	III
2023-07-25	17.0901	145.5391	379	5.6	209 km N of Saipan	us7000ki6k	II
2023-03-01	14.1495	146.8086	10	5.5	156 km SE of San Jose Village	us7000jgmu	III
2023-02-24	14.0720	146.7009	10	5.0	152 km SE of San Jose Village	us6000jrca	
2023-02-07	**14.0618**	**145.0781**	**111**	**5.0**	**61 km NNE of Yigo Village, Guam**	**us6000jm51**	
2023-01-28	13.1191	145.6150	10	5.0	91 km ESE of Yigo Village, Guam	us6000jjxp	
2022-12-25	18.5988	145.4632	239	5.1	Pagan region	us6000jbjm	
2022-12-05	19.2274	146.5544	35	5.1	Mariana Islands region	us6000j6y9	
2022-11-26	18.7607	146.9612	17	5.6	Pagan region	us7000ishx	III
2022-10-24	18.7416	146.37	85	5.3	Pagan region	us6000iw49	
2022-09-20	**13.7889**	**145.0017**	**128**	**5.0**	**30 km NNE of Yigo Village, Guam**	**us7000i9ka**	
2022-08-29	**13.7441**	**144.9427**	**127**	**5.7**	**23 km NNE of Yigo Village, Guam**	**us7000i3cd**	**V**
2022-07-08	18.8211	146.9402	10	5.9	Pagan region	us6000i12c	III
2022-07-08	18.8957	146.9699	10	5.8	Pagan region	us6000i126	III
2022-07-08	18.8161	146.9559	10	5.3	Pagan region	us6000i10z	
2022-07-08	18.8499	146.9747	10	5.0	Pagan region	us6000i0za	
2022-07-08	18.7719	146.9891	10	5.3	Pagan region	us6000i0ys	
2022-06-08	18.3994	146.0531	136	5.4	Pagan region	us7000hfrk	IV
2022-05-23	**14.1036**	**145.9290**	**82**	**5.1**	**101 km SSE of San Jose Village**	**us7000hbzi**	
2022-05-07	18.7961	145.5103	233	5.6	Pagan region	us7000h7t6	III

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2022-05-05	18.7428	145.6617	183	5.3	Pagan region	us7000h7cj	
2022-01-21	12.9071	144.2017	11	5.2	64 km SW of Merizo Village, Guam	us7000gdsi	
2021-11-04	19.0213	145.0577	563	5.3	Maug Islands region	us7000frem	
2021-11-02	**14.6885**	**145.6134**	**102**	**5.0**	**30 km S of San Jose Village**	**us7000fqrw**	
2021-10-25	19.3470	144.6251	10	5.1	Maug Islands region	us6000fxej	
2021-08-24	12.6962	145.144	10	5.0	76 km SE of Inarajan Village, Guam	us7000f750	
2021-08-24	12.7427	145.0883	10	5.4	69 km SSE of Inarajan Village, Guam	us7000f30t	
2021-06-21	18.8865	145.4174	224	5.5	Pagan region	us7000eeu6	III
2021-04-29	18.4185	145.5738	196	5.3	Pagan region	us7000dyet	
2021-03-20	16.8263	145.6869	176	5.2	178 km N of Saipan	us7000dla9	
2021-03-02	13.0036	146.4009	10	5.1	174 km ESE of Yigo Village, Guam	us7000deux	
2021-02-24	**13.8107**	**144.7841**	**135**	**5.1**	**32 km NNW of Yigo Village, Guam**	**us7000ddg5**	
2020-11-24	**13.7662**	**145.6449**	**85**	**5.2**	**85 km ENE of Yigo Village, Guam**	**us6000crvb**	
2020-10-20	17.9617	146.2487	100	5.2	Alamagan region	us6000ca0c	
2020-10-05	19.8649	145.3563	133	5.3	Maug Islands region	us6000c5t3	
2020-10-02	18.7253	145.916	110	5.2	Pagan region	us6000c521	
2020-09-29	13.4292	145.88	10	5.1	107 km E of Yigo Village, Guam	us6000c2cv	
2020-09-22	12.7999	143.8689	10	5.0	100 km WSW of Merizo Village, Guam	us6000bziq	
2020-06-23	**13.9998**	**145.587**	**65**	**5.9**	**91 km NE of Yigo Village, Guam**	**us6000ahcr**	**IV**
2020-06-20	17.5164	145.1047	13	5.0	264 km NNW of Saipan	us6000affa	
2020-06-13	18.9317	145.1116	622	6.2	Pagan region	us6000abgq	II
2020-05-26	14.2569	146.8916	10	5.0	158 km ESE of San Jose Village	us70009qej	
2020-05-25	12.5992	144.1894	9	5.2	90 km SW of Merizo Village, Guam	us70009q8z	
2020-04-10	12.512	144.0556	10	5.0	106 km SW of Merizo Village, Guam	us70008t0m	
2020-02-22	13.4175	146.4244	10	5.0	166 km E of Yigo Village, Guam	us6000859z	
2020-01-20	**13.7818**	**144.6194**	**157**	**5.1**	**35 km NNW of Asan-Maina Village, Guam**	**us60007b1n**	

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2019-12-19	18.5797	145.6077	186	5.6	Pagan region	us70006nf0	IV
2019-11-17	13.4448	145.280	66	5.0	Guam region	us700069ai	
2019-11-13	15.8697	146.8303	14	5.3	136 km ENE of Saipan	us60006ay4	
2019-10-19	**13.9933**	**145.4339**	**91**	**5.0**	**77 km NE of Yigo Village, Guam**	**us70005vys**	
2019-10-13	16.5267	146.3691	17	5.2	159 km NNE of Saipan	us70005tty	
2019-08-22	17.5608	145.4748	520	5.5	261 km N of Saipan	us70005719	I
2019-08-18	16.3083	146.5003	10	5.0	145 km NNE of Saipan	us600056s1	
2019-08-18	16.6260	146.3156	18	5.9	167 km NNE of Saipan	us600056r6	IV
2019-06-28	19.8515	144.3477	410	6.4	Maug Islands region	us700046la	III
2019-06-14	13.5416	145.3384	60	5.2	48 km E of Yigo Village, Guam	us600040n3	
2019-03-23	19.1711	145.7672	104	5.0	Maug Islands region	us1000jkn4	
2019-02-12	19.0200	145.7965	144	6.0	Maug Islands region	us2000jgma	III
2018-12-12	18.1439	146.0140	112	5.0	Pagan region	us2000iswk	
2018-12-04	19.5466	144.5567	10	5.1	Maug Islands region	us1000i1xf	
2018-09-20	16.9691	145.592	219	5.2	195 km N of Saipan	us2000hheu	
2018-08-28	16.8044	146.8395	55	6.4	211 km NNE of Saipan	us1000gj78	IV
2018-08-08	**13.7235**	**146.3737**	**39**	**5.1**	**159 km SSE of San Jose Village**	**us1000g58l**	
2018-07-20	18.4500	145.9930	121	5.6	Pagan region	us2000gaa3	IV
2018-05-22	12.8057	145.2942	35	5.2	78 km SE of Inarajan Village, Guam	us1000e9nq	
2018-05-22	12.8932	145.4248	11	5.7	84 km ESE of Inarajan Village, Guam	us1000e9mu	IV
2018-05-17	12.9721	145.4202	16	5.4	80 km ESE of Inarajan Village, Guam	us1000e7fv	
2018-05-09	**13.9690**	**145.6779**	**96**	**5.4**	**97 km ENE of Yigo Village, Guam**	**us1000e1lx**	
2018-03-10	18.2438	146.6735	48	5.0	Pagan region	us1000d2uy	
2018-03-07	17.9872	145.5203	215	5.1	Alamagan region	us2000ddpy	
2018-02-13	**14.0555**	**146.2966**	**10**	**5.2**	**124 km SE of San Jose Village**	**us2000d6yi**	
2018-02-13	**13.7415**	**146.3782**	**10**	**5.3**	**158 km SSE of San Jose Village**	**us2000d1a0**	

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2018-02-13	**13.8029**	**146.3351**	**10**	**5.6**	**150 km SSE of San Jose Village**	**us2000d18y**	**III**
2018-02-13	**13.8398**	**146.3405**	**11**	**5.7**	**147 km SSE of San Jose Village**	**us2000d18h**	**III**
2018-02-11	**13.8205**	**146.4377**	**10**	**6.0**	**154 km SE of San Jose Village**	**us2000d0p1**	
2017-11-28	18.5029	145.6535	189	5.2	Pagan region	us2000bvfp	
2017-11-18	12.5392	143.6766	35	5.0	134 km SW of Merizo Village, Guam	us2000bqzj	
2017-11-15	13.0996	143.7117	123	5.8	105 km W of Merizo Village, Guam	us2000bnmq	IV
2017-11-01	16.616	144.9991	10	5.0	175 km NNW of Saipan	us2000bf6k	
2017-10-27	16.7162	146.1225	91	5.0	171 km NNE of Saipan	us1000axp3	
2017-10-25	18.8983	145.4986	213	5.0	Pagan region	us1000awn4	
2017-09-28	20.2278	145.1423	10	5.4	Maug Islands region	us2000avtg	
2017-09-14	18.6881	145.7467	166	5.8	Pagan region	us2000amk5	III
2017-09-02	14.0158	146.5948	11	5.5	148 km SE of San Jose Village	us2000aek2	
2017-08-30	12.9924	145.6228	10	5.2	99 km SE of Yigo Village, Guam	us2000ad3j	
2017-07-15	20.1475	146.5662	26	5.2	Mariana Islands region	us20009wj2	
2017-05-31	19.0797	145.8362	118	5.5	Maug Islands region	us10008wst	IV
2017-05-16	12.7464	145.1293	42	5.4	71 km SE of Inarajan Village, Guam	us10008snf	III
2017-05-09	**13.6487**	**144.9481**	**125**	**5.4**	**14 km NNE of Yigo Village, Guam**	**us10008qyt**	**None**
2017-04-29	18.6554	145.6294	200	5.1	Pagan region	us10008m4b	
2017-04-24	12.7716	144.0112	36	5.0	89 km SW of Merizo Village, Guam	us10008kds	
2017-04-06	18.5058	146.4860	38	5.2	Pagan region	us10008f4a	
2017-03-13	**14.3879**	**145.2126**	**99**	**5.5**	**77 km SW of San Jose Village**	**us100088m4**	**IV**
2017-02-16	18.7358	145.1448	346	5.0	Pagan region	us20008kc8	
2017-01-29	12.6938	145.1540	10	5.0	77 km SE of Inarajan Village, Guam	us10007w1b	
2017-01-10	14.6898	144.3400	10	5.7	140 km NNW of Dededo Village, Guam	us10007sb5	IV
2016-12-23	18.5619	145.3394	268	5.0	Pagan region	us10007m5m	
2016-12-17	16.3746	145.7646	130	5.0	128 km N of Saipan	us2000821y	

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2016-10-08	20.0245	146.7634	10	5.4	Mariana Islands region	us20007cti	III
2016-09-27	17.5577	145.6196	476	5.0	259 km N of Saipan	us10006t7y	
2016-08-21	18.4626	145.5698	207	5.1	Pagan region	us10006fl5	
2016-08-08	18.3222	145.5767	196	5.1	Pagan region	us10006c47	
2016-07-29	18.4584	145.9534	206	5.3	Pagan region	us100069rp	
2016-07-29	18.7561	145.4878	188	5.6	Pagan region	us100069rr	III
2016-07-29	18.5429	145.5073	196	7.7	Pagan region	us100068jg	VI
2016-07-16	16.5777	145.8398	130	5.1	151 km N of Saipan	us20006f61	
2016-04-08	16.8012	146.7165	10	5.1	203 km NNE of Saipan	us20005gel	
2016-02-07	**14.0933**	**145.2200**	**89**	**5.1**	**71 km NNE of Yigo Village, Guam**	**us20004yi3**	
2015-11-24	18.7787	145.2659	587	6.0	Pagan region	us100040q8	None
2015-11-03	13.4423	145.9775	26	5.1	118 km E of Yigo Village, Guam	us200041hf	
2015-10-20	12.8678	143.9008	78	5.4	94 km WSW of Merizo Village, Guam	us10003ptl	IV
2015-09-25	16.9923	145.8960	16	5.2	197 km N of Saipan	us20003p94	
2015-08-29	19.1695	145.6204	120	5.2	Maug Islands region	us100035y3	
2015-08-02	18.3940	146.6099	46	5.3	Pagan region	us10002xc9	
2015-07-25	13.1282	146.2059	10	5.1	149 km ESE of Yigo Village, Guam	us2000305b	
2015-07-16	14.6091	146.9194	10	5.3	142 km ESE of Saipan	us20002xwj	
2015-07-15	18.8249	145.1523	507	5.0	Pagan region	us20002xt0	
2015-06-11	12.9945	146.2829	20	5.3	162 km ESE of Yigo Village, Guam	us20002p1q	
2015-06-08	13.0215	146.1496	32	5.0	148 km ESE of Yigo Village, Guam	us20002mxg	
2015-06-04	12.9380	146.0787	17	5.0	144 km ESE of Yigo Village, Guam	us20002lzg	
2015-05-17	13.0711	146.1150	11	5.0	142 km ESE of Yigo Village, Guam	us10002cj6	
2015-05-17	12.9436	146.1194	31	5.2	148 km ESE of Yigo Village, Guam	us100029zi	
2015-04-25	**13.8503**	**144.8365**	**140**	**5.1**	**35 km N of Yigo Village, Guam**	**us20002910**	
2015-03-22	13.2251	145.7186	10	5.5	96 km ESE of Yigo Village, Guam	us10001pj6	III

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2015-03-15	18.7532	146.4233	46	5.8	Pagan region	us10001mh6	III
2015-03-12	13.0904	145.5124	15	5.3	83 km SE of Yigo Village, Guam	us10001luu	
2015-03-12	13.1510	145.4075	42	5.0	70 km SE of Yigo Village, Guam	us10001lug	
2015-03-12	13.2299	145.5374	10	5.1	78 km ESE of Yigo Village, Guam	us10001n0w	
2015-03-12	13.1051	145.4306	23	5.1	Guam region	us10001lue	
2015-03-10	13.0856	145.5705	10	5.0	89 km SE of Yigo Village, Guam	us10001l73	
2015-02-28	16.9798	145.9228	17	5.0	196 km N of Saipan	usc000ttwj	
2015-02-27	16.9824	145.8629	28	5.0	196 km N of Saipan	usc000ttp5	
2015-02-27	16.9041	145.8303	20	5.7	187 km N of Saipan	usc000ttnw	IV
2015-01-21	17.9964	146.5629	79	5.4	Alamagan region	usc000thqq	
2014-12-31	**13.7874**	**146.2435**	**60**	**5.1**	**146 km SSE of San Jose Village**	**usc000taw1**	
2014-12-24	15.6979	144.9700	50	5.0	99 km WNW of Saipan	usc000t9lq	
2014-12-21	19.2029	145.7722	136	5.0	Maug Islands region	usc000t8yw	
2014-09-17	13.7641	144.4294	130	6.7	43 km NW of Piti Village, Guam	usb000sdcr	VI
2014-08-13	**13.9091**	**144.9757**	**98**	**5.6**	**42 km NNE of Yigo Village, Guam**	**usb000s29m**	**IV**
2014-08-01	17.5060	146.5315	109	5.0	267 km NNE of Saipan	usb000rz4k	
2014-07-31	**14.9238**	**145.4737**	**123**	**5.0**	**16 km WSW of San Jose Village**	**usb000ryyd**	
2014-06-30	17.7919	145.2965	320	5.1	289 km N of Saipan	usc000rnqz	
2014-05-23	18.9494	145.0446	558	5.7	Pagan region	usb000r209	III
2014-03-06	18.5747	145.5627	210	5.3	Pagan region	usc000n3x6	
2014-02-04	13.3607	144.1285	121	5.2	57 km W of Agat Village, Guam	usc000mh97	
2014-01-23	13.3936	146.1758	10	5.7	140 km E of Yigo Village, Guam	usb000m6jk	III
2014-01-23	13.3556	146.1336	7	5.8	136 km E of Yigo Village, Guam	usb000m6jc	III
2013-12-23	12.7711	143.036	92	5.8	185 km WSW of Merizo Village, Guam	usc000lq86	IV
2013-11-29	16.8263	146.5329	46	5.3	197 km NNE of Saipan	usb000l7us	
2013-11-19	18.4753	145.2041	511	6.0	Pagan region	usb000l25i	III

Table C.9-1. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 through January 2024. Earthquakes in red triggered a tsunami alert, but no warnings. Earthquakes near Rota, Saipan, and Tinian are highlighted in bold (*cont'd*).

Date	Latitude	Longitude	Depth	Mag	Place	ID	Shakemap
2013-09-20	19.0219	145.3493	239	5.0	Maug Islands region	usb000jwul	
2013-09-18	19.1862	145.6039	117	5.4	Maug Islands region	usb000jvgy	IV
2013-07-27	13.0960	145.5170	22	5.4	83 km SE of Yigo Village, Guam	usc000iqf8	None
2013-06-22	12.5690	143.7400	10	5.1	126 km SW of Merizo Village, Guam	usc000hxwy	
2013-06-21	12.5810	143.800	35	5.0	120 km SW of Merizo Village, Guam	us2013rsb9	
2013-06-21	12.5360	143.7300	35	5.3	130 km SW of Merizo Village, Guam	usc000hxu0	
2013-06-04	16.9840	145.8270	16	5.4	196 km N of Saipan	usb000hcxe	VII
2013-05-14	18.7280	145.2880	602	6.8	Pagan region	usc000gw27	III
2013-01-16	17.4590	145.9080	108	5.3	249 km N of Saipan	usp000jyfh	

Source: https://earthquake.usgs.gov/earthquakes/search/

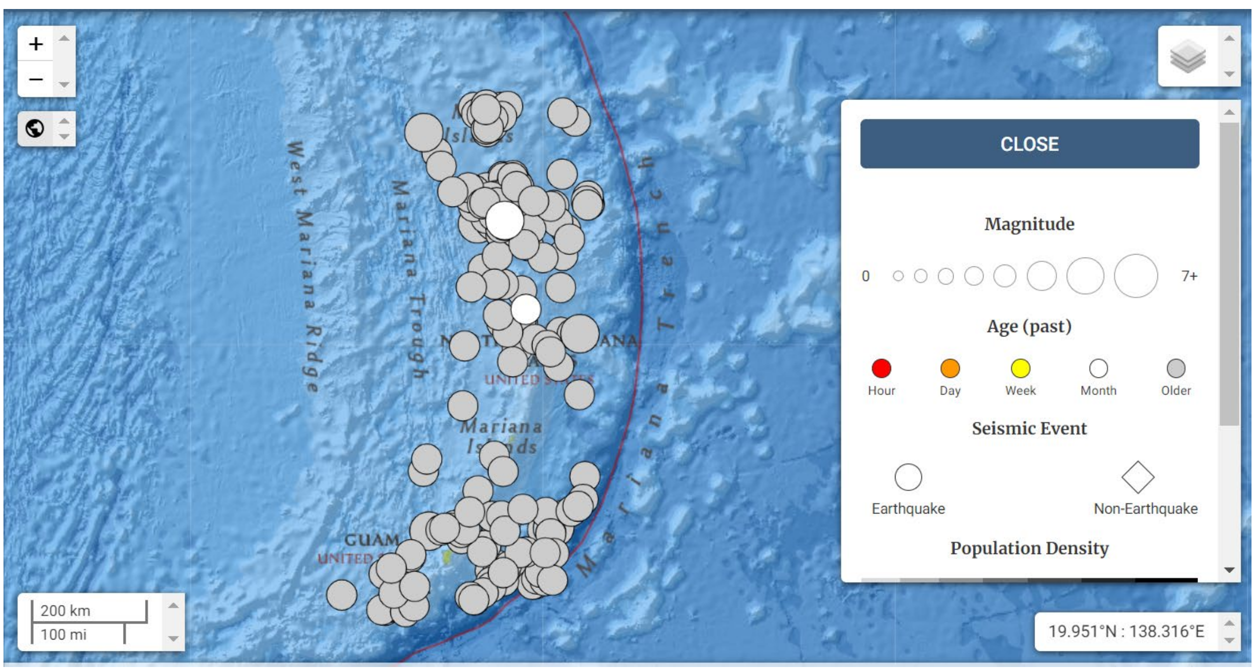


Figure C.9-3. Earthquakes greater than 5.0 magnitude in the CNMI Region from January 2013 to January 2024. Data points are listed in Table 1.
Source: https://earthquake.usgs.gov/earthquakes/search/

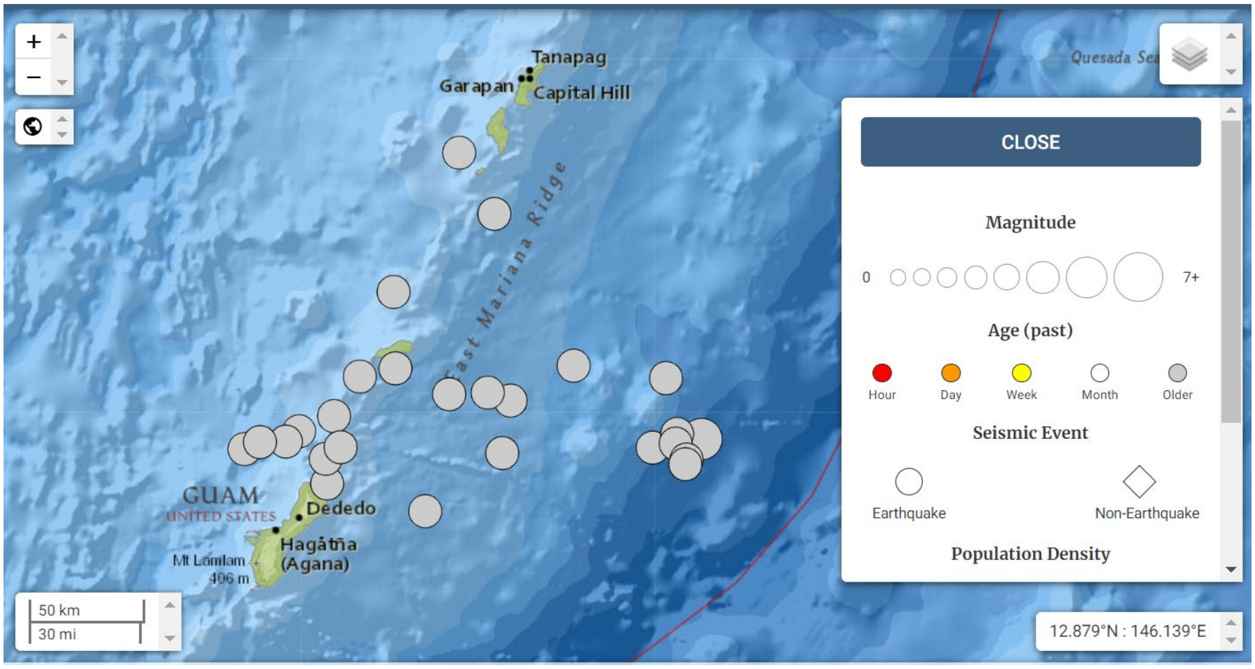


Figure C.9-4. Earthquakes greater than 5.0 magnitude in the CNMI main islands from January 2013 through January 2024. Data points are listed in Table 1.
Source: https://earthquake.usgs.gov/earthquakes/search/

All islands are located outside the megathrust zone. The estimated recurrence for shallow ground-shake seismic events (≤ 25 miles) was interpolated from the graph provided in Figure 4*B* in Muller et al. (2012) and reproduced below in Figure C.9-5 and listed in Table C.9-1.

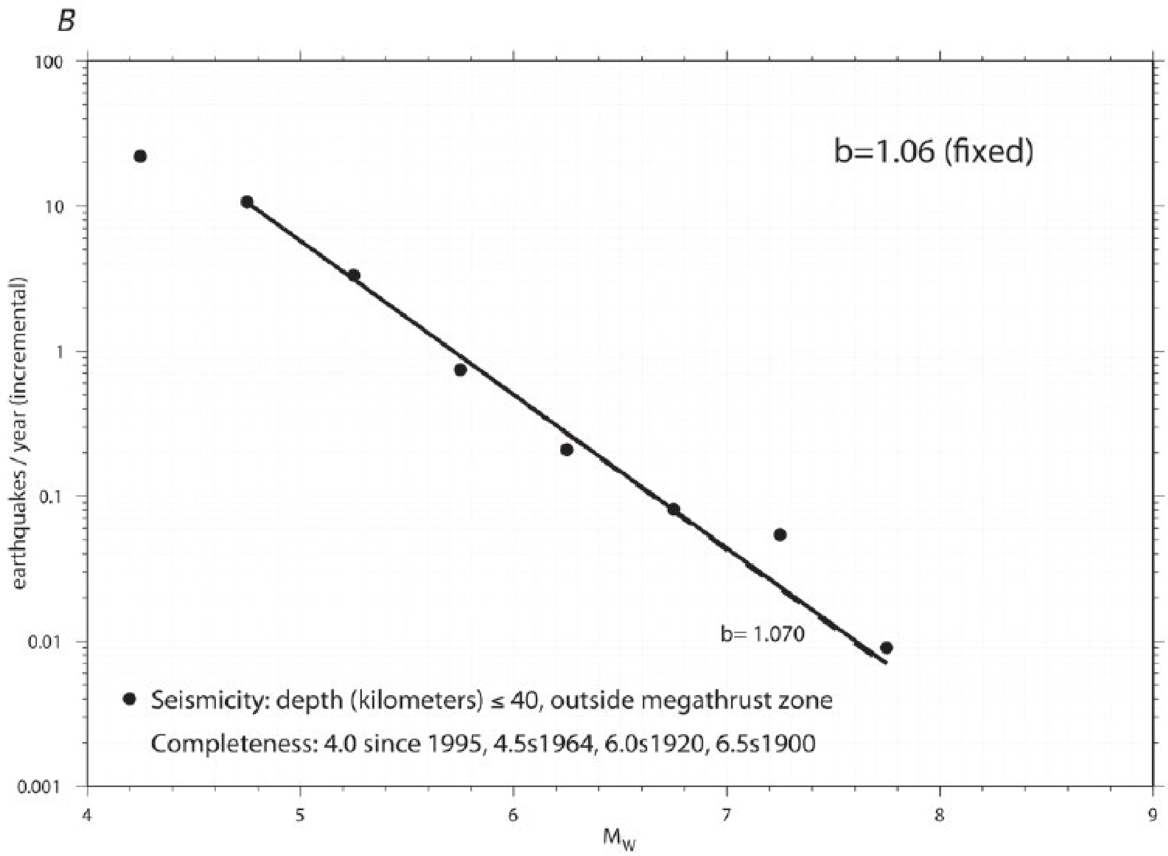


Figure C.9-5Seismicity rates and exponential-model fit for variable completeness. Data (dots) are annual earthquake rates in 0.5-magnitude-unit bins. Depth 0–25 miles, outside megathrust zone and the solid line is used in the hazard calculation.
Source: Muller et al. (2012), Figure 4B.

Table C.9-2Estimate earthquake recurrence for various shallow earthquake (≤ 25 miles) magnitudes outside the megathrust zone.

Magnitude (M_w)	Estimated Recurrence
4–5	35 per year
5–6	~1 every 2–5 years
6-7	~1 every 5–25 years
7-8	~1 every 25-100 years

C.10 Volcanic Activity

No additional information at this time.

References

Carruth, R. L. (2003). *Ground-water resources of Saipan, Commonwealth of the Northern Mariana Islands* (Water-Resources Investigations Report 03–4178). US Department of the Interior and US Geological Survey.

Chou, L. W. (1989). *Typhoon water source analysis for west coast of Saipan Mariana Islands* (Miscellaneous Paper CERC-89-12; p. 54). US Army Corps of Engineers, Waterways Experiment Station.

Chowdhury, Md. R., Chu, P.-S., Zhao, X., Schroeder, T. A., & Marra, J. J. (2010). Sea level extremes in the US-Affiliated Pacific Islands—A coastal hazard scenario to aid in decision analyses. *Journal of Coastal Conservation*, *14*(1), 53–62. https://doi.org/10.1007/s11852-010-0086-3

Global Historical Climatology Network daily (GHCNd). (2021, March 1). National Centers for Environmental Information (NCEI). https://www.ncei.noaa.gov/products/land-based-station/global-historical-climatology-network-daily

Historical Hurricane Tracks. (n.d.). Retrieved April 6, 2024, from https://coast.noaa.gov/hurricanes/#map=7.33/15.194/145.761&search=eyJzZWFyY2hTdHJpbmciOiJTYWlwYW4sIEdhcmFwYW4sIFNhaXBhbiBNdW5pY2lwYWxpdHksIE5vcnRoZXJuIE1hcmlhbmEgSXNsYW5kcywgOTY5NTAsIFVTQSIsInNlYXJjaFR5cGUiOiJnZW9jb2RlZCIsIm9zbUlEIjoiMzIxODMxOCIsImNhdGVnb3JpZXMiOlsiSDUiLCJINCIsIkgzIiwiSDIiLCJIMSIsIlRTIiwiVEQiLCJFVCJdLCJ5ZWFycyI6W10sIm1vbnRocyI6W10sImVuc28iOltdLCJwcmVzc3VyZSI6eyJyYW5nZSI6WzAsMTAzMF0sImluY2x1ZGVVbmtub3duUHJlc3N1cmUiOnRydWV9LCJidWZmZXIiOjYwLCJidWZmZXJVbml0IjpbIk5hdXRpY2FsIE1pbGVzIl0sInNvcnRTZWxlY3Rpb24iOnsidmFsdWUiOiJ5ZWFyc19uZXdlc3QiLCJsYWJlbCI6IllYXIgKE5ld2VzdCkifSwiYXBwbHlUb0FPSSI6dHJ1ZSwiaXNTdG9ybUxhYmVsc1Zpc2libGUiOnRydWV9

[USACE] US Army Corps of Engineers. (2011). *Sea Level Change Considerations for Civil Works Programs.* (US Army Corps Circular 1065-2–212). US Army corps of Engineers. http://corpsclimate.us/docs/EC_1165-2-212%20-final_10_Nov_2011.pdf

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Appendix D Commonwealth Planning Profile and Risk Assessment Supplement

28 July 2024

Table of Contents

List of Tables

List of Figures

Appendix D Commonwealth Planning Profile and Risk Assessment Supplement

D.1 Commonwealth Planning Profile Supplement

D.1.1 Commonwealth Owned and Operated Buildings

Below are descriptions of the buildings and facilities owned and operated by the Commonwealth from the 2018 Standard State Mitigation Plan (SSMP). This information was minimally updated in 2024. References for Section D.1.1 are not included in the 2024 State Hazard Mitigation Plan (SHMP); refer to the 2018 SSMP.

D.1.1.1 Public and Private Schools

According to the CNMI Public School System School Year (SY) 2017–2018 Facts & Figures, there were 10,445 students enrolled in a public school for the academic year with 549 teachers employed. Approximately 516 students are enrolled in Early Childhood or Headstart/Early Head Start programs with centers provided in Tanapag, Garapan, Oleai, San Vincente, Chalan Kanoa, San Antonio, Kagman, and San Roque on the island of Saipan. Additionally, there are Head Start/ Early Head Start programs on Tinian and Rota. The CNMI Public School System consist of 20 campuses.

Currently, there are 9 elementary schools, 5 middle schools, and 6 high schools (2 schools that are Jr. / Sr. High Schools; and 1 high school academy). On the island of Saipan, there are total of 10 elementary schools, 7 of which are situated along the western portion of the island. Gregorio T. Camacho (GTC) is located at the northern end of the island of Saipan. Garapan Elementary School (GES) is located within the central part and main business district vicinity of the main business district in Saipan. Within the village of Kagman—Kagman Elementary School is the only elementary school within the eastern part of the island of Saipan. Oleai Elementary School (OES), William S. Reyes Elementary (WSR), and Koblerville Elementary School (KES) are located at the southern end of the island—while San Vicente Elementary School is nested along the eastern side of the island. For the Secondary Level—there are 5 Middle Schools and 3 High Schools that are situated on the island of Saipan. Hopwood Middle School (HMS), Dandan Middle School (DMS), Tanapag Middle School (TMS), Francisco M. Sablan Middle School (FMS), and Chacha Ocean View Middle School (CHA) enrolls students from grades 6th through 8th.

On the island of Tinian, Tinian Elementary School (TIN) and Tinian Jr. / Sr. High School (TJSH) are situated within the village of San Jose. Tinian Elementary School currently enrolls students from grades Kindergarten through 6th grade. Tinian Jr. / Sr. High School enrolls students from grades 7th to 12th grade.

Within the village of Songsong on the island of Rota is Dr. Rita Hocog Inos Jr. / Sr. High School (RHI). RHI provides instruction from 7th through 12th grade. Sinapalo Elementary School (SNP) located in Sinapalo Village provides instruction from grades kindergarten through 5th grade

In addition to those schools under the public system, there are several private schools that provide instruction from elementary through secondary levels. The majority of these institutions are managed and operated by local church affiliates.

As discussed further in the hazard profiles and analysis section, many schools function as emergency shelter facilities.

Table D.1-1. Listing of Public Schools within the CNMI.

Island	School	Grades	Students	Classrooms	Structure
Saipan	Marianas High School	9–12	1601	66	Wood, tin, semi-concrete, concrete
	Cha Cha Ocean View Middle School	6–8	208	30	Concrete
	Garapan Elementary School	K–6	595	50	Wood, tin, semi-concrete, concrete
Saipan	GTC Elementary School	K–6	309	16	Wood, tin, semi-concrete, concrete
	Hopwood Middle School	7–8	917	64	Wood, tin, semi-concrete, concrete
Saipan	Kagman Elementary School	K–5	437	34	Concrete
	Kagman High School	9–12	594	37	Concrete
Saipan	Koblerville Elementary School	K–6	648	26	Wood, tin, semi-concrete, concrete
	Oleai Elementary School	K–6	454	25	Wood, tin, semi-concrete, concrete
Saipan	Saipan Southern High School	9–12	780	31	Concrete, structure metal
Saipan	San Vincente Elementary school	K–6	652	34	Wood, tin, semi-concrete, concrete

Table D.1-1. Listing of Public Schools within the CNMI (*cont'd*).

Island	School	Grades	Students	Classrooms	Structure
Saipan	W. S. Reyes Elementary School	K–6	704	39	Wood, tin, semi-concrete, concrete
Tinian	Tinian Junior & Senior High School	7–12	262	38	Concrete
	Tinian Elementary School	K–6	258	23	Concrete, semi-concrete
Rota	Sinapalo Elementary School	K–5	220	16	Concrete, metal
	Rota Junior High School	6–8	129	19	Concrete
	Rota High School	9–12	164	16	Concrete

D.1.1.2 Northern Marianas College (NMC)

The Northern Marianas College is a community college dedicated to providing the best quality postsecondary and adult educational opportunities within the Commonwealth. With instructional sites on Tinian and Rota, the College's main campus is located in Saipan. The College has an annual student population of around 1,500 students.

The College also offers a variety of certificate programs including Fire Science Technology, Basic Law Enforcement, and Nursing Assistant. Currently, the instructional sites on Tinian and Rota offer continuing and adult education as well as federally supported programs that aim to assist students from various grade levels in preparation for college success.

D.1.1.3 Weather Monitoring Stations

Surf observations and seismic data are taken from four stations on Saipan, which are located at Sugar Dock Beach, Agingan Point, Tank Beach, and Wing Beach with shared responsibility between the CNMI HSEM's Response and Recovery Section and Monitoring Section. The surf data is transmitted daily by both facsimile and email to ensure redundancy. This data is sent over the Aeronautic Fixed Intercommunication Network (AFIN) alerting boats and aircraft around the CNMI. Messages are sent to the FAA authorized control tower and to NOAA for tagging and filing as well as the Guam National Weather Service for inclusion in regular Saipan weather updates.

Meteorological aviation reports (METAR) and Terminal Aerodrome Forecasts (TAF) data are provided at three observation stations within the CNMI. In the US, METAR reports are taken once an hour between 50 minutes past the hour and the top of the (next) hour. TAFs are produced four times a day starting at approximately 30 minutes before each main synoptic hour. All the observations taken within this time are considered to be for the same cycle. The METAR and

TAF stations at the Saipan International Airport are the only full-time stations with two part-time stations in operation at Rota International Airport and West Tinian Airport.

D.1.1.4 Ice Plants

There are two major ice plants in Saipan. The Saipan Ice and Water Company is located in the Lower Base Area. The facility encompasses two buildings that house three reverse osmosis units and a 375 bottles-per-hour automatic bottler. The plant features an in-house testing laboratory and provides service to 16 designated delivery areas on Saipan. The J. G. Sablan Ice and Water Plant is located in the Garapan area. Both private companies distribute ice and water daily to businesses, residential, and government offices. There are also smaller private ice and water companies in Saipan and in the main villages on the islands of Tinian and Rota.

D.1.2 Commonwealth Critical Facilities by Lifeline Category

D.1.2.1 Safety and Security Lifeline

Emergency Operations Centers

On Saipan, a state-of-the-art Emergency Operation Center (EOC) building funded through a FEMA grant was completed in 2010. It has been furnished and operable since 2012. In July 2013, the state of the art EOC was officially open with a ribbon-cutting ceremony. Although not established, alternate EOC sites include the Office of the Governor or the Commonwealth Ports Authority Conference Room at the Airport. The Saipan EOC has a backup generator and a 250,000-gallon water tank.

On the islands of Tinian, the local EOC is situated at the Office of the Mayor. On Rota, it is located at the Office of Aging. The EOC serves as the central location for command and control in planning, decision-making, and coordination of all response and recovery operations at both the State and local levels of government. For the island of Rota, the Office of the Mayor has a backup generator, and the Rota Public Works can deliver water using an 8,000-gallon water truck. For the island of Tinian, there is no backup generator or water tank but those can be provided from Tinian Public Works.

Police Stations

The Department of Public Safety (DPS) is primarily tasked with all law enforcement assignments. The department is divided into sections and bureaus with specific law enforcement tasks and consists of Uniform Services, Criminal Investigation, Boating Safety, Logistics and Support, and Armory. Under the Uniform Services, there are two subdivisions: The Patrol Section and Traffic Services. On the island of Saipan, the main police station is located in Susupe with substations located in Chalan Kanoa, Garapan, Kagman, and San Roque. The island of Tinian has one police station in San Jose Village, while Rota has the main station in Songsong Village and a substation in Sinapalo Village.

The Patrol Section is designated as the primary responding unit to all calls for public assistance. The island of Saipan is currently divided into 8 sectors. Each sector is patrolled by at least nine (9) police officers in addition to an Officer-in-Charge (OIC) and a Field Supervisor. There are currently at least eight (8) vehicles in the Patrol Section at any given time to patrol the eight (8) sectors of Saipan. The Traffic Section must also respond and direct traffic whenever primary traffic control lights are down because of power failures or lack of maintenance. The Boating Safety Section (BSS) is the only CNMI agency in charge of marine law enforcement with staffing on the islands of Saipan, Tinian, and Rota. The Criminal Investigation Bureau is tasked with conducting follow-up investigations on all criminal complaints that are not resolved by the Uniform Services Section.

Fire Stations

DFEMS is divided into three main sections and its current objectives are prevent the ignition of fires, provide life support service and reliable ambulance transportation, identify the underlying causes of emergency responses, and develop and implement prevention programs that target at-risk sectors of the community. The Division includes the following sections: The Suppression Section, Emergency Medical Services and Rescue, and Inspection and Investigation. The Suppression Section is primarily tasked to combat fire incidents in the CNMI. There are four fire stations on the island of Saipan and one on each on the islands of Tinian and Rota. Each station is equipped with a fire pump truck and support apparatus that include a tanker or a rescue vehicle. A listing of the station locations on each island is provided below:

D.1.2.2 Food, Water, Shelter Lifeline

Public Assembly Facilities

The Public School System is responsible for the provision of temporary shelters for typhoon, flooding, and tsunami hazards by using school buildings and classrooms that are structurally secure against typhoons. These buildings have a foundation, exterior walls, and roofs constructed out of concrete. Additional public shelters are managed by the CNMI Department of Community and Cultural Affairs. Table 4-3 provides a listing of shelters, the village coverage, and ready usable rooms that is available.

Table D.1-2. CNMI Shelters.

Island	Shelter site	Responsible agency	*Shelter capacity (Number of people)	*Funding Assistance Request for
Saipan	Tanapag Elementary School (cafeteria)	Public School System (PSS)	40	Hardening of Shelter (flooding issues), Generator House, Water Tank, Generator
Saipan	Garapan Elementary School (cafeteria)	Public School System (PSS)	65	Hardening of Shelter (flooding issues), Generator House, Water Tank, Generator
Saipan	Marianas High School (cafeteria)	Public School System (PSS)	200	Generator House, Generator
Saipan	San Vicente Elementary School (cafeteria)	Public School System (PSS)	100	Generator House, Water tank, Generator
Saipan	Koblerville Elementary School (cafeteria)	Public School System (PSS)	46	Generator House, Water Tank, Generator and Shutters Replacements
Saipan	Dandan Middle School (cafeteria)	Public School System (PSS)	60	Generator House, Water Tank, Generator
Saipan	Chacha Ocean View Middle School (cafeteria)	Public School System (PSS)	50	Generator House, Generator, Shutters
Saipan	Kagman High School (cafeteria)	Public School System (PSS)	80	Generator House, Water Tank, Generator

Table D.1-2. CNMI Shelters (*cont'd*).

Island	Shelter site	Responsible agency	*Shelter capacity (Number of people)	*Funding Assistance Request for
Saipan	Kagman Community Center	Department of Community and Cultural Affairs (DCCA)	-	Generator House, Water Tank, Generator
Saipan	Gilbert C. Ada Gymnasium	Department of Community and Cultural Affairs (DCCA)	-	-
Tinian	Tinian Elementary School (cafeteria)	Public School System (PSS)	40	Generator House, Water Tank, Generator
Tinian	Tinian Jr. Sr. High School (cafeteria)	Public School System (PSS)	40	Generator House, Water Tank, Generator, Electrical for Generator and Water Pump
Rota	Aging Office Building	Department of Community and Cultural Affairs (DCCA)	-	-
Rota	Dr. Rita H. Inos Jr. Sr. High School (cafeteria)	Public School System (PSS)	40	Generator House, Water Tank, Generator
Northern Islands	No Designated shelter	N/A	-	-

D.1.2.3 Water Supply

The water supplies on Saipan, Tinian and Rota are unique, each having different vulnerabilities. Most of Saipan is supplied with water from wells scattered all over the island operated by the Commonwealth Utilities Corporation (CUC) and from an additional 65 regulated Public Water Systems. A Public Water System is a retailer that serves 25 or more people with water meant for human consumption including bathing and cooking. Many of these have their own wells or water sources. Tinian has one primary water source operated by CUC that collects water from an infiltration gallery beneath a wetland and is pumped all over the island. Rota has one primary water source operated by CUC which is a spring on the mountain side that is gravity fed through most of the island.

On Saipan, CUC operates 140 wells which pump an average of 9. 5 to 10. 5 million gallons per day. There is also 1 spring that pumps water to a storage tank in one of 14 Tank Service Areas.

A list of these Tank Service Areas along with their respective capacities and service hours is provided in Appendix F (2018 SSMP). Water is distributed by gravity from each tank to the village or villages in their respective services areas. Some areas on the west coast are interconnected such that water from one tank can reach multiple service areas. On the east side of Saipan, the service areas are generally connected in series such that water flows from one tank to the next tank (e.g., Kagman > Papago > San Vicente > Dan Dan). The water supplied by CUC on Saipan is not internally consumed by the local population as it is generally considered too salty to drink. The water meets all the standards in the National Primary Drinking Water Regulations (40 CFR Part 141), but these do not currently address salinity or chloride concentration.

People on Saipan primarily drink bottled water produced by one of the ten bottled water companies on Saipan, all of which are regulated as Public Water Systems. In addition, most hotels and many businesses and apartment buildings produce their own drinking water by using water from their own wells and rainwater catchment systems or providing additional treatment such as reverse-osmosis to water supplied by CUC. In total, there are 64 additional regulated Public Water Systems on Saipan besides CUC. These bottled water companies and other Public Water systems are critical sources of drinking water for the residents of Saipan. In emergency situations, providing power to these systems is crucial to ensuring that adequate supplies of drinking water are maintained for public health and safety.

Two of the largest and most critical drinking water providers on Saipan are Saipan Ice & Water, which can produce 50,000 gallons per day (gpd) of drinking water and S. T. A. R. Water Company which can produce 20,000 gpd of drinking water. Hyatt hotel makes about 100,000 gpd of drinking water and also supplies American Memorial Park. During the recovery phase after typhoon Soudelor, Coral Ocean Point golf course and American Memorial Park established drinking water drive-through filling station. BECQ established one in Kagman as well using one of the irrigation wells at Lau Lau (LaoLao) Golf Course. The hotels provided critical water infrastructure not only to their guests but to neighboring residents. Although not advertised, San Roque residents were allowed to get drinking water from Aqua Resort Club post-Soudelor. Local agencies also used fire trucks to suck water from hotel swimming pools in order to provide toilet-flushing water to the shelters.

On Tinian, CUC operates a water treatment facility that chlorinates and distributes groundwater collected from a Maui-type infiltration gallery. This infiltration gallery is relatively shallow and located beneath and adjacent to a wetland, so it is very susceptible to surface contamination. The water is pumped from the treatment facility in the Marpo valley to tanks located in the hills on either side of the valley for gravity distribution to San Jose village and the homesteads. Unlike Saipan, this water is drinkable from the tap, however there are also two bottled water companies on Tinian that are regulated as Public Water Systems. CUC has three deep wells that can be used as a backup if the main source is compromised; however, these would require pumps to be installed in order to be operable. There are also two deep wells on Tinian used as public filling stations for livestock watering.

On Rota, CUC operates a spring on the side of the mountain that supplies the island with water via a gravity fed distribution system. CUC also has 3 deep wells that can be activated during the dry season when flow from the spring diminishes. The water from the spring is chlorinated and is drinkable. There are two bottled water companies on Rota, both regulated as Public Water Systems. They both get their water from CUC. The Rota Resort has its own wells and water treatment system and is also a regulated Public Water System.

The most prevalent contamination sources are from inorganic contaminants (salts and metals from stormwater runoff, discharge from septic tanks, or industrial wastes); organic chemical contaminants (volatiles from gas stations, septic systems, and stormwater runoff); microbial contaminants (bacteria, viruses and protozoa derived from sewage treatment plants, agricultural livestock, and septic systems); pesticides and herbicides (discharge from agricultural operations, stormwater runoff, or residential users of such chemicals); and radioactive contaminants (can be naturally occurring from gas operations or mining).

Tables 4-8 through 4-10 provide a description of water sources, the region and villages serviced, type of water provided, and source of contaminants for each island. The Saipan data table is organized into regions. However, CUC no longer formally uses this designation system and instead divides the island into Tank Service Areas.

D.1.2.4 Health and Medical Lifeline

Hospitals and Health Clinics

The Commonwealth Healthcare Corporation (CHCC) located on Saipan is an 156,000 square foot two-level Medicare certified unit that accommodates 74 inpatient beds, 4 adult ICU beds, auxiliary services, extensive outpatient facilities, public health offices and clinics. The CHCC has a staff of about 37 physicians, 10 physician's assistants, 6 nurse practitioners, 3 midwives, and 150 nurses. The Department of Public Health and CHCC provide inpatient and outpatient services including both an inpatient and outpatient pharmacy. Additionally, the division of Mental Health & Social Services provides various community health programs.

The hospital scope of services includes an Emergency Department, Obstetrics, Post-partum, Nursery and Neonatal Intensive Care Unit, Adult Intensive Care Unit, Medical and Surgical Units, Pediatric Unit, Dialysis Unit, Women's Care Clinic, Children's Care Clinic, Family Care Clinic and various outpatient services. Clinical support services include the Pharmacy, Clinical Laboratory, Respiratory Care Services, Physical Therapy, Radiology, Medical Social Services, Dietitian Services, Surgical Services and Anesthesia, Dental Service and Immunization Program, and Plant Engineering. The Center also has a helipad (FAA Identifier C21) whose dimensions are 45" x 45" that is used for emergency air medical transport directly to the hospital. The helipad is maintained in good condition.

In 2018 CHCC opened new inpatient and outpatient pharmacy services at the facility. Future improvements focus on expanding the LD&D surgical department in order to reopen the operating room, future lab expansion for Bio-Safety Level II Hood, and adding anesthesia capabilities for dental work. As described in the *Climate Change Vulnerability Assessment for the Island of Saipan* (Greene & Skeele, 2014), the primary concern that Climate Change Working Group (CCWG) participants noted with CHCC aside from issues with service reliability was its single location and proximity to flood-prone areas of Garapan and Middle Road. While access to the facility is limited in some cases by cultural and financial barriers, the potential for physical access to be blocked also exists. Both entrances to the facility require passage through one of the lowest-lying stretches of Middle Road. Although physical access was not hindered after Typhoon Soudelor, power was disrupted, and the facility was forced to rely on costly back-up generators. In order to alleviate risk of power disruptions in the future and improve system redundancy, CHCC is looking into the installation of back-up solar arrays.

There are five private health clinics on the island of Saipan. The Pacific Medical Center (PMC) has a staff of three medical doctors and five nurses. The Saipan Health Clinic has a staff of three medical doctors, one certified physician assistant, and six nurses. The Marianas Medical Center has a staff of one medical doctor, one physician assistant, and one nurse. The Pacific Care Health Center has a staff of two doctors, two physician assistants, and six nurses. The newest private health clinic on Saipan is the Kagman Community Health Center which has a staff of two doctors, two nurses, and two medical assistants. Further, there are private Seventh Day Adventist dental and Marianas Eye Institute clinics that charge higher rates than the government. There are also health centers with dental facilities on Rota and Tinian.

On the island of Tinian, the Health Center has four inpatient beds, two medical doctors, thirteen nurses, and one nurse practitioner. All of the medical facilities except for the Marianas Medical Center have a back-up generator and water source.

The island of Rota has a well-equipped, modern medical facility that offers 24-hour emergency service and a wide range of health care capabilities. Two medical doctors and seven nurses staff the Rota Health Center. The center houses 10 inpatient beds.

D.1.2.5 Energy Lifeline

The CUC Power Division, which operates an integrated system of power generators and transmission and distribution facilities, provides electrical service for the islands. As the US Energy Information Administration notes, meets nearly all of its energy demand by importing petroleum products, including 22 million to 24 million gallons of diesel fuel annually to run the islands' electricity generating plants. Diesel fuel surcharges on electricity in the CNMI have decreased in recent years, as lower world petroleum prices have brought the surcharge down from 30 cents per kilowatt-hour in April 2014 to 15 cents in mid-2017. Petroleum products are a major import for the CNMI, accounting for about 20% of annual imports. They are brought in by ship through harbors on Saipan, Tinian, and Rota. The Commonwealth Utilities Corporation

(CUC) was awarded $5 million from the US Interior Department in early 2017 to repair storage tanks that hold petroleum for its power plants so the tanks could meet industry standards. The CUC, the CNMI's public utility, is looking at long-term alternatives to petroleum-fired electricity generators, which are aging and at times cannot run at full capacity. The CNMI's renewable portfolio standard requires the islands to get 20% of their net electricity sales from renewable energy if cost-effective resources are available, but, so far, only small-scale wind and solar resources have been built, mostly at government and school facilities.

On the island of Saipan, three power generation facilities are currently available to supply power to the island. The installed capacity on the island of Saipan is 106.8 Megawatts (MW). Power plants 1, 2, and 4 have design capacities of 80.8 MW, 10.0 MW and 15.9 MW respectively with a combined total of 106.7 MW however, currently only 70.9 MW of that is operational. The recent peak load recorded on Saipan is 43.2 MW, down from an all time of high of 72 MW in 2002. On Tinian, a 10 MW power plant was completed in November 1999 and in the fall of 2004 two additional 5 MW units came online. The recent peak load recorded in Tinian is 2.5 MW. On the island of Rota, there is a power plant located adjacent to the West Dock. This power plant contains one 2.5 MW unit and two 1.9 MW units in working condition. Recent peak demand recorded on Rota is 1.7 MW.

Installation of photo-voltaic (PV) solar power arrays are becoming more popular in both new and existing residential and commercial buildings on Saipan. This emerging technology is rapidly improving to become cheaper and more efficient and is considered a good way to ensure reliable electrical power in the event of an emergency or CUC power outage. The electrical grid on Saipan does not currently support smart grid technology which would allow individual solar power producers to sell excess electricity back into the grid so all existing PV on Saipan arrays must use the power as it is generated or store it in on-site battery banks which can be costly to install and maintain. This has limited more widespread use of PV technology in the CNMI.

D.1.2.6 Communications Lifeline

Two private corporations currently provide the majority of telecommunications services in the CNMI: IT&E and DOCOMO Pacific. Pacific Telecom Incorporated bought out IT&E Guam on February 27, 2008 and now operates as IT&E. DOCOMO Pacific subsequently bought out Saipan and Guam Cell Company and became IT&E's primary competitor. Both companies currently provide similar services including telephone service (land-line and cellular), DSL internet, and cable television via a system of fiber optics and copper cables which are buried underground and submerged undersea between islands. These cables are utilized as the primary telecommunications systems for the CNMI with satellite and micro-wave link relay services utilized as secondary systems. The fiber optic cables run through Saipan, Tinian, and Rota and feed to a hubbed network on Guam. Operating under the National Telecommunications and Information Administration (NTIA), FirstNet has contracted with AT&T for designation of the Nationwide Public Safety Broadband Network (NPSBN). AT&T has selected DOCOMO Pacific to be the local (NPSBN) for CNMI and Guam.

As the 2016–2021 Comprehensive Economic Development Strategy describes, in 2015 a break in the Incumbent Local Exchange Carrier's (ILEC) undersea cable precipitated a crisis that private and public-sector organizations were not prepared for. The event crippled communication within and outside of the CNMI, impacting emergency response, financial systems, and travel. Although the event was resolved in a matter of days, the impact that the break had on the community prompted private sector investments to begin the installation of a second fiber optic cable to service the CNMI. The competition between the ILEC and competing firms is anticipated to impact consumer pricing, but also provides redundancy for the community in the event of another break in the cable. Deployment of this additional cable is ongoing as of 2018.

The Motorola ASTRO E25 trunking system was installed on Saipan in 2008 and is currently the primary communications system for daily and emergency communications between all government agencies in the CNMI. This replaced the 800MHz SmartNet system that had previously provided this service. This installation opened the system proprietorship for interoperability and upgraded the network to Digital Narrow Band as mandated by the FCC. Tinian and Rota are also using a conventional Digital VHF MOTOROLA MOTO-Turbo system. This MOTO Turbo is linked via DSL (VoIP) to the State Warning Point (EOC) and can be patched into other stakeholders in Saipan. Other secondary systems include cellular service that most departments and agencies use and private Ham Radio Operators group that are willing to volunteer their services in disaster response operations. During disasters and recovery, a state Emergency Operations Center (EOC) is created, a Technical Interoperable Communications Plan (TICP) is activated, and a Communications Unit Leader (COML) is engaged. Tactical Interoperable Channel (TIC) 1 thru TIC 6 are used for Command Net which provides Land Mobile Radio (LMR) interoperability between the Incident Command Post (ICP) and Departmental and State EOCs. Upon request by the ICP Commander, TIC-7 through TIC-18 are used as Tactical Net connecting ICP to their perspective operations. The OEC has developed and maintains the Emergency Communications Plan (CNMI ECP) which can be found in the current FEMA Region IX Communications Plan.

The American Red Cross also has several methods of communicating in emergency situations including four (4) satellite phones installed in their office, one (1) BGAN (Broadband Global Area Network Satellite) unit and one (1) SSB (Single Side Band) radio unit. The ARC also has five (5) Chatty Beetle Units which send and receive short text messages via Iridium Short Burst Data (SBD) service. Two of these are currently installed at OHSEM and at the ARC office. The others will be deployed to the Northern Islands Mayor's Office (NIMO), Tinian, and Rota. Additionally, the ARC has two (2) P25 Radios that are tied into the local HSEM network.

On the island of Tinian, the primary two-way radio communication system for the Office of the Mayor and all response agencies is maintained by Radio Comm, a private company, under a lease agreement with the local government. Secondary communications systems include underground landline telephones provided by PTI. Other secondary systems include cellular service, but island wide coverage is not provided.

On the island of Rota, the primary two-way radio communications system operates differently than on the other islands. Agencies such as the CPA, the CNMI Historic Preservation Office, DEQ and DCRM own their hand-held radios and are using the VHF SMARTRUNK system. DPS owns and operates a VHF SMARTRUNK system that was installed by Radio Com but is now being maintained by HSEM Saipan. Currently, the Office of the Mayor has obtained a new integrated early warning system and communication system for all agencies in Rota funded under the Public Assistance and Hazard Mitigation Grant Program. Secondary communications systems include underground landline telephones provided by PTI. Other secondary systems include cellular service, but island-wide coverage is limited.

D.1.2.7 Transportation Lifeline

Airports

The Saipan International Airport is located between Dandan and Obyan on the southeastern side of the island. The runway is approximately 8,700 feet long by 250 feet wide. The airport has six gates and services various types of aviation craft from small planes to the Boeing 747 class aircraft.

The West Tinian Airport is situated on the west side of the island with a new international runway recently completed near the existing runway. The existing runway is 5,000 feet long by 150 feet wide. The new Tinian International Airport is 8,600 feet long. The West Tinian Airport is limited to small 18 passenger aircraft, Shorts 360s, but has the capacity to support a military C-130 aircraft. The new runway allows for Boeing 727 and 747 class aircraft to land.

The Rota International Airport is located in Sinapalo on the northern side of the island. The runway is 7,000 feet long by 250 feet wide and is capable of landing Boeing 727 aircraft. All the airports are connected to island power with main and back-up generators.

Seaports and Anchorages

The Port of Saipan is the primary seaport facility that is located on the northwest side of the island near the Exxon-Mobil Tank Farms. The dock is over 1,000 feet long and has a capacity of three large cargo vessels (250–300 feet long) that can be docked simultaneously. The grand debut of the port occurred in April 1999, which represented the culmination of the Saipan Harbor Improvement Project (SHIP), took place more than 20 years after its original inception and six years after construction began in 1993. The port is considered a world-class facility featuring 2,600 linear feet of berthing space, a 22-acre container yard, a water line, an underground fuel line protected by a concrete vault, an underground sewage removal system and dockside lights for nighttime operation. Additional improvements included the upgrading of the port's electrical system to better accommodate refrigerated containers. The channel, turning basin, and berthing areas have been widened and deepened to uniform 40 feet to support medium to deep draft vessels into port. With the help of the United States Coast Guard, the Commonwealth Ports Authority improved its navigational aids and repositioned the harbor buoys to mark the safest route into port.

Saipan Harbor includes Garapan Anchorage, the outer anchorage, and Puetton Tanapag. Puetton Tanapag (Tanapag Harbor) is also referred to as the inner harbor. Puetton Tanapag is sheltered by the barrier reef to the north. Most of the outer anchorage has been dredged to a depth of 52 feet, with some shallower areas dredged to lesser depths. The lagoon formed by the barrier reef is mostly shallow except for the harbor basin. The entrance channel to Puetton Tanapag lies due west of the harbor basin. In 1979, the channel was dredged to a depth of 29 feet and a width of 350 feet; it was proposed to be dredged to a depth of 30 feet and a width of 540 feet.

Despite its modern design, the *Climate Change Vulnerability Assessment for the Island of Saipan* (Greene & Skeele, 2014) reported that Climate Change Working Group members identified this integral asset as one of the most exposed resources to changing ocean conditions, as it is located in an extremely low-lying area with access corridors occupying the lowest points on Saipan’s road system. Prolonged extreme wave events associated with typhons or shifts in wind conditions may negatively impact the Port, as the entire complex is partially exposed to wave and surge action during periods of southwest swell and storm conditions. Additionally, there is no berth or anchorage available in Saipan Harbor that would be safe during the close passage of a typhoon. Saipan Harbor, being small and shallow, is generally not susceptible to extreme seas being generated within the barrier reef. The main problem is with externally generated seas and swells entering through the harbor entrance, which is almost one nautical mile wide. Since the harbor entrance faces southwest, Saipan is most susceptible to tropical cyclones that pass to the west and especially those on a northward track. Such an event happened with the passage of Typhoon Olive in April 1963.

As the 2016 anchorage map below depicts, although by definition “anchorage” may be found “in depths of 10 to 20 fathoms (18.3 to 37 meters),” under normal conditions anchorage is primarily focused on the western side of Saipan. Text from the 2014 SSMP describing Bahai Laulau (or LaoLao) Bay as an anchorage area has been omitted in this update as current anchorage charts do not include that location. Because most tropical storms approach from directions between south and east, this bay is likely to be severely affected by most storm events. As of this 2018 update the Commonwealth Ports Authority reports that harbor improvement planning is underway for the ports of Saipan, Tinian, and Rota. Additional information regarding the Tinian and Rota harbor updates is not included in the scope of the 2018 update.

On Tinian, the seaport facility is situated on the west side of San Jose village. The 1,000-foot long dock was built by US naval engineers during World War II and can service three large cargo vessels simultaneously. A 3,500-foot breakwater protects the harbor. On Tinian, the usable length of the main quay is 2,200 feet with depths varying between 25 and 29 feet. There are two piers, pier 1 and pier 2, lying to the southwest of the main quay. Each has a usable length of 500 feet at both sides and a depth of 25 feet. Two shorter quays between the main quay and pier 1 and between piers 1 and 2 have 225 feet of berthage space each and a depth of 25 feet, bringing the total berthing space to 4,650 feet. There are also some short quays in a shallow lagoon at the northwest end of the inner harbor, but these are used by local craft US Navy ships normally occupy the new part of the main quay. There is also an area available for anchorage within the inner harbor, but it is very small with a diameter of only 1,000 ft. The bottom of this portion of the harbor consists of coral and sand providing reasonable holding.

The outer anchorage provides no shelter from westerly winds and there is very little protection from easterly winds except close to the shore. However, the inner harbor provides some protection from all winds, especially those between north and southeast. For winds between south and west, minimal protection is provided by a breakwater built on the barrier reef that fronts the town. Although the breakwater has sustained some damage, it still provides some barrier against wave and swell action. It is therefore considered that the inner harbor at Tinian would provide protection against both wind and wave action in all conditions except the close passage of a typhoon.

Tinian Shipping and Transportation, Inc. does not provide daily ferry service between the islands of Tinian and Saipan. The ferry service has been discontinued.

On Rota, the West Dock is the primary seaport facility located on the southwest side of Songsong village. There are two docking areas that comprise West Dock, one is approximately 100 feet long and the other is 150 feet long. This dock can support two vessels simultaneously. Sea walls and revetments in the West Harbor need repair. Typhoon *Pongsona* changed some of the harbor walls in 2002. All seaports are connected to island power.

D.1.2.8 Hazardous Materials Lifeline

Hazardous Materials

Currently the Lower Base transfer station on Saipan offers residential hazardous waste disposal services and a municipal transfer station with a small household hazardous waste management area is under construction through the CIP office on Tinian. Commercial hazardous waste must be stored and shipped off island by a registered hazardous waste handler. According to the United States Department of Agriculture Cooperative State Research, Education, and Extension Service, Southwest States and Pacific Islands Regional Water Quality Program, a primary concern to maintaining adequate sources of drinking water within the CNMI is to address the potential seepage and/or leakage of trichloroethylene (TCE) into the islands' water aquifer systems. Past issues with the illegal dumping of TCEs, which is a hazardous chemical used as a spot remover for fabrics in the garment sector and as a degreaser in automotive repair, have warranted the monitoring of storage and disposal of such chemicals.

Other types of hazardous materials such as unexploded ordinance and poly-chlorinated biphenyls (PCBs) that were left on the island in damaged electrical equipment after World War II continue to be an issue of concern within the CNMI. Further, the protection and immediate emergency response to chemical contaminants from hazardous material spills of the islands‟ coral reef ecosystems and groundwater resources is of major concern. Overall, previously conducted environmental remediation projects directed towards this end have been initiated within the CNMI include groundwater and soil remediation; underground storage tank removal; asbestos and lead paint abatement; and post-typhoon hazardous materials clean-up activities.

CNMI HSEM has completed the CNMI Hazardous Materials Commodity Flow Analysis Report that lists all the primary importers of hazardous materials into the CNMI, and the types and quantities of hazardous materials being imported. In addition, HSEM recently completed updating the Facility Profiles Reports (FPR) for the CNMI. The FPR lists all facilities in the CNMI that are required to submit Tier Two reports required under the Emergency Planning and Community Right-To-Know Act (EPCRA). The EPCR Act requires all facilities that meet the Threshold Planning Quantities of certain chemicals to submit Tier Two reports. These reports provide facility information that will assist first responders in the event of a major hazardous materials incident within those facilities.

The release of hazardous materials could be caused by accidental release or natural events such as typhoons and major earthquakes with a great potential for loss of life and/or damage to the environment.

Solid Waste

On the island of Saipan, there is one US EPA certified landfill. The Puerto Rico dump has been closed to public dumping since 2003 and Superfund remediation was completed as summarized by the 2006–2017 report from the CNMI's Capital Improvements Program Office (CIP) in 2017. The Puerto Rico dump site was originally created by the US Navy in the mid-1940s as a dock facility post World War II. Between 1953 and 2003 the area had been used for disposal of municipal solid waste, though it did not become the principal municipal solid waste disposal facility on the island of Saipan until 1978. With the economic development boom in the 1980s, the island wide volume of waste increased tremendously, from an estimated island volume of 128 tons per day in 1994 to 320 tons per day in 2003. Due to several violations of the Clean Water Act, the Environmental Protection Agency issued an administrative order in 1994 that mandated that the Puerto Rico site be closed. With the 2017 opening of the Governor Eloy Inos Peace Park, the Puerto Rico dump has officially been remediated. In 2018 Black Construction was honored with an award in construction excellence for the reclamation project, which is now open to the public as a waterfront park.

The EPA certified Marpi landfill opened in February 2003 and has a capacity of approximately one million cubic yards, which at the current rate of waste generation should last about 20 to 25 years. The 43-acre landfill in Saipan's northern district, along with its transfer station, cost approximately $18.5 million. The Marpi Landfill footprint covers 27 acres and is designed to house 6 cells, two of which have been completed and are able to accept waste. A high-density polyethylene liner prevents leachate from seeping into ground water or finding its way into the ocean. Water accumulating within the liner is pumped out (on the side of the landfill farthest from the shore) and into a separate treatment system before it is tested and, when acceptably clean, is disposed of in a leaching field. Soil cover is applied to the refuse daily to minimize noxious fumes and to defend against vectors such as rats, dogs and insects. To help reduce the volume of waste that is deposited into the Marpi landfill, tipping fees are avoided if users take recyclables such as aluminum, glass, metal, cardboard and paper to a collection station operated by a private contractor. The aluminum and paper are shipped to Asian scrap markets, while the glass is ground into sand and used in construction-related activities. The government assists by subsidizing the recycling costs.

Typhoon Soudelor resulted in approximately 38,714 cubic yards of material classified as typhoon debris being delivered to the Marpi Solid Waste Facility (MSWF). DPW entered into a contract with a vendor to segregate, process and dispose of this material. This contract has been completed and DPW has gained additional space at the MSWF to manage debris from future storm events.

Additionally, DPW is currently in the process of performing a Feasibility Study designed to allow for the construction and operation of Neighborhood Convenience Centers, similar to small solid waste transfer stations, that include a component part to act as a temporary storage location for debris generated by a storm event or other man-made or natural disaster. DPW's experience with Typhoon Soudelor resulted in the need to develop a more robust method to manage debris during the immediate post-disaster event. The locations of these Convenience Centers are within a reasonable distance of the temporary debris management sites that were mobilized immediately post-impact from Typhoon Soudelor. This provides a more regimented response methodology for DPW to manage debris generated from any disaster. DPW is also soliciting proposals for the design of Cell #3 to increase disposal capacity.

On the island of Tinian, the open dump is estimated at about 20 thousand cubic yards that will last approximately less than two years at the current rate of waste generation, which is currently in violation of regulations, by the USEPA and the CNMI Department of Environmental Quality, Solid Waste Division. However, to comply with local and federal environmental regulations, Tinian will close its dumpsite and build its own fully compliant $3 million landfill. Tinian dedicated a Transfer Station located next to Tinian's CUC power plant to provide for the separation of recoverable material and the reduction of municipal solid waste (MSW) that requires disposal in a permitted facility.

On the island of Rota, the open dump capacity is the same as Tinian with a similar rate of waste generation and regulatory violations. Contrary to Tinian's projected construction of a new solid waste facility, the island of Rota is currently in the process of securing funds to address its waste management issues.

D.1.3 General Assets

D.1.3.1 Military Facilities

Military Sealift Command ships routinely anchor off Saipan. Maritime Prepositioning Ship Squadron Three, normally in the Guam/Saipan area, has four ships. The ships are manned by civilians under contract to the US Military Sealift Command. Three ships operate out of Guam and Saipan without a permanent homeport in that area. A small training facility and supply store is located in Saipan's Ports and Industrial area.

The Navy maintains a training area on Tinian, which served as the launch of the atomic weapons that brought an end to World War II. Training on Tinian occurs within the Military Lease Area, with limited activities in San Jose Harbor. Over two thirds of the island is retained by the US Federal government for military contingency purposes.

The Farallon de Medinilla, an uninhabited 200-acre island, stands about 280 feet above sea level and is approximately 3 miles by 1/2 mile. The Farallon de Medinilla Target Range is located about 150 miles north of Guam and is leased from the Government of the Commonwealth of the Northern Mariana Islands. The range has been used since 1976 under an agreement between the United States and the Commonwealth of the Northern Mariana Islands. Farallon de Medinilla is classified as public land that is under lease by the US military from the Commonwealth. The Commonwealth of the Northern Mariana Islands has a lease agreement with the US military that allows use of the island until 2075. The Farallon de Medinilla Target Range is the Pacific Fleet's only US-controlled range available for live-fire training for forward deployed naval forces.

D.1.3.2 Banks and Finance Companies

According to the CDA, both federal and local bank laws apply within the CNMI. In addition to banking services, the Mariana Islands are host to several finance companies, security broker dealers, trust companies, remittance companies, and foreign exchanges.

There are six identified banking institutions on the island of Saipan, which include:

- Bank of Guam
    - Garapan and Chalan Piao (Saipan)
    - San Jose (Tinian)
    - Songsong (Rota)
- Bank of Hawaiʻi
    - Gualo Rai (Saipan)
- Bank of Saipan
    - Chalan Kanoa and Garapan (Saipan)
    - San Jose (Tinian)
    - Songsong (Rota)
- City Trust Bank
- Gualo Rai (Saipan)
- First Hawaiian Bank:
    - Oleai and Gualo Rai (Saipan)
- Bank Pacific Ltd.
    - Garapan (Saipan)

D.1.3.3 Hotels and Tourist Facilities

It is general policy that the hotels within the CNMI are responsible for providing shelter for their guests. The majority of hotels are constructed out of concrete with existing provisions of backup power and water supply. The lead agency responsible for the coordination of tourist activity with airlines, travel bureaus, and the hotel association is the Mariana Visitors Authority. According to their current statistics, there are currently 3,670 authorized hotel rooms available on Saipan; 116 on Rota and 57 on Tinian.

Appendix I provides detailed information from MVA as to the identified hotels and other types of tourist accommodations within the CNMI as well as a list of "major siting" developments recently permitted by the Coastal Resources Management Agency Board as reported by the Division of Coastal Resources Management.

D.1.3.4 Shopping & Entertainment

The Northern Mariana Islands offer convenient shopping for residents and tourists alike. Major shopping areas abound with modern supermarkets, duty free shops replete with designer goods, specialty shops and the ubiquitous *mom and pop* stores. The following are a list of identified major shopping outlets:

- ABC Stores

- Cabrera Center
- DFS Galleria
- Hafa Adai Shopping Center
- Joeten Shopping Center
- Payless Supermarket
- Joeten Superstore (formerly Price Costco)
- Townhouse Shopping Center

D.1.4 Socially Vulnerable Populations

For the 2024 SHMP Update, socially vulnerable populations on Saipan, Tinian, and Rota were assessed using socially vulnerable indices developed in 2014 . According to Greene and Skeele (2014), 22 socio-economic variables were used to develop a social vulnerability index and the factors the Greene and Skeele report are reproduced below.

Factors Impacting Vulnerability

<u>Socioeconomic status</u>

Socioeconomic status affects a population's ability to absorb and recover from losses. Wealth increases one's resilience to coastal hazards and improves access to recovery aids such as insurance and social safety nets.

- Median Household Income
- Percentage of Population Below Poverty Line
- Median Rent as a Percentage of Median Household Income
- Per Capita Income
- Percentage of Population Over 16 Unemployed
- Median Rent
- Percentage of Population with No Health Insurance

<u>Average Household Size</u>

Large households tend to have a larger number of dependents and less flexibility in their ability to relocate to areas that are safe from coastal hazards, thereby decreasing these households' resilience and ability to recover.

Percentage of Population Over 16 Relying Solely on Subsistence Activities

Occupations that rely heavily on natural resources may be severely affected by a hazard event, or by gradual change that limits the availability of those resources. Those who rely solely on subsistence activities for their livelihoods may not have alternative means of support if the natural resources that they rely on are no longer available.

Education

Higher education is linked to socioeconomic status and earning potential. Limited education is linked to a lower earning potential and limits the ability to access and understand disaster warnings.

- Percentage of Population 25 and Older with a Bachelor's Degree
- Percentage of Population 25 and Older with High School Education

Percentage of Population Disabled

People with disabilities tend to have more reliance on their families and social services and therefore are more vulnerable in the face of hazards and disasters.

Type of Housing Material

The quality of housing material affects how easily a home may be destroyed by a storm or rising sea level. Less durable building materials such as corrugated metal and wood decrease a home's resiliency to hazards and increase vulnerability. Super Typhoon Keith, which produced sustained winds of over 160 mph in the CNMI in November 1997, caused significant damage on Saipan, Tinian, and Rota. Over 106 homes were destroyed, and another 477 homes sustained significant damage. These homes were primarily constructed out of metal or wood (CNMI Emergency Management Office, 2010).

- Percent of Houses with Metal Roof
- Percent of Houses with Metal Wall
- Percentage of Houses with Wood Roofs
- Percentage of Houses with Wood Walls
- Percentage of Houses Built on Wood Pilings
- Percent of Houses Mobile or Non-permanent

Access to warning information systems

Households without access to disaster warnings and evacuation information are less able to prepare and therefore less resilient. While "warning information systems" are often thought of in the context of extreme events (e.g., typhoons, tsunamis), additional information systems in the Pacific Region may be developed or enhanced to raise awareness of potential long-term events or trends such as droughts or sub-regional changes in sea level. Both radios and computers are important means of accessing this type of information in the Pacific Islands.

- Percentage of Households without a Computer
- Percentage of Households with No Radio

Percentage of Households Receiving Social Security Income

People who are eligible for social security benefits are most likely elderly, disabled, or otherwise unable to support themselves. Therefore, they tend to be more reliant on others for support and have less resilience to natural disasters and climate stressors.

Percent Non-Us Citizen

Non-US citizens may be unable to access and understand disaster/climate-related warnings due to language or cultural barriers and may be unable to access government provided disaster relief and funding due to immigration status. In addition, any future changes in political or legal situations pertaining to non-resident workers may limit non-US citizens' entire livelihoods, thus reducing their performance among other vulnerability indicators such as employment or education.

The table below lists the individual variables, along with the weights that were applied to each.

Table D.1-3. Social vulnerability variables and weights.

Variable	Weight 0. 0–1. 0
Average Household Size	0.75
Median Household Income	0.5
Median Rent	0.75
Percentage of Population 25 and Older with Bachelor's Degree	0.5
Percentage of Population 25 and Older with High School Education	0.5
Percentage of Population Disabled	0.75
Percentage of Population Below Poverty Line	1.0
Percentage of Houses with Metal Roofs	0.5
Percentage of Houses with Metal Wall	0.5
Percentage of Houses Mobile or Non-permanent	0.5

Table D.1-3. Social vulnerability variables and weights (*cont'd*).

Variable	Weight 0. 0–1. 0
Percentage of Houses without a Computer	0.25
Percentage of Population with No Health Insurance	0.75
Percentage of Households with No Radio	0.25
Percentage of Households receiving Social Security	0.5
Percentage of Population Over 16 Relying Soley on Subsistence Activities	0.75
Percentage of Population Over 16 Unemployed	1.0
Percentage of Houses with Wood Roofs	0.5
Percentage of Houses with Wood Walls	0.5
Percentage of Houses Build on Wood Pilings	0.75
Median Rent as Percentage of Median Household Income	1.0
Percent Non-US Citizens	0.75
Per Capita Income	1.0

D.1.5 Natural Resources Supplement

D.1.5.1 Species of conservation concern

Table D.1-4. Species designated as federally threatened or endangered under the US Endangered Species Act of 1973 (ESA) and locally as *threatened* or *endangered* by the CNMI Division of Fish and Wildlife.

English / Chamorro Name	Scientific Name	ESA Designation	CNMI Designation[1]	ESA List Year	Critical Habitat	CNMI Range[2]
Plants						
Cebello halumtano	*Bulbophyllum guamense*	Threatened	Not listed	2015	Proposed 2023	Rota, **Saipan, Pagan**
Fadang	*Cycas micronesica*	Threatened	Not listed	2015	Proposed 2023	Saipan, Tinian, Rota
	Dendrobium guamense	Threatened	Not listed	2015	Proposed 2023	Rota, **Saipan**, Tinian, Aguiguan, **Agrihan**
Ufa-halomtano	*Heritiera longipetiolata*	Endangered	Not listed	2015	Proposed 2023	Saipan, Tinian, Rota
Cat's Tail/ Disciplina	*Lycopodium phlegmaria* var. *longifolium*	Not listed	Listed	N/A	None	Rota
	Maesa walkeri	Threatened	Not listed	2015	Proposed 2023	Rota

Table D. 1-4. Species designated as federally threatened or endangered under the US Endangered Species Act of 1973 (ESA) and locally as *threatened* or *endangered* by the CNMI Division of Fish and Wildlife (*cont'd*).

English / Chamorro Name	Scientific Name	ESA Designation	CNMI Designation[1]	ESA List Year	Critical Habitat	CNMI Range[2]
	Nesogenes rotensis	Endangered	Not listed	2004	None	Rota
	Nervilia jacksoniae	Threatened	Not listed	2015	Proposed 2023	Rota
	Osmoxylon mariannense	Endangered	Not listed	2004	None	Rota
Fire tree or Hayun lagu/ Tronkon guafi	*Serianthes nelsonii*	Endangered	Listed	1987	None	Rota
	Solanum guamense	Endangered	Not listed	2015	Proposed 2023	**Rota, Sailan, Tinian, Asuncion, Guguan, Maug**
	Tabernaemontana rotensis	Threatened	Not listed	2015	Proposed 2023	Rota
	Tuberolabium guamense	Threatened	Not listed	2015	Proposed 2023	Rota, **Tinian, Aguiguan**
Mammals						
Mariana Fruit Bat or Fanihi	*Pteropus mariannus mariannus*	Threatened	Listed	1984	Yes 2004	Most islands
Sheath-tailed bat or Payesyes	*Emballonura semicaudata*	Endangered	Listed	2015	Proposed 2023	**Rota,** Aguiguan, **Saipan, Tinian, Anatahan, Maug**
Birds						
Nightingale Reed-Warbler or Ga'ga Karisu	*Acrocephalus luscinia*	Endangered	Listed	1970	None	Saipan, Alamagan
Mariana Swiftlet or Chachaguak	*Aerodramus bartschi*	Endangered	Listed	1984	None	Saipan, Aguiguan
Mariana Crow or Aga	*Corvus kubaryi*	Endangered	Listed	1984	Yes 2004	Rota
Micronesian Megapode or Sasangat	*Megapodius laperouse*	Endangered	Listed	1970	None	Most islands

Table D. 1-4. Species designated as federally threatened or endangered under the US Endangered Species Act of 1973 (ESA) and locally as *threatened* or *endangered* by the CNMI Division of Fish and Wildlife (*cont'd*).

English / Chamorro Name	Scientific Name	ESA Designation	CNMI Designation[1]	ESA List Year	Critical Habitat	CNMI Range[2]
Mariana Common Moorhen or Pulattat	*Gallinula chloropus guami*	Endangered	Listed	1984	None	Saipan, Tinian, Rota
Rota White-eye or Nosa Luta	*Zosterops rotensis*	Endangered	Listed	2004	Yes 2006	Rota
Short-tailed albatross	*Phoebastria albatrus*	Endangered			None	All
Guam rail	*Gallirallus owstoni*	Experimental Population, Non-Essential			None	Rota
Terrestrial Invertebrates						
Mariana Eight-spot Butterfly	*Hypolimnas octocula marianensis*	Endangered	Not listed	2015	Proposed 2023	**Saipan**
Mariana Wandering Butterfly	*Vagrans egistina*	Endangered	Not listed	2015	Proposed 2023	Rota
Rota Blue Damselfly	*Ischnura luta*	Endangered	Not listed	2015	Proposed 2023	Rota
Humped tree snail	*Partula gibba*	Endangered	Not listed	2015	Proposed 2023	Many islands
Langford's tree snail	*Partula langfordi*	Endangered	Not listed	2015	Proposed 2023	Aguiguan
Fragile tree snail	*Samoana fragilis*	Endangered	Not listed	2015	Proposed 2023	Rota
Reptiles						
Micronesian Gecko	*Perochirus ateles*	Not listed	Listed	N/A	None	Saipan, Tinian, Rota
Slevin's Skink	Emoia sleveni	Endangered	Not listed	2015	Proposed 2023	Rota, Aguiguan, Tinian, Sarigan, Alamagan, Pagan, Asuncion

Table D. 1-4. Species designated as federally threatened or endangered under the US Endangered Species Act of 1973 (ESA) and locally as *threatened* or *endangered* by the CNMI Division of Fish and Wildlife (*cont'd*).

English / Chamorro Name	Scientific Name	ESA Designation	CNMI Designation[1]	ESA List Year	Critical Habitat	CNMI Range[2]
Reptiles–Sea Turtles						
Green Sea Turtle or Haggan	*Chelonia mydas*	Threatened	Listed	1978	Proposed 2023	All
Hawksbill Turtle or Haggan Karai	*Eretmochelys imbricata*	Endangered	Listed	1973	None in CNMI	All
Leatherback Turtle	*Dermochelys coriacea*	Endangered		1973	None in CNMI	CNMI Waters
North Pacific Loggerhead Turtle	*Caretta caretta*	Endangered		2011	None in CNMI	CNMI Waters
Olive Ridely Turtle	*Lepidochelys olivacea*	Endangered		1978	None	CNMI Waters
Marine Mammals						
Blue Whale	*Balaenoptera musculus*	Endangered		1970	None in CNMI	CNMI Waters
Fin Whale	*Balaenoptera physalus*	Endangered		1970	None	CNMI Waters
Western N. Pacific Humpback Whale	*Megaptera novaeangliae*	Endangered		1970	None in CNMI	CNMI Waters
Sei Whale	*Balaenoptera borealis*	Endangered		1970	None	CNMI Waters
Sperm Whale	*Physeter macrocephalus*	Endangered		1970	None	CNMI Waters
Dugong	*Dugong dugon*	Endangered		?	None	CNMI Waters
Fish						
Indo-West Pacific Scalloped Hammerhead Shark	*Sphyrna lewini*	Endangered				
Giant Manta Ray	*Manta birostris*	Endangered				
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Endangered				

Table D. 1-4. Species designated as federally threatened or endangered under the US Endangered Species Act of 1973 (ESA) and locally as *threatened* or *endangered* by the CNMI Division of Fish and Wildlife (*cont'd*).

English / Chamorro Name	Scientific Name	ESA Designation	CNMI Designation[1]	ESA List Year	Critical Habitat	CNMI Range[2]
Marine Invertebrates—Corals						
	Acropora globiceps	Endangered	Not listed	2014	Proposed 2023	Saipan, Tinian, Rota, Aguijan, Alamagan, Pagan. Maug, Uracas
	Acropora retusa	Endangered	Not listed	2014	Proposed 2023	Saipan, Tinian, Rota, ?
	Seriatopora aculeata	Endangered	Not listed	2014		Saipan, Tinian, Rota, ?

[1]CNMI lists species as threatened or endangered, with no distinction between threatened and endangered species.

[2]Known or assumed. Bold indicates the former range of the species, but the species is not currently found on the island.

D.1.5.2 Landcover and Vegetation Maps

The following vegetation maps and landcover syntheses were produced by the US Fish and Wildlife Service (Amidon et al., 2017).

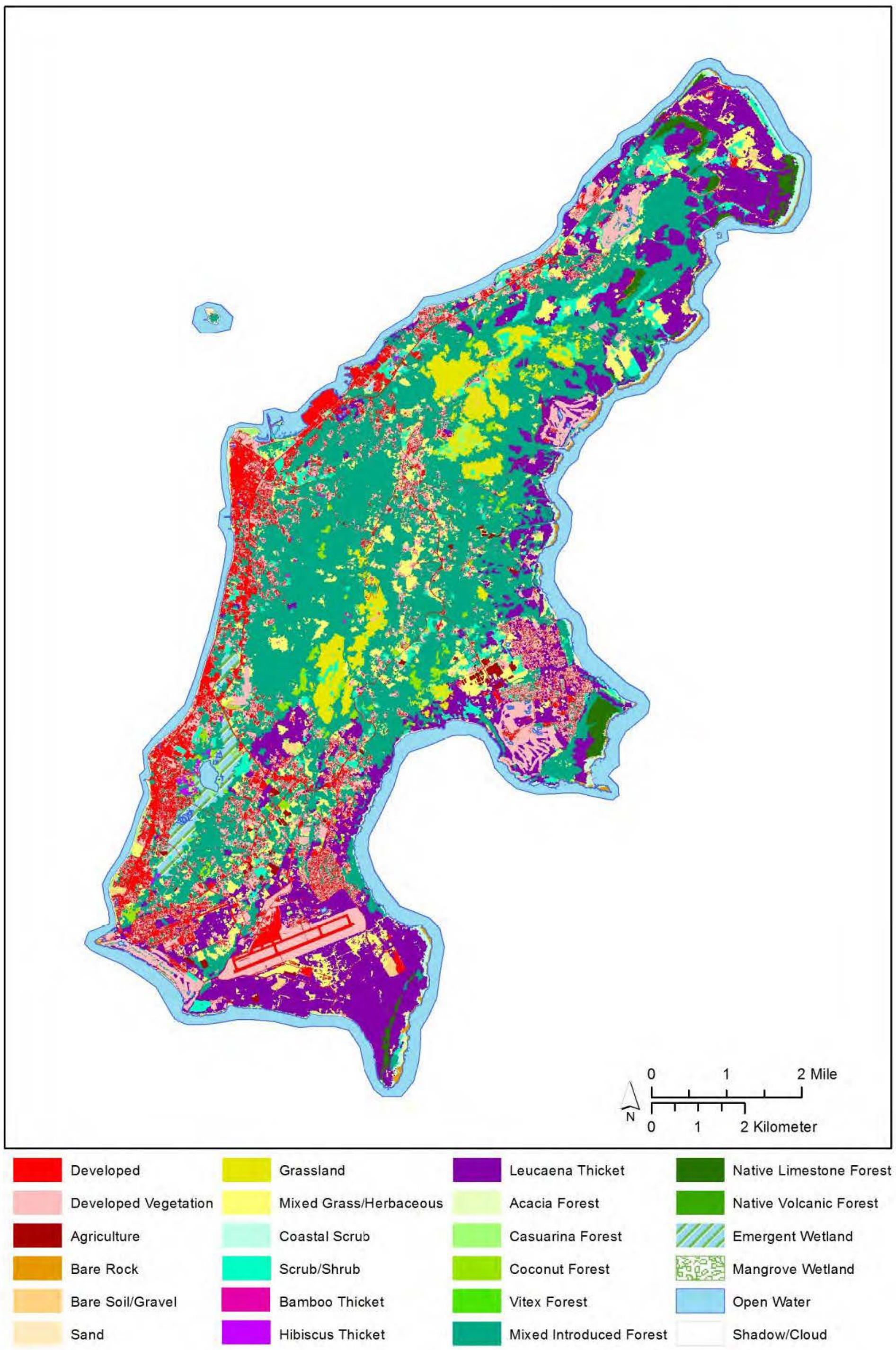


Figure D.1-1. Saipan vegetation map.

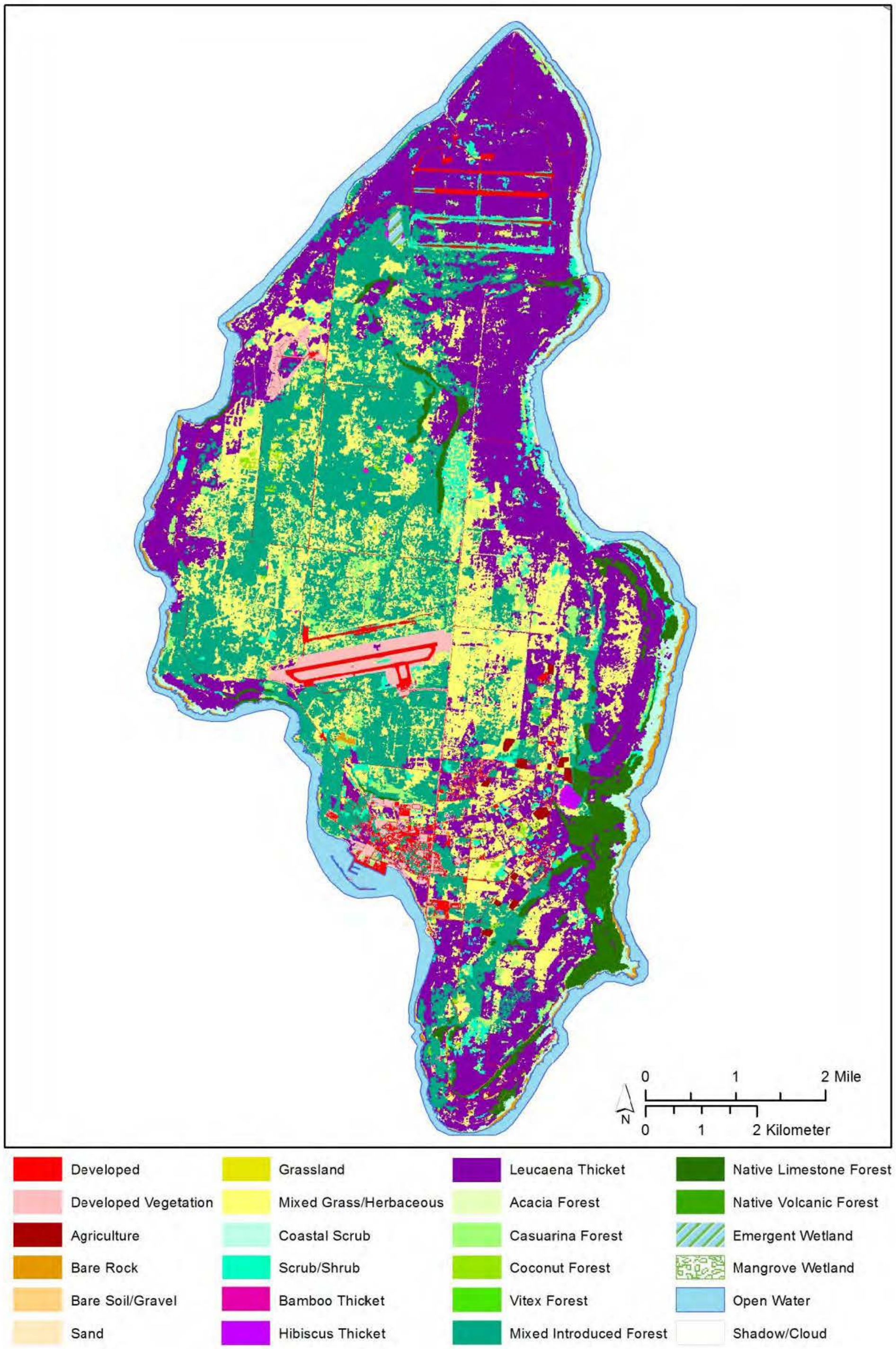


Figure D.1-2. Tinian vegetation map.

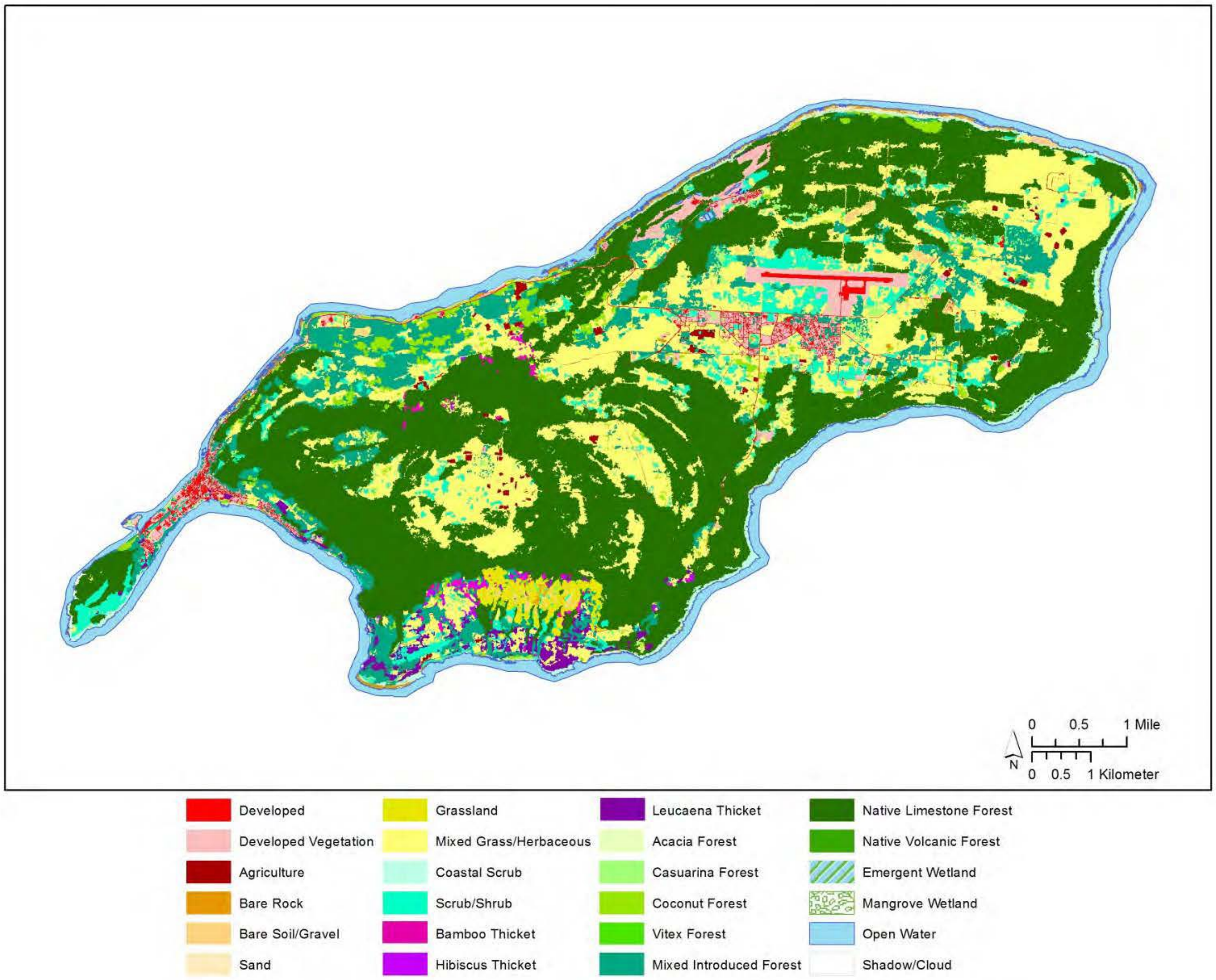


Figure D.1-3. Rota vegetation map.

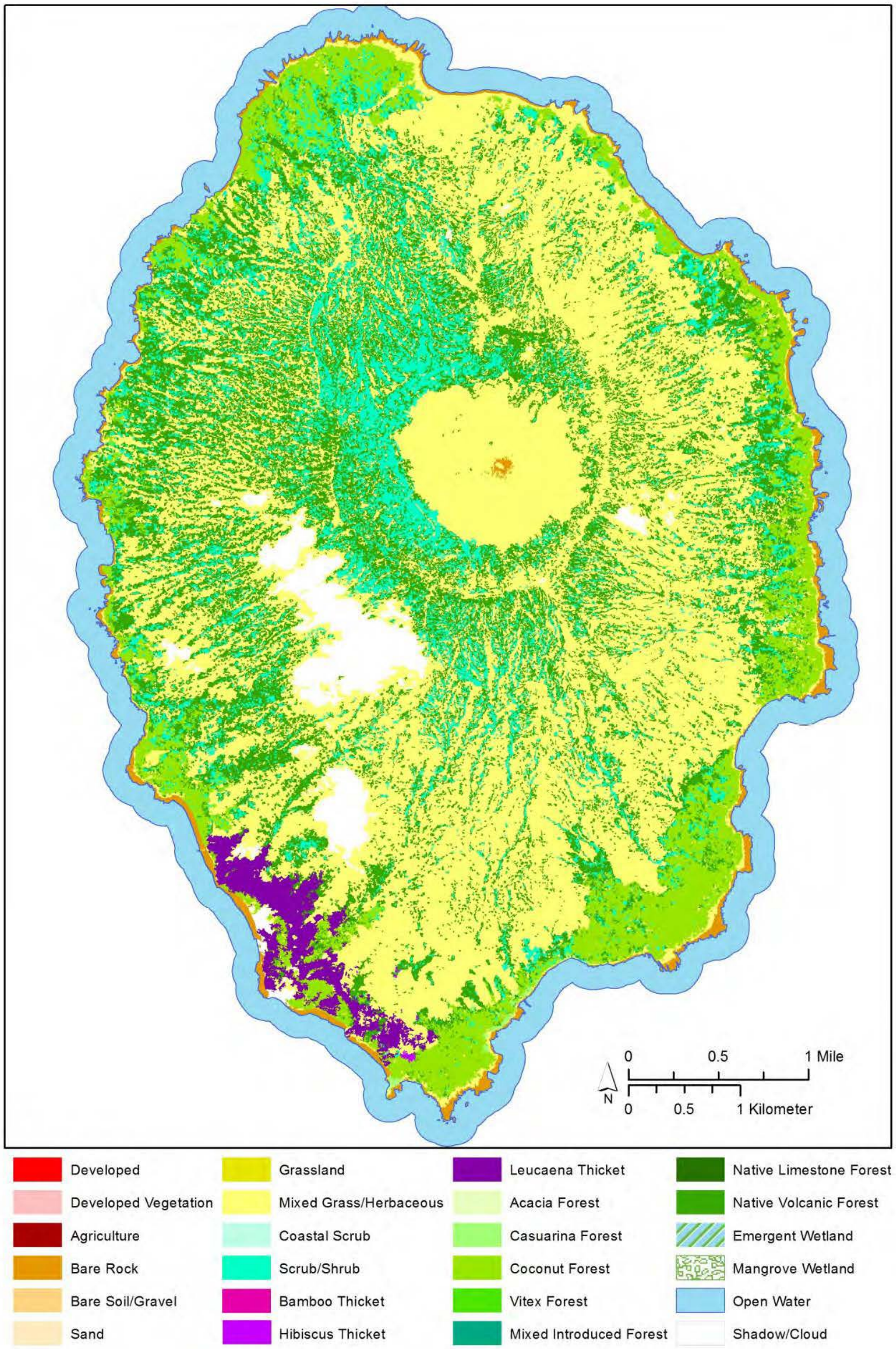


Figure D.1-4. Agrihan vegetation map.

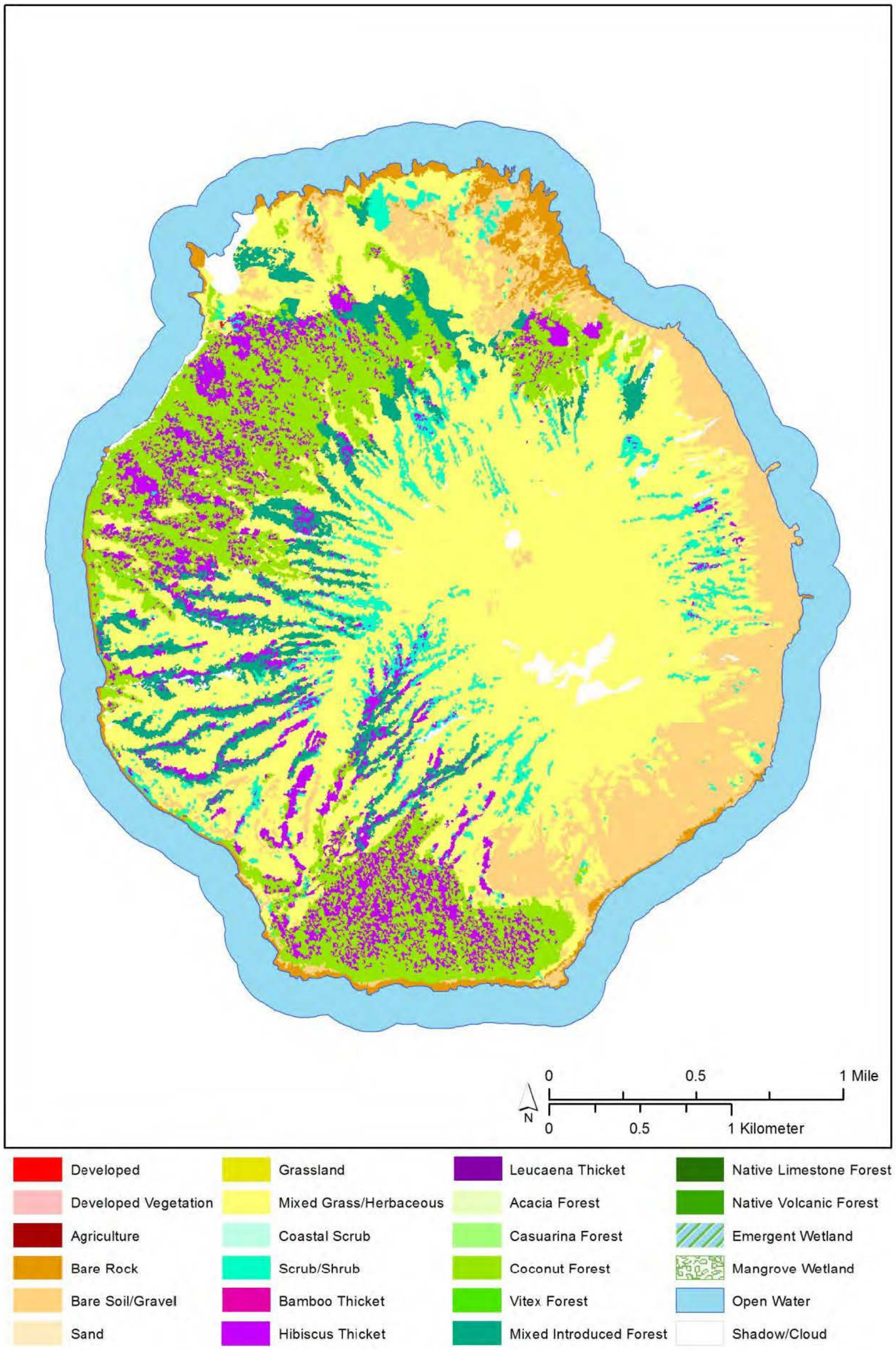


Figure D.1-5. Alamagan vegetation map.

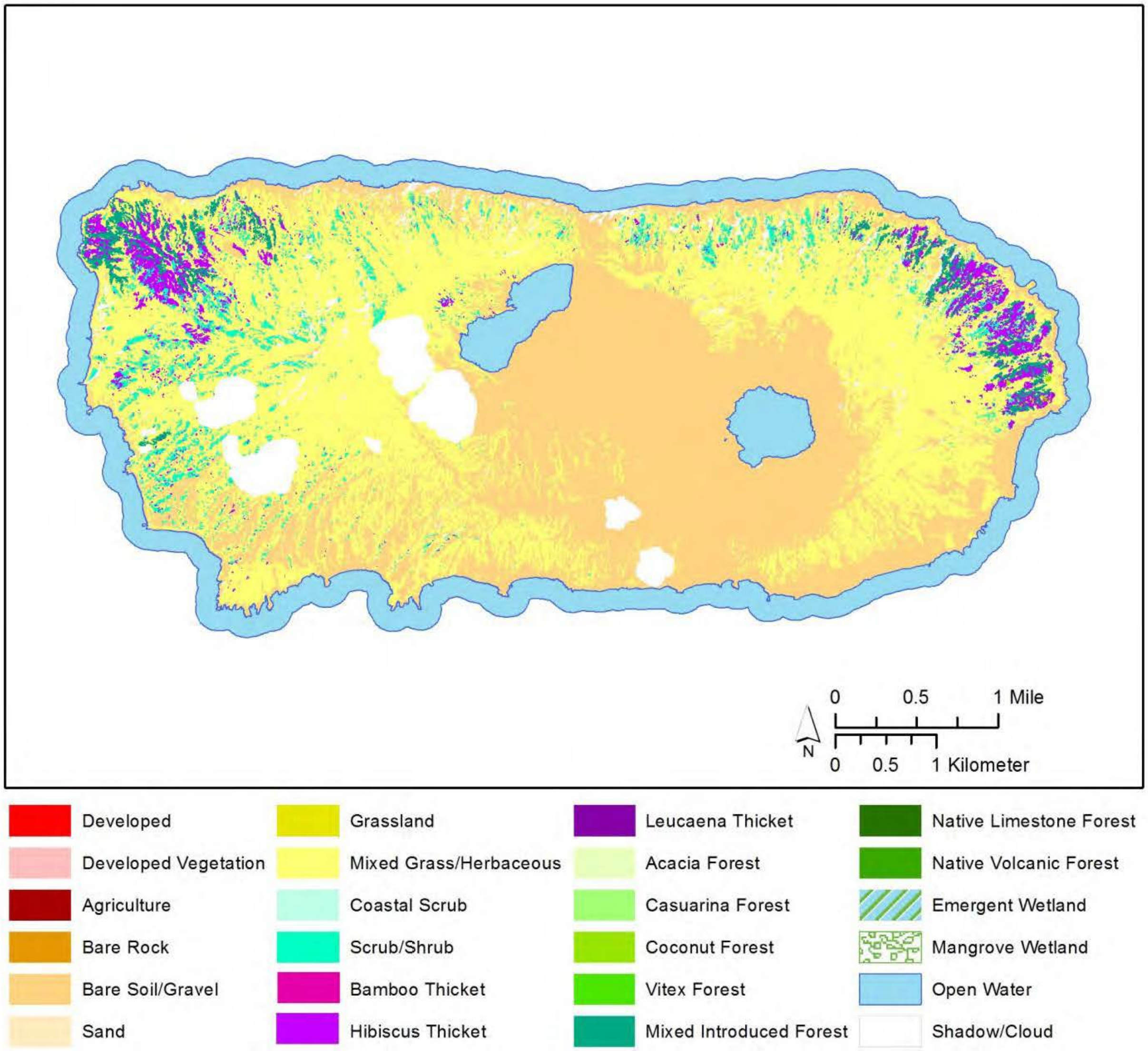


Figure D.1-6. Anatahan Vegetation map.

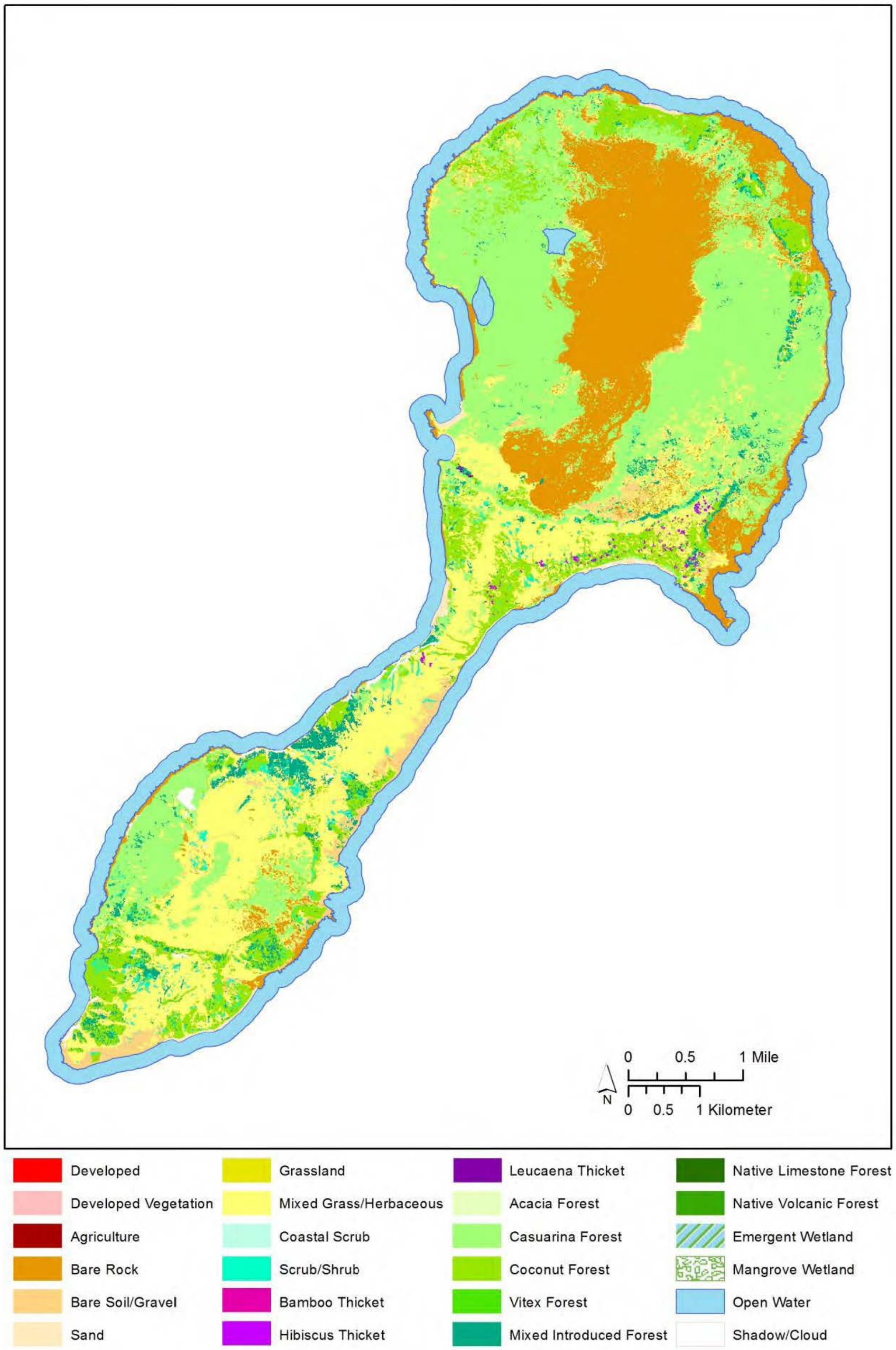


Figure D.1-7. Pagan vegetation map.

Table D.1-5. Estimated acreages of landcover/vegetation types by island. All acreages in acres.

Landcover/ Vegetation Category	Guam	Rota	Aguiguan	Tinian	Saipan	FDM	Anatahan	Sarigan	Guguan	Alamagan	Pagan	Agrihan	Asuncion	Maug	Uracus	Total
Developed	13,125	365	0	749	2,908	0	0	0	0	< 1	0	0	0	0	0	17,147
Developed Vegetation	14,909	690	0	707	3,684	0	0	0	0	0	0	0	0	0	0	19,990
Agriculture	672	108	0	77	131	0	0	0	0	0	0	0	0	0	0	987
Bare Rock	79	253	159	328	241	34	0	98	119	93	2,505	222	109	112	424	4,775
Bare Soil/Gravel	2,509	168	43	15	109	11	3,226	234	117	411	391	0	117	0	11	7,360
Sand	240	68	0	15	133	0	0	0	0	0	69	0	0	0	0	525
Mixed Grass/Herbaceous	6,475	4,911	1	5,260	2,122	105	3,678	341	392	1,530	2,928	5,357	918	214	120	34,353
Grassland	21,770	225	0	0	1,194	0	0	0	0	0	0	0	0	0	0	23,189
Coastal Scrub	532	307	0	621	339	0	0	0	0	0	0	0	0	0	0	1,800
Scrub/Shrub	11,272	991	445	756	1,027	25	302	15	0	146	185	1,205	99	12	0	16,480
Hibiscus Thicket	114	44	0	33	39	0	242	25	0	252	25	3	4	39	0	821
Bamboo Thicket	508	67	0	16	6	0	0	0	0	0	0	0	0	0	0	597
Leucaena Thicket	4,914	229	74	8,279	5,492	0	0	9	0	0	2	196	0	0	0	19,194
Acacia Forest	217	0	0	0	0	0	0	0	0	0	0	0	0	0	0	217
Casuarina Forest	147	170	30	781	231	0	0	0	0	0	4,014	10	0	0	0	5,382
Coconut Forest	1,345	497	0	108	295	0	3	273	0	508	1,163	1,003	156	36	0	5,388
Vitex Forest	2240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,240
Mixed Introduced Forest	30,522	2,096	31	6,186	10,651	0	168	2	0	205	403	0	0	0	0	50,262
Native Limestone Forest	12,978	10,008	939	1,034	388	0	0	0	0	0	0	0	0	0	0	25,347
Native Volcanic Forest	8,576	0	0	0	0	0	0	100	410	0	0	2,530	480	23	0	12,120
Emergent Wetland	734	1	0	34	363	0	0	0	0	0	0	0	0	0	0	1,132
Mangrove Wetland	182	0	0	0	2. 1	0	0	0	0	0	0	0	0	0	0	184
Open Water	360	74	0	1	89	0	249	0	0	0	58	0	0	0	0	832
Shadow/Cloud	0	13	0	5	6	5	494	2	0	55	64	357	61	98	0	1,160
Total	134,420	21,284	1,722	25,003	29,448	179	8,361	1,099	1,038	3,203	11,806	10,884	1,945	534	554	251,481

Table D.1-6. Percent cover of landcover/vegetation types for all islands. Each row and column lists the percent cover of each type by total island area. Cloud and shadow areas are included in the total area for each island. See Table D.1-5 for acreages uses in calculations.

Landcover/Vegetation Category	Guam	Rota	Aguigua n	Tinian	Saipan	FDM	Anataha	Sarigan	Guguan	Alamaga n	Pagan	Agrihan	Asuncio n	Maug	Uracus	Total
Developed	10%	2%	0%	3%	10%	0%	0%	0%	0%	< 1%	0%	0%	0%	0%	0%	7%
Developed Vegetation	11%	3%	0%	3%	13%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	8%
Agriculture	< 1%	< 1%	0%	< 1%	< 1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	< 1%
Bare Rock	< 1%	1%	9%	1%	1%	19%	0%	9%	11%	3%	21%	2%	6%	21%	77%	2%
Bare Soil/Gravel	2%	1%	3%	< 1%	< 1%	6%	39%	21%	11%	13%	3%	0%	6%	0%	2%	3%
Sand	< 1%	< 1%	0%	< 1%	< 1%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	< 1%
Mixed Grass/Herbaceous	5%	23%	< 1%	21%	7%	60%	44%	31%	38%	48%	25%	49%	47%	40%	22%	14%
Grassland	16%	1%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%
Coastal Scrub	< 1%	1%	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Scrub/Shrub	8%	5%	26%	3%	3%	14%	4%	1%	0%	5%	2%	11%	5%	2%	0%	7%
Hibiscus Thicket	< 1%	< 1%	0%	< 1%	< 1%	0%	3%	2%	0%	8%	< 1%	< 1%	< 1%	7%	0%	< 1%
Bamboo Thicket	< 1%	< 1%	0%	< 1%	< 1%	0%	0%	%	0%	0%	0%	0%	0%	0%	0%	< 1%
Leucaena Thicket	4%	1%	4%	33%	19%	0%	0%	1%	0%	0%	< 1%	2%	0%	0%	0%	8%
Acacia Forest	< 1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	< 1%
Casuarina Forest	< 1%	1%	2%	3%	1%	0%	0%	0%	0%	0%	34%	< 1%	0%	0%	0%	2%
Coconut Forest	1%	2%	0%	< 1%	1%	0%	< 1%	25%	0%	16%	10%	9%	8%	7%	0%	2%
Vitex Forest	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Mixed Introduced Forest	23%	10%	2%	25%	36%	0%	2%	< 1%	0%	6%	3%	0%	0%	0%	0%	20%
Native Limestone Forest	10%	47%	55%	4%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%
Native Volcanic Forest	6%	0%	0%	0%	0%	0%	0%	9%	39%	0%	0%	23%	25%	4%	0%	5%
Emergent Wetland	< 1%	0%	0%	< 1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	< 1%
Mangrove Wetland	< 1%	0%	0%	0%	< 1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	< 1%
Open Water	< 1%	< 1%	0%	0%	< 1%	0%	3%	0%	0%	0%	< 1%	0%	0%	0%	0%	< 1%
Shadow/Cloud	0%	< 1%	0%	< 1%	< 1%	3%	6%	< 1%	0%	2%	< 1%	3%	3%	18%	0%	< 1%

D.2 Risk Assessment Supplement

D.2.1 Hazard Analyses Geodatabase

D.2.1.1 Introduction

This document provides a detailed explanation of the GIS files and datasets utilized in the 2024 State Hazard Mitigation Plan (SHMP) for the Commonwealth of the Northern Mariana Islands (CNMI). It describes the structure, content, and purpose of the provided GIS resources, including the geodatabase, map package, and source hazards data. All products were created using ArcGIS Pro 3.3.1.

D.2.1.2 Geodatabase

The geodatabase consolidates the spatial data used in the 2024 update. A comprehensive attribute table description is included in an associated spreadsheet (SHMP_Update_Geodatabase_Schema_2024.xlsx).

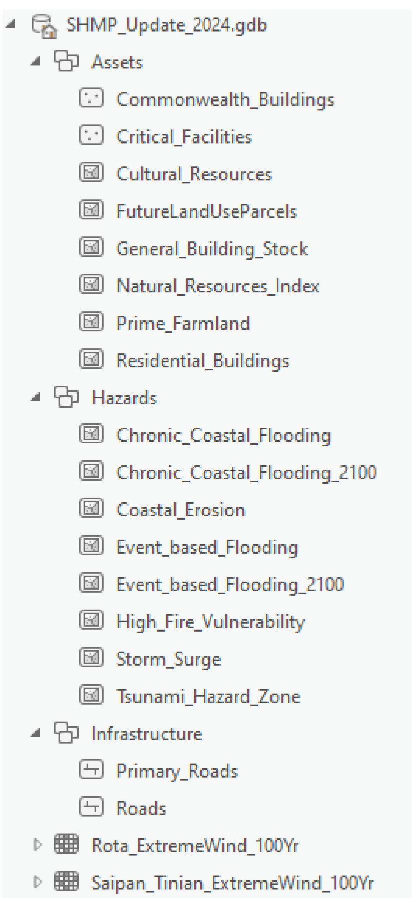


Figure D.2-1. Geodatabase structure as viewed in ArcGIS Pro.

The SHMP_Update_2024.gdb is organized into three feature datasets: Assets, Hazards, and Infrastructure. Each feature dataset contains multiple feature classes.

Assets

The assets feature dataset encompasses a range of feature classes that represent various important community resources and structures.

Commonwealth Buildings and Infrastructure (Commonwealth_Buildings, Critical_Facilities)

The CNMI HMGP provided a list of Commonwealth owned/operated buildings and infrastructure as identified in the Facilities Assessment Matrix (FAM). The list of Commonwealth facilities was originally developed for the 2010 Standard State Mitigation Plan (SSMP) via a FAM tool, which was a form that asked detailed questions about each facility or infrastructure each agency managed. Data was entered into a database and a list of facilities was included in each subsequent SSMP update through 2018. For the 2024 SHMP Update, the FAM was updated by consulting with agency personnel and is as complete as practical given the compressed project timeline; this data will be referred to as buildings in the 2024 SHMP Update. The dataset did not have attributes to determine the number of owned versus leased buildings. The list of facilities was geocoded to generate a spatial layer with the attributes needed for the analyses. Not all facilities had sufficient location data for geocoding. Of the total 478 facilities, 456 had sufficient data to be successfully geocoded and included in the spatial analyses reported in Sections 4.2–4.10. The dataset included various structural attributes used for the analyses, including 2022 replacement cost values from Hazus 6.0, agency that owns or leases the building, use description, year built, number of stories, and square footage. For buildings missing values for these attributes and for additional attributes required for the analyses, default values were used. For each entry in the identified facilities list initial geospatial locations were assigned using best available information from sources including google maps, OpenStreetMap, and high-resolution orthoimagery. An ESRI Field Maps project was created and loaded to mobile devices which enabled each facility to be marked as ground-truthed and allowed the dataset to be enrich and correct with additional fields such as the current tenant (some facilities had changed organizations since the last update) and building construction. An additional 279 Commonwealth facilities (not all critical facilities) were identified, which were not included in the previous dataset. Each facility was spatially joined to the nearest point entry in the Hazus database. Most facilities had a direct match but for those that did not, an adjacent point was used to assign a limited number of fields such as replacement value per square foot etc. Due to the extremely large scale that the Hazus dataset must cover, it uses a generalized model for assigning values of structures and their contents that uses building type and occupancy to assign a standardized building footprint size and replacement value to all buildings of that type. Over large areas these errors likely average and are of little consequence. However, for the 2024 SHMP Update, a slightly different approach was used to calculate replacement values for structures. Building footprints derived from OpenStreetMap for each building in the CNMI were multiplied by replacement value per square foot provided in Hazus 6.0 for CNMI structures and the number of floors to calculate the replacement value for structures.

General Building Stock (General_Building_Stock)

General building stock data for the CNMI are not available via the US Army Corps of Engineers 2021 National Structure Inventory and information and buildings are not geospatially represented in Hazus. Therefore, for the 2024 SHMP Update, a new geodatabase was created by combining GIS data developed for the CNMI Community Development Block Grant–Mitigation (CDGB-MIT) Program Initial Action Plan (NMHC, 2023) and building data from OpenStreetMap, an open-source application. Information for the general building stock was enriched with information from FEMA Hazus 6.0 and GIS data obtained from the CDBG-MIT program.

Natural and Cultural Resources (Natural_Resources_Index, Cultural_Resources)

The Commonwealth contains an abundant array of onshore and offshore environmental assets, including many species that are endemic to the CNMI. Recently, as part of the *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (Dobson et al., 2020a), terrestrial and marine indices that reflect habitat suitability models were developed. These terrestrial and marine indices allow for a greater understanding of important habitat and fish and wildlife resources in the CNMI. The CNMI assessment included only species of concern with federal-or state-level protected status and/or those species included in resources management plans. For a detailed description of how the indices were developed see the associated *Regional Coastal Resilience Assessment: Methodology and Data Report* (Dobson et al., 2020b).

According to Dobson et al. (2020a), the terrestrial index was created relative to the habitat preferences and needs of the species of greatest conservation concern in the region, which were identified using the *2015–2025 State Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands* (Liske-Clark, 2015) and species listed as threatened or endangered under the Endangered Species Act. Broad taxonomic groupings were used to model species' habitat preferences throughout the region including birds, reptiles, and terrestrial mammals. Several land cover datasets were used to identify habitats and International Important Bird Areas (IBAs) from BirdLife were also included. The index shows areas of relative concentrations of wildlife assets and is classed from 1 (low concentration of assets) to 5 (high concentration of assets).

A similar approach was used by Dobson et al.(2020a) to develop the marine index. The marine index aimed to identify areas capable of supporting significant biodiversity. Three important habitats were included: coral reefs, seagrass beds, and mangroves. A number of datasets were used to generate the marine index including benthic habitat maps, coral cover data, mangrove extent, presence of coral nurseries, and Marine Protected Areas. See Dobson et al. (2020a) for details. The index shows areas of relative concentrations of marine assets and is classed from 1 (low concentration of assets) to 5 (high concentration of assets).

To assess exposure and vulnerability to natural hazards, the terrestrial and marine indices were overlaid with hazards in GIS to determine the area of terrestrial and marine assets within the hazard area. The proportion of terrestrial and marine index classes within the hazard region is reported. Refer to Chapter 2.0 (CNMI Planning Area Profile) for a more detailed description of the terrestrial and marine assets in the Commonwealth.

Cultural resource asset information in the Commonwealth is managed by the CNMI Historic Preservation Office within the Department of Community and Cultural Affairs (DCCA). The location of cultural resources was obtained from the CNMI Data Portal and verified by the Historic Preservation Office as the most current information. Cultural resource assets include archaeological sites, burial sensitivity areas, historic buildings and structures, historic districts, and objects. Coordination with Historic Preservation Office personnel clarified historic properties listed on the National Register of Historic Places and National Historic Landmarks. Sensitive locational information for archaeological sites and other historic properties is omitted from this report because it is protected under Section 304 of the National Historic Preservation Act and Section 9 of the Archaeological Resources Protection Act and is excluded from public disclosure under the Freedom of Information Act. To the extent possible, the spatial hazard layers were overlaid with cultural resource asset area polygon data in GIS to determine the area of land located in the impact area of the hazard. Refer to Chapter 2.0 (CNMI Planning Area Profile) for a more detailed description of cultural resources assets in the Commonwealth.

<u>Projected Development (FutureLandUseParcels)</u>

In an attempt to understand if projected new development may be impacted by hazards, when possible, an exposure analysis was conducted using land use designations from the Department of Public Lands. The spatial hazard layers were overlaid with land use that is likely to support future development to determine the area of land located within an area likely to be affected by a hazard.

<u>Roads (Roads) and Primary Roads (Primary_Roads)</u>

The Department of Public Works is responsible for the primary road network throughout the Commonwealth. GIS information for the roads was obtained through OpenStreetMap, an open-source application. The economic impact of hazard events on road infrastructure has not been monetized, although exposure is identified and discussed.

A subset of the roads layer was created including only numbered roads to better illustrate primary roadways for each island and declutter map products where the full roads layer was too complex.

Hazards

<u>Typhoon (Storm_Surge)</u>

The tropical cyclone hazard was evaluated for Category 5 typhoon conditions. To estimate the flood hazard associated with a tropical cyclone, the National Flood Hazard Layer Digital Flood Insurance Rate Map (DFIRM) data (effective April 2006) for V-zones were used to assess exposure from the 1% annual-chance flood event. An exposure analysis was conducted to assess the vulnerability of Commonwealth owned and operated buildings, primary roads, community lifelines, and the general building stock. The 2018 SSMP assumed a 70% damage ratio to vulnerable buildings and their contents within the V-zone. This damage ratio was derived from the V-zone Flood Contents Loss Estimate Table provided in the FEMA Benefit-Cost Analysis Coastal V-zone Module (1999) and was adopted for the 2024 SHMP Update. Refer to Section 4.2 (Typhoon) for more information about typhoon hazard.

Category 5 typhoon conditions were used to determine displaced households and shelter needs. Data from the CNMI 2023 Threats and Hazard Identification Assessment (THIRA) (HSEM, 2024) for Super Typhoon *Yutu* was used to estimate the number of people needing to evacuate and requiring shelters.

Tsunami (Tsunami_Hazard_Zone)

The recently developed GIS layer for tsunami evacuation zone (maximum inundation) for Rota, Saipan, and Tinian was provided through the CNMI Tsunami Hazard and Evacuation Application website. To assess exposure and vulnerability of Commonwealth assets on these islands to tsunami hazard, an exposure analysis was completed. The tsunami risk to the Northern Islands has not been quantitatively assessed; therefore, the risk to these communities is assessed qualitatively. Refer to Section 4.3 (Tsunami) for more information about tsunami hazard.

Drought (Prime_Farmland)

Because rainfall patterns are generally similar throughout the Commonwealth (Grecni et al., 2021), it was assumed patterns of drought would affect the islands similarly. No data exists to model areas within the islands that are more exposed to drought conditions. Therefore, drought impacts were assessed on an island-wide scale.

To characterize the recent drought history, tabular data for Saipan and Rota were extracted from the Outside the Continental US (OCONUS) Drought Status webpage within the US Drought Monitor website (National Drought Mitigation Center, 2024) and data were charted to display the number of days classified as drought.

To assess the vulnerability of the Commonwealth to drought and its associated impacts, a qualitative assessment was conducted. Refer to Section 4.4 (Drought) for more information about the drought hazard.
Drought is expected to intensify in the CNMI as the climate continues to change. A qualitative analysis was conducted to evaluate additional future vulnerabilities due to climate change and other conditions.

Flood

Because flood risks for the Commonwealth cannot be evaluated via Hazus, the 2024 SHMP Update continues to use previous methods to evaluate vulnerability and loss estimates for all types of flood risks evaluated below as well as flood risks related to tropical cyclones and tsunami. In previous SSMPs, the FEMA Benefit-Cost Analysis Full Data Module (1999) was used to evaluate potential damage to buildings and infrastructure. Specifically, facilities situated within the coastal plain or located within a flood zone were assumed to have a 43% building damage estimate and 65% damage estimate for contents. Refer to Section 4.5 (Flood) for more information about the flood hazard.

Event-based (Event_based_Flooding, Event_based_Flooding_2100)

FEMA defines a Special Flood Hazard Area (SFHA) as the area that will be inundated by a flood event having a 1% chance of being equaled or exceeded in any given year (i.e., the 100-year flood). These areas are labeled as A-zones and V-zones in the FIRM. The Commonwealth has adopted the FEMA designated SFHA for the CNMI. To assess exposure of Commonwealth and general assets to a 1% annual-chance flood event, the National Flood Hazard Layer Digital Flood Insurance Rate Map (DFIRM) data (effective April 2006) for A-zones and V-zones were used for Rota, Saipan, and Tinian.

FEMA has not developed Flood Insurance Rate (FIRM) maps for the Northern Islands. A qualitative approach was used to assess vulnerability to event-based flooding in the Northern Islands.

The spatial extent of event-based flooding is expected to increase in the future due to climate change, specifically due to projected sea level rise (SLR). The US Fifth National Climate Assessment (USGCRP, 2023) provides several scenarios for SLR in the Western Pacific by 2100. For the 2024 SHMP Update, intermediate emission scenario with 3 ft of SLR for the Western Pacific was selected. Using the 2100 projection for the Western Pacific, SLR data for the CNMI was downloaded from NOAA's Digital Coast; however, this data does not incorporate storm surge. To account for storm surge, data for wave driven flooding developed by Storlazzi et al. (2019) was used by overlaying the polygons in the GIS and dissolving the boundaries into a single polygon. The resultant polygon was used to conduct an exposure analysis for current Commonwealth assets, projected changes in development and land use, and changes in population. Refer to Section 4.5 (Flood) for more information about event-based flooding.

Chronic Coastal Flooding (Chronic_Coastal_Flooding, Chronic_Coastal_Flooding_2100)

Spatial data from the NOAA's Digital Coast for high-tide flood was used to conduct an exposure analysis for passive flooding only. The spatial extent of chronic coastal flooding is expected to increase as sea level continues to rise due to changing climate conditions. Using the 2100 projection for SLR of 3 ft for the Western Pacific, SLR data for the CNMI was downloaded from NOAA's Digital Coast. Refer to Section 4.5 (Flood) for more information about chronic coastal flooding.

Coastal Erosion (Coastal_Erosion)

Coastal erosion hazards for Saipan were recently mapped in GIS in the *CNMI CDBG-MIT Program Initial Action Plan* (NMHC, 2023). This data layer was used to conduct an exposure analysis for Saipan. Assets within zones for high potential erosion were considered impacted and loss estimates were qualitatively assessed.

For Rota and Tinian, the erodible soils GIS layer developed by the National Fish and Wildlife Foundation and available on the CREST website (*Coastal Resilience Evaluation and Siting Tool (CREST)*, n.d.) was clipped to a 45 m buffer from the shoreline similar to the process develop for the coastal erosion hazard GIS layer for Saipan. An exposure analysis was conducted using the clipped erodible soil layer and assets within the highest class of probable erosion were considered vulnerable. Loss estimates for these assets were qualitatively assessed.

Although coastal erosion is expected to increase in correlation to SLR, increased storm intensity, and increased flooding, there were no readily available models to project future coastal erosion. A qualitative analysis was conducted to describe coastal erosion hazards on future development and changes in population.

<u>Wildfire (High_Fire_Vulnerability)</u>

A new wildfire map was recently developed for the Commonwealth (Bubb & Williams, 2022). Environmental variables of landcover, elevation, slope, aspect, temperature, and population were used as predictor variables for presence or absence of fire. Gridded map data for these predictors was then compared with the historic fire boundaries to train and validate the wildfire probability model. The results of this work generated a spatial dataset with probability of occurrence values ranging from 0%–100%. For the vulnerability analysis, four classes for the probability of occurrence were defined: 0–24%, 25–49%, 50–74% and < 75%.

An exposure analysis was conducted generating results for the probability of occurrence classes. For the purposes of the 2024 SHMP Update risk assessment, all physical assets in the 75% or greater probability of occurrence class were considered fully lost similar to the analysis for the *CNMI CDBG-MIT Program Initial Action Plan* (NMHC, 2023). Refer to Section 4.8 (Wildfire) for more information about the wildfire hazard.

<u>Extreme Wind Events (Rota_ExtremeWind_100Yr, Saipan_Tinian_ExtremeWind_100Yr)</u>

The FEMA Special Wind Region (SWR) Maps for the Commonwealth of the Northern Mariana Islands (CNMI) were used to analyze extreme wind events (FEMA, 2020). These data represent the forecasted highest potential wind speeds over a 100 year return period. Unlike all of the other datasets provided which are either point or polygon feature layers, these data are presented in raster format with cell values representing maximum wind speed in miles per hour.

D.2.1.3 Map Package

The Environmental Systems Research Institute (ESRI), Inc. has developed an easy way to share map documents developed with ESRI ArcGIS Pro software called map packages. A map package contains a map document (.mxd) and the data referenced by the layers it contains, packages into one portable file.

The map package developed for the 2024 SHMP Update contains pre-rendered maps and associated data bundled together for easy distribution and access. This package is designed to facilitate the sharing of visual and spatial information with stakeholders, allowing for quick dissemination of the SHMP findings and supporting informed decision-making. To access the map package, users must have ESRI ArcGIS Pro software. Users can copy the map package to their local workstation and double click the map package file to unpack both the geodatabase and map project to be opened in ArcGIS Pro.

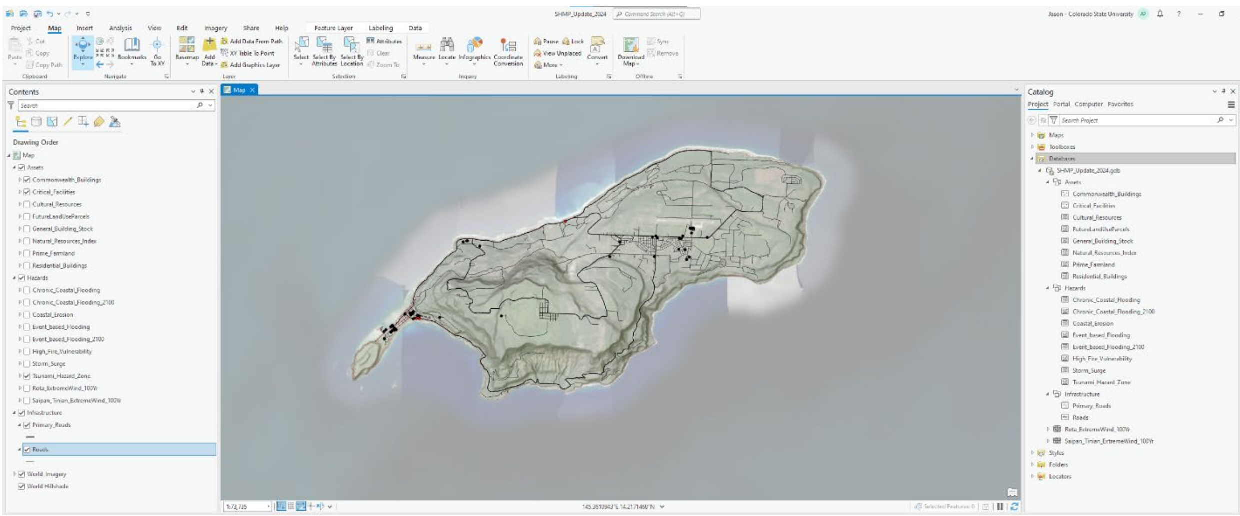


Figure D.2-2. Map Package as viewed in ArcGIS Pro.

D.2.1.4 Source Hazards Data

This dataset comprises unprocessed information on various natural hazards, including typhoons, tsunamis, droughts, floods, coastal erosion, and wildfires. The raw data formed the basis for subsequent analyses.

Table D.2-1. Geographic information system data sources used for risk assessment analyses.

Name of Data	Source	Year of Data Update
Commonwealth Owned/Operated Buildings	2018 Facilities Assessment Matrix (FAM), On-site Data Acquisition, Agency Staff Input	2024
Commonwealth Roads	OpenStreetMap	2024
Critical Facilities and Lifelines	2018 FAM, Emergency Management Office	2024
Commonwealth General Building Stock	OpenStreetMap, Hazus 6.0	2024
Socially Vulnerable Populations	General Building Stock with Social Vulnerability Index (SVI) smoothed	SVI 2014 Updated with 2024 General Building Stock
Terrestrial Wildlife Index	National Fish and Wildlife Fund	2022
Marine Index	National Fish and Wildlife Fund	2022
Historic Office Preservation	CNMI BECQ Open Data Portal	2023
Watersheds	CNMI CRMO	2023
Northern Mariana Decent Homesteads	Department of Public Lands	2019
DPL–layers for future development	Department of Public Lands	2019
1% Annual Chance Flood Event	FEMA	2006
Chronic Coastal (High Tide) Flood Event	NOAA Digital Coast	2021
Sea Level Rise for 3 ft	NOAA Digital Coast	2023
Storm-driven Wave Flood-Saipan/Tinian only	Storlazzi et al.	2019
Prime Agricultural Lands	USDA NRCS SSURGO	2022
Coastal Erosion-Saipan	Northern Mariana Housing Corporation	2022
Erodible Soils	NFWF RCRA	2020
Special Wind Maps	FEMA SWR	2020
Tsunami Inundation and Evacuation Zones	HSEM/PCRP	2023
Wildland Fire	CNMI CRMO	2020
Census tracts	US Census Bureau	2010

D.2.2 Typhoon

No additional data at this time.

D.2.3 Tsunami

Because the spatial analysis resulted in minimal exposure to parcels designated for potential future development, result tables are presented in Appendix D instead of Chapter 4.3 (Tsunami).

Table D.2-2. Parcels planned for future development exposure by municipality to the tsunami inundation zone.

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed: Land Use Type (sq miles)	Future Land Use Exposed: % Land Use Type Exposed for total Area of Each Land Use Type
Saipan			
Agricultural Homestead	0.07	0.00	0.0%
Civic Uses	0.04	0.00	0.0%
Homestead Village	0.10	0.00	0.0%
Recreation	0.36	0.00	0.0%
Renewable Energy	0.24	0.00	1.0%
School Relocation	0.11	0.00	0.1%
Saipan Total	**0.91**	**0.00**	**0.3%**
Tinian			
Agricultural Homestead	1.57	0.01	0.5%
Homestead Village	2.92	0.06	1.9%
Tinian Total	**4.48**	**0.06**	**1.4%**
Rota			
Civic Uses	0.14	0.00	0.0%
Cultural Visitor Center	0.01	0.00	0.0%
Homestead Village	2.62	0.00	0.0%
Power Plant	0.03	0.00	0.0%
Renewable Energy	0.10	0.00	0.0%
Rota Total	**2.90**	**0.00**	**0.0%**

D.2.4 Drought

No additional data at this time.

D.2.5 Flood

Because some spatial analysis resulted in minimal exposure of the assets to the hazard, the result tables are presented in Appendix D instead of Section 4.5 (Flood).

Table D.2-3. Suitable habitat for species of conservation concern exposure to the coastal erosion hazard by municipality.

			Suitable Habitat (SH) for Species of Conservation Concern Exposed	
Municipality	SH Index No.	SH Total Area (sq miles)	SH Area (sq miles)	% of SH Total Area
Saipan	1	26.5	0.5	1%
	2	14.5	0.3	0%
	3	27.8	0.5	1%
	4	4.0	0.1	0%
Saipan Total		**72.8**	**1.4**	**2%**
Tinian	1	1.8	0.0	0%
	2	35.8	0.7	1%
	3	7.8	0.3	1%
	4	0.1	0.0	0%
Tinian Total		**45.4**	**1.0**	**2%**
Rota	1	10.5	0.2	0%
	2	2.0	0.1	0%
	3	13.5	0.4	1%
	4	15.6	0.3	1%
Rota Total		**41.6**	**1.0**	**2%**

Table D.2-4. Cultural resources exposure to the coastal erosion hazard by municipality.

		Cultural Resources (CR) Exposed	
Municipality	CR Total Land Area (sq miles)	CR Land Area (sq miles)	% of CR Total Land Area
Saipan			
National Historic Landmark	14.9	0.2	1%
Sensitive Area	16.0	0.8	3%
Saipan Total	**30.9**	**1.0**	**3%**

Table D.2-3. Cultural resources exposure to the coastal erosion hazard by municipality (*cont'd*).

Municipality	CR Total Land Area (sq miles)	Cultural Resources (CR) Exposed: CR Land Area (sq miles)	Cultural Resources (CR) Exposed: % of CR Total Land Area
Tinian			
National Historic Landmark	0.0	0.0	0
Sensitive Area	16.6	0.3	2%
Tinian Total	**16.6**	**0.3**	**2%**
Rota			
National Historic Landmark	0.4	0.0	0%
Sensitive Area	33.9	0.9	3%
Rota Total	**34.3**	**0.9**	**3%**

Table D.2-5. Parcels planned for future development exposure by municipality to future event-based flood hazard and 3 feet of sea level rise.

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed: Land Use Type (sq miles)	Future Land Use Exposed: % Land Use Type Exposed for total Area of Each Land Use Type
Saipan			
Agricultural Homestead	0.07	0.00	0.00%
Civic Uses	0.04	0.00	0.00%
Homestead Village	0.10	0.00	0.00%
Recreation	0.36	0.00	0.00%
Renewable Energy	0.24	0.00	0.00%
School Relocation	0.11	0.00	0.00%
Saipan Total	**0.91**	**0.00**	**0.00%**
Tinian			
Agricultural Homestead	1.57	0.00	0.00%
Homestead Village	2.92	0.01	0.34%
Tinian Total	**4.48**	**0.01**	**0.22%**
Rota			
Civic Uses	0.14	0.00	0.00%
Cultural Visitor Center	0.01	0.00	0.00%
Homestead Village	2.62	0.00	0.00%
Power Plant	0.03	0.00	0.00%
Renewable Energy	0.10	0.00	0.00%
Rota Total	**2.90**	**0.00**	**0.00%**

Table D.2-6. Parcels planned for future development exposure by municipality to chronic coastal flooding with 3 feet of sea level rise.

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed: Land Use Type (sq miles)	Future Land Use Exposed: % Land Use Type Exposed for total Area of Each Land Use Type
Saipan			
Agricultural Homestead	0.07	0.00	0.00%
Civic Uses	0.04	0.00	0.00%
Homestead Village	0.10	0.00	0.00%
Recreation	0.36	0.00	0.00%
Renewable Energy	0.24	0.00	0.00%
School Relocation	0.11	0.00	0.00%
Saipan Total	**0.91**	**0.00**	**0.00%**
Tinian			
Agricultural Homestead	1.57	0.00	0.00%
Homestead Village	2.92	0.01	0.31%
Tinian Total	**4.48**	**0.01**	**0.20%**
Rota			
Civic Uses	0.14	0.00	0.00%
Cultural Visitor Center	0.01	0.00	0.00%
Homestead Village	2.62	0.00	0.00%
Power Plant	0.03	0.00	0.00%
Renewable Energy	0.10	0.00	0.00%
Rota Total	**2.90**	**0.00**	**0.00%**

Table D.2-7. Parcels planned for future development exposure by municipality to current coastal erosion hazards.

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed: Land Use Type (sq miles)	Future Land Use Exposed: % Land Use Type Exposed for total Area of Each Land Use Type
Saipan			
Agricultural Homestead	0.07	0.00	0.00%
Civic Uses	0.04	0.00	0.00%
Homestead Village	0.10	0.00	0.00%
Recreation	0.36	0.00	0.00%
Renewable Energy	0.24	0.00	0.32%
School Relocation	0.11	0.00	0.22%
Saipan Total	**0.91**	**0.00**	**0.11%**

Table D.2-6. Parcels planned for future development exposure by municipality to current coastal erosion hazards (*cont'd*).

Municipality	Total Area of Future Land Use Type (sq miles)	Future Land Use Exposed: Land Use Type (sq miles)	Future Land Use Exposed: % Land Use Type Exposed for total Area of Each Land Use Type
Tinian			
Agricultural Homestead	1.57	0.01	0.64%
Homestead Village	2.92	0.06	2.06%
Tinian Total	**4.48**	**0.07**	**1.56%**
Rota			
Civic Uses	0.14	0.00	0.00%
Cultural Visitor Center	0.01	0.00	0.00%
Homestead Village	2.62	0.00	0.00%
Power Plant	0.03	0.00	0.00%
Renewable Energy	0.10	0.00	0.00%
Rota Total	**2.90**	**0.00**	**0.00%**

D.2.6 Health Risk

No additional data at this time.

D.2.7 Extreme Heat and Heatwave

No additional data at this time.

D.2.8 Wildfire

No additional data at this time.

D.2.9 Earthquake

No additional data at this time.

D.2.10 Volcanic Activity

No additional data at this time.

D.2.11 Summary of Risks

For the 2024 SHMP Update, a questionnaire was provided to agency stakeholders to review current perspectives on how staff prioritize natural hazards. All the hazards addressed in the 2018 SSMP were included, and several new hazards were included to evaluate if these hazards are becoming more of a risk especially with climate change. New hazards included heatwave, public health risk, and land slide. Table D.2-8 presents the results from the agency stakeholder questionnaires and show how important agency staff consider each natural hazard. This prioritization may be slightly difference from the final relative rank assigned to each hazard as presented in Section 4.11. This difference reflects personal perceptions about hazards and data-driven ranking. Differences in ranking were discussed with stakeholders and adjustments were made to the final hazard prioritization present in the main body of the document.

Table D.2-8.CNMI agency staff natural hazard risk priority from questionnaire results.

Natural Hazard	Definition	Priority Rating
Typhoons & Tropical Storms	Is a tropical cyclone or localized, low-pressure weather system that has organized thunderstorms but no front (a boundary separating two air masses of different densities) and maximum sustained winds of at least 74 miles per hour.	High
Coastal Flooding (Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of high or rising tides or storm surges.	High
Coastal Erosion	Occurs as a result of flooding, typhoons or storm surges that wear away land resulting in beach, shoreline, or dune loss. This hazard can be long-term or short-term in scale.	High
Public Health Risk	A disease outbreak that spans several countries and affects a large number of people.	High
Coastal Flooding (Non-Typhoon related)	Occurs when water inundates or covers normally dry coastal land because of rising sea level.	Moderate
Earthquake	The shaking of the earth's surface by energy waves emitted by slowly moving tectonic plates overcoming friction with one another underneath the earth's surface.	Moderate
Wildfire	An unplanned fire burning in natural or wildland areas such as forests, shrub lands, grasslands, or prairies.	Moderate
Water Course Flooding	Occurs when streams or rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land.	Moderate
Heatwave	A period of abnormally and uncomfortably hot and unusually humid weather (greater than 90°F) typically lasting two or more days with temperatures outside the historical averages for a given area.	Moderate
Drought	A deficiency of rain over an extended period of time resulting in a water shortage.	Moderate

Table D.2-7.CNMI agency staff natural hazard risk priority from questionnaire results (*cont'd*).

Natural Hazard	Definition	Priority Rating
Tsunami	A wave, or series of waves, generated by an earthquake, landslide, volcanic eruption, or a large meteor strike in the ocean causing a rise or mounding of water at the ocean surface.	Low
Volcanic Activity	Occurs via vents that act as a conduit between the Earth's surface and inner layers, and erupt gas, molten rock, and volcanic ash when gas pressure and buoyancy drive molten rock upward and through zones of weakness in the Earth's crust.	Low
Landslide	The movement of a mass of rock, debris, or earth down a slope.	Low

References

Amidon, F., Metevier, M., & Miller, S. E. (2017). *Vegetation Mapping of the Mariana Islands: Commonwealth of the Northern Mariana Islands and Territory of Guam* (p. 94). US Pacific Fish and Wildlife Service.

Bubb, I. E., & Williams, Z. B. (2022). Spatial and Temporal Patterns of Fire on Saipan, CNMI. *Pacific Science*, *76*(1). https://doi.org/10.2984/76.1.1

CNMI Emergency Management Office. (2010). *Standard State Mitigation Plan, Commonwealth of the Northern Mariana Islands, pre-final May 2010* (p. 493). CNMI Emergency Management Office.

Greene, R., & Skeele, R. (2014). *Climate Change Vulnerability Assessment for the Island of Saipan* (p. 102). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

Coastal Resilience Evaluation and Siting Tool (CREST). (n.d.). Retrieved July 2, 2024, from https://resilientcoasts.org/#AnalyzeProjectSites

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020a). *Commonwealth of the Northern Mariana Islands Coastal Resilience Assessment* (p. 52). UNC Ashville National Environmental Modeling and Analysis Center.

Dobson, G., Johnson, I., Rhodes, K., Byler, K., & Lussier, B. (2020b). *Regional Coastal Resilience Assessments: Methodology and Data Report* (p. 74). UNC Ashville National Environmental Center.

[FEMA] Federal Emergency Management Agency. (2020). *Special Wind Region (SWR) Maps for the Commonwealth of the Northern Mariana Islands (CNMI)* (p. 11). US Department of Homeland Security.

Grecni, Z., Derrington, E. M., Greene, R., Miles, W., & Keener, V. (2021). *Climate Change in the Commonwealth of the Northern Mariana Islands: Indicators and Considerations for Key Sectors*. https://doi.org/10.5281/ZENODO.4426942

[HSEM] CNMI Homeland Security and Emergency Management. (2024). *2023 CNMI Threats and Hazards Identification Risk Assessment (THIRA)*. CNMI Homeland Security and Emergency Management.

Liske-Clark, J. (2015). *Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands 2015-2025* (p. 292). CNMI, Division of Fish and Wildlife.

National Drought Mitigation Center. (2024). *OCONUS Drought Status*. US Drought Monitor. https://droughtmonitor.unl.edu/DmData/OCONUSDroughtStatus.aspx

[NMHC] Northern Marianas Housing Corporation. (2023). *Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Initial Action Plan: 2018 Disasters Typhoon Mangkhut (DR 4396) and Typhoon Yutu (DR 4404)*. Northern Marianas Housing Corporation. https://opd.gov.mp/library/reports/2023-cdbg-dr-program-action-plan.pdf

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

[USGCRP] US Global Change Research Program. (2023). *Fifth National Climate Assessment*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Appendix E Mitigation Capabilities Supplement

28 July 2024

Table of Contents

List of Tables

Appendix E Mitigation Capabilities Supplement

E.1 Mitigation Capabilities Assessment

This appendix includes detailed information that supports the Capability Assessment discussion in Chapter 5 (Capability Assessment) of the 2024 State Hazard Mitigation Plan (SHMP) Update. The goal of this assessment was not to identify all capabilities an agency may have, but only those that are currently used or could be used to support mitigation efforts. Capabilities are generally arranged by agency. Information is provided for each capability as appropriate:

- **Capability Summary**—Provides a high level overview of the capability in terms of capability type, effect on loss reduction, and if the capability provides funding.
  - **Type of Hazard Management Capability**—Indicates whether the capability applies pre- or post-disaster.
  - **Effect on Loss Reduction**—Indicates if the capability supports, facilitates, or conflicts with hazard mitigation goals.
  - **Funding**—Indicates if the capability provides funding for mitigation.
- **Capability Category**—Lists which capability category the capability best aligns with (i.e., Planning and Regulatory; Administrative and Technical; Capital Projects and Maintenance; Financial; Education, Outreach, and Capacity Building; Disaster Response/Recovery).
- **Capability Description**—Provides a brief, succinct description of the capability.
- **Notable changes**—Description of any significant changes that have impacted the capability since the 2018 SSMP was developed. Changes include but are not limited to plan updates, changes in staff/resources, changes in administrative rules or amendment to law, etc.
- **Challenges**—Describes any issues with implementing the capability, capability effectiveness or any aspects of the capability that conflict with hazard mitigation goals. Challenges include but are not limited to a lack of funding or staff training for implementation, outdated information, policies, or procedures, etc.
- **Opportunities**—Describes identified opportunities to address challenges, integrate mitigation goals, or otherwise enhance capabilities.
- **Effect on Future Conditions**—Describes how the capability integrates future conditions (i.e., climate change).

- **Equitable Outcomes**—Describes how the capability helps advance equitable outcomes for socially vulnerable populations.
- **Community Lifelines**—Lists which FEMA community lifeline(s) the capability supports (i.e., Safety and Security; Food, Water, Shelter; Health and Medical; Energy; Communications; Transportation; and/or Hazardous Materials).
- **Hazards**—Lists the hazard(s) of concern that the capability addresses.
- **SHMP Objectives**—Lists the SHMP objectives(s) the capability advances.

Mitigation capability categories are:

1) Administrative and Technical
2) Education, Outreach, and Capacity Building
3) Planning and Regulatory
4) Disaster Response / Recovery
5) Financial
6) Capital Project and Maintenance.

E.1.1 Office of the Governor

The Office of the Governor is the chief executive office and manages the executive branch of the Commonwealth of the Northern Mariana Islands (CNMI) Government. Strategic goals include growing and diversifying the CNMI economy, modernizing and improving the efficiency of government services, strengthening partnerships with federal agencies and regional entities, protecting the vulnerable, implementing programs that protect and sustain the CNMI's natural resources, expediting ongoing and new infrastructure projects and growing renewable energy programs, bolstering healthcare services, and expanding digital equity and inclusion. Table E.1-1 includes information on hazard mitigation related capabilities for the Office of the Governor

Table E.1-1. Office of the Governor Capabilities.

Capital Improvement Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Capability Summary:	❖	❖	❖	❖		❖
Capability Category:	Capital Project and Maintenance					
Description:	The Capital Improvement Program (CIP) funds and manages capital improvement projects through annual funding from the Office of Insular Affairs (OIA), Department of the Interior, through Section 702 of the CNMI Covenant. The mission of CIP is to manage project in accordance with critical needs in health, education, power, water, wastewater, and solid waste.					
Notable Changes:	Audit delays has impacted funding levels from OIA.					
Opportunities:	Opportunities to integrate hazard mitigation goals, including *Smart, Safe Growth* Principles into project designs. Projects can be aligned with Sustainable Development Goals (SDG) to work toward greater community equity.					
Challenges:	Economic downturn due to COVID and budget shortfalls.					
Effect on Future Conditions:	None Identified					
Equitable Outcomes:	Aligning with SDG goals can increase equitable outcomes.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	1,5,7					

Table E.1-1. Office of the Governor Capabilities (*cont'd*).

CNMI Disaster Recovery Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:		❖	❖	❖		❖
Category:	Disaster Response and Recovery					
Description:	The CNMI Disaster Recovery website is managed by the Office of Grants management and State Clearing House and Department of Finance. OIA funds were used to develop the website and the goal is to streamline financial management and reporting efforts for disaster-related grants, especially Super Typhoon *Yutu* and Typhoon *Mangkhut.*					
Notable Changes:	This is a new capability.					
Opportunities:	Increases accountability and transparency for federally funded programs and projects associated with recovery efforts. The website also lists various disaster-related funding sources and programs available to the public.					
Challenges:	None Identified as this is a new capability.					
Effect on Future Conditions:	None Identified.					
Equitable Outcomes:	Improves access to federal and grant programs to aid the public in disaster recovery.					
Community Lifelines:	Energy, Food, Water, Shelter, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Flood					
Support SHMP Objectives:	1, 5, 7					

Community Development Block Grant Infrastructure Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Disaster Response / Recovery					
Description:	The CNMI Community Development Block Grant–Disaster Reduction Program is focused on meeting the unmet need after Super Typhoon *Yutu* and Typhoon Mangkhut. The program aims to rebuild and strengthen current facilities and to build more resilient structures that can withstand future disasters. The program funds public facilities, roads, and utilities projects.					
Notable Changes:	None identified.					
Opportunities:	Opportunities to integrate hazard mitigation goals, including *Smart, Safe Growth* Principles into project designs. Projects can be aligned with Sustainable Development Goals (SDG) to work toward greater community equity.					
Challenges:	Ensuring projects meet grant specifications and time to implement projects.					
Effect on Future Conditions:	More resilient infrastructure better able to withstand future hazards including increasingly severe weather events due to climate change.					
Equitable Outcomes:	Aligning with SDG goals can increase equitable outcomes.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Flood					
Supports SHMP Objective:	1					

Table E.1-1. Office of the Governor Capabilities (*cont'd*).

Infrastructure and Recovery Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:		❖	❖	❖		
Category:	Disaster Response and Recovery					
Description:	The Infrastructure and Recovery Program (IRP) was created to help expedite federally funded projects for different government agencies. The IRP dedicates resources and subject matter experts to agencies to facility completion of federally funded projects and to meet local and federal permitting requirements. IRP provides technical assistance in the following areas: Archaeological assessments, Section 106 review and monitoring, biological assessments and repots, engineering consultation and review, engineering inspection and monitoring, stakeholder coordination and liaising, planning and logistics for trainings, and technical writing assistance.					
Notable Changes:	None identified.					
Opportunities:	Streamline resource use and speed up project timelines.					
Challenges:	None identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Flood					
Supports SHMP Objectives:	1, 3					

Planning and Development Advisory Council (PDAC)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Administrative and Technical					
Description:	The Planning and Development Advisory DAC was established under Public Law 20-20. The PDAC is an advisory group comprised of the Bureau of Environmental & Coastal Quality, Commonwealth Utilities Corporation, Department of Public Works, Department of Public Lands, Department of Lands and Natural Resources, the CNMI Department of Commerce, the Commonwealth Zoning Board, the Office of Planning and Development, the Marianas Visitors Authority, the Office of the Mayors, and the Chamber of Commerce. They provide oversight and recommendations to the Office of Planning and Development. There are several taskforces within the PDAC that concentrate in specific areas including: 1) Socioeconomic and Disaster Risk Reduction, 2) Built Environment, and 3) Natural Resources.					
Notable Changes:	None Identified					
Opportunities:	The PDAC provides continuity in cross-agency planning initiatives and helps to guide progress toward Sustainable Development Goals. The PDAC is uniquely positioned to guide mitigation efforts to incorporate *Smart, Safe Growth* Principles to ensure CNMI builds back better and results in more resilient communities in the future.					
Challenges:	Advisory role only.					
Effect on Future Conditions:	More resilient infrastructure better able to withstand future hazards including increasingly severe weather events due to climate change.					
Equitable Outcomes:	Through planning recommendations, PDAC can influence more equitable outcomes in future development projects.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1,2,3,4,5					

Table E.1-1. Office of the Governor Capabilities (*cont'd*).

Commonwealth Planning Act, Office of Planning and Development (OPD)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The CNMI Planning and Development Act of 2017 (Public Law 20-20, 1 CMC §§ 20171–20186) established the Office of Planning and Development (OPD). The law is intended to guide the growth of the CNMI through improved planning to increase the effectiveness of government and private actions as well as coordination among different agencies and levels of government. The law mandates that the OPD establish Commonwealth planning policy guidance that all agencies, departments, boards, commissions, and other instrumentalities of the government of the CNMI:					
Notable Changes:	None identified					
Opportunities:	Coordinate future development initiatives among agencies to streamline resource use. Algin future development project with Sustainable Development Goals (SDG) and ensure projects are implemented with a *Smart, Safe Growth* framework to increase the resiliency of the built environment and to track progress toward the SDG.					
Challenges:	None identified.					
Effect on Future Conditions:	Increased agency coordination and implementation of actions that improve the CNMI resiliency to outside shocks, including natural hazards, and that improve the ability to recover quickly from disturbances, hazards, or other events.					
Equitable Outcomes:	Provisions of the planning act and the Comprehensive Sustainable Development Plan focus on increasing equity.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1,2,3,4,5					

Comprehensive Sustainable Development Plan (CSDP)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	Under Public Law 20-20 § 2013(a), the OPD was directed to establish a Comprehensive Sustainable Development Plan (CSDP) that would serve as a guide for future long-range development using and improving on existing plans, maps, and other resources.					
Notable Changes:	A *Draft—2023 Resources Report* to track progress toward SDG was prepared (OPD, in prep.).					
Opportunities:	Continue to track progress toward SDG and make recommendations to agencies and legislators to prioritize funding and projects aimed at increasing resiliency and sustainability.					
Challenges:	None identified.					
Effect on Future Conditions:	Future development becomes increasingly sustainable, equitable, and resilient.					
Equitable Outcomes:	Several SDG focus on increasing equitable outcomes for socially vulnerable groups.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake					
Supports SHMP Objectives:	1, 2, 3, 4, 6					

Table E.1-1. Office of the Governor Capabilities (*cont'd*).

Energy Task Force	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖	❖	
Category:	Planning and Regulatory					
Description:	The Energy Task Force (ETF) as established by Executive Order 2021-16 is comprised of Department of Public Works–Energy division, Commonwealth Utilities Corporation, and OPS in coordination with the Office of Grants Management. The ETF aims to update the Strategic Energy Plan from 2013. This plan will identify goals to reduce energy costs and lower carbon emissions.					
Notable Changes:	The update to the 2013 plan is significant. The updated draft has more focus on renewable energy.					
Opportunities:	Potential to reduce the high cost of energy from burning petroleum.					
Challenges:	Existing contracts for petroleum commit CNMI to a particular pathway for the period of time. Renewable energy solutions remain costly. High winds during typhoons may negatively impact solar installations.					
Effect on Future Conditions:	Reduce dependency on petroleum for energy and reduce carbon emissions. However, risks to renewable energy infrastructure, notably typhoon wind effects on solar panels, need to be considered and mitigated.					
Equitable Outcomes:	Not identified					
Community Lifelines:	Energy					
Hazards:	Typhoon					
Supports SHMP Objective:	1					

Mariana Mappers Working Group	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The OPD facilitates the Mariana Mappers Work Group, which includes CNMI agencies involved in maintaining GIS information and other federal and non-governmental organizational stakeholders working to develop geospatial information for planning in the CNMI. The Mariana Mappers Working Group helps to coordinate and disseminate geospatial information. The Working Group has complied geospatial information pertaining to the CNMI, and information is available for download on the OPD website					
Notable Changes:	Substantial gaps remain in spatial data available for the CNMI. These data gaps contribute to a lack of usable data in online tools, data products, and maps to assist with planning and mitigation efforts.					
Opportunities:	With multiple CNMI agencies and other stakeholders participating in the Working Group, pressing data gaps can be identified and addressed. The Group can play a role in ensuring consistency and accuracy in CNMI geospatial data and information.					
Challenges:	Some CNMI agencies still lack GIS capabilities and lack of funding for software can impede forward progress. Agencies remain proprietary with information and an agreement among agencies for data sharing is lacking.					
Effect on Future Conditions:	Improvements in geospatial data will assist planners to design mitigation actions more effectively.					
Equitable Outcomes:	Developing geospatial data for underserved communities will help to better describe risks posed by natural hazards. Understanding risks will help planners develop effective mitigation actions and emergency response plans that account for underserved communities.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3, 4, 5, 6, 8					

E.1.2 Bureau of Environmental and Coastal Quality

The Bureau of Environmental and Coastal Quality (BECQ), Division of Environmental Quality (DEQ) is responsible for protecting, preserving, and enhancing the environmental quality of water, air, and land of the Commonwealth. DEQ ensures compliance with hazardous waste regulations. Strategic goals include inter-agency collaboration with various government agencies, private partners, and citizens of the Commonwealth to ensure healthy communities and a green and sustainable environment by encouraging land use master planning, floodplain management, and the development of zoning and building code legislation with a focus on reducing risks of coastal hazards to people and the environment. Table E.1-2 includes information on hazard mitigation related capabilities for the Bureau of Environmental and Coastal Quality.

Table E.1-2 Bureau of Environmental & Coastal Quality capabilities.

Areas of Particular Concern	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Division of Costal Resources Management (DCRM) Permitting Section is responsible for permitting minor and major developments and/or projects that are situated within and around the DCRM designated Areas of Particular Concern, a geographically delineated area with special management requirements, including developments that have the potential to cause significant adverse impacts to coast resources.					
Notable Changes:	One-Start Permit Application process route applications to partner regulatory agencies for review. The BECQ Public Permitting web application is a publicly available tool to assist in making informed development decisions.					
Opportunities:	Opportunity to improve inter-agency coordination of permit review and approval processes by CRM Agency Board. Opportunity to update existing cultural resources data.					
Challenges:	None identified.					
Effect on Future Conditions:	Ongoing development pressures may complicate cultural resources management policy; Historic Preservation Plan update pending with Historic Preservation Office. Future development and land use becomes increasingly sustainable, equitable, and resilient.					
Equitable Outcomes:	None identified					
Community Lifelines:	Water Systems					
Hazards:	Typhoon, Tsunami, Flood, Wildfire					
Supports SHMP Objectives:	3, 8					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Clean Water Act Section 401 Water Quality Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Clean Water Section 401 Water Quality Program established water quality certification procedures for federal licenses or permits that authorize an activity that may result in a discharge to US waters within the CNMI. A water quality certification ensures that a discharge from a federally licensed or permitted activity will comply with CNMI Water Quality Standards.					
Notable Changes:	In 2019, a new strategy for better building practices was adopted to address coastal hazards. The guidebook *Better Buildings Practices in the CNMI: Addressing Coastal Hazards Through Responsible Development and Resiliency* (2022) and Better Building and Development Practices through permit incentives are used to address cumulative and secondary impacts of stormwater runoff and non-point source pollution on shoreline and coastal waters.					
Opportunities:	Promote better building and development practices through DCRM permit incentives through Better Building and Development Practices.					
Challenges:	CNMI remains under federal stipulated orders for violating the Clean Water Act and the Safe Water Drinking Act issues in 2008. Implementing provisions in the stipulated orders remains challenging.					
Effect on Future Conditions:	Future Support and Propagation of Aquatic Life, Land Development, and Recreational Land Use becomes increasingly sustainable, equitable, and resilient.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Water Systems, Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Flood, Wildfire					
Supports SHMP Objectives:	5, 6					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Coastal Zone Management	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Division of Coastal Resources Management (DCRM) administers the federal Coastal Zone Management Act of 1972 to promote efficient resources management through coordination across CNMI departments to achieve 23 legislative policies, including to "plan for and manage any use or activity with the potential for causing a direct and significant impact on coast resources" (Public Law 3-47, 2 CMC § 1500 et seq.). The DCRM provides technical assistance and enforces the laws that affect the Commonwealth's coastal uses and resources. The DCRM has the authority to review certain federal actions that affect coastal uses or resources to ensure the activities are consistent with enforceable policies approved by NOAA.					
Notable Changes:	The *2016–2020 Section 309 Assessment* (2016) showed a need to maintain a high priority focus on coastal hazards, cumulative and secondary impacts, ocean resources, and wetlands enhancement areas, and Special Area Management Planning as a medium priority area. Coastal hazards remain a high priority for the CNMI Coastal Management Program due to historic, current, and projected impacts on CNMI shorelines, coastal infrastructure, and freshwater resources.					
Opportunities:	1) Adopt regulations and policies to reduce exposure to risk in coastal hazard areas, including shoreline setback requirements and buffer enhancement incentives in high-risk areas; 2) adopt policies and laws to incorporate coastal hazard considerations in the permitting process and enhance public support and awareness of these risks and potential solutions; 3) develop policy support and incentives to facilitate protection of natural hazard mitigation features; 4) promote better building and development practices through DCRM permit incentives, and 5) create a DCRM-specific coastal hazards guidance plan that will help DCRM better address and mitigate coastal hazards.					
Challenges:	Pollutants in nearshore waters is generally a result of coastal development, land clearing, burning, and other activities that alter the landscape. Pesticides, herbicides, petroleum products, and other chemicals can interfere with important physiological processes, such as reproduction and growth, of corals and other marine organisms. In addition to supplying an excess of nutrients and other chemicals to coastal waters, sewage discharge and runoff may also introduce pathogens that directly cause diseases of marine organisms.					
Effect on Future Conditions:	Coastal protections will continue to help improve near shore waters, provide guidelines for responsible development, and continue to identify, implement, and manage mitigation projects.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Water Systems, Transportation, Hazardous Materials					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	2, 3, 5, 8					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Commonwealth Environmental Protection Act	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Commonwealth Environmental Protection Act of 1982, 2 CMC §§ 3101 to 3135 et seq., Public Law 3-23, and Public Law 11-103 was established to promote and enforce environmental standards to protect and preserve marine resources, uninhabited islands, and the overall natural environment. It empowers the DEQ to administer, implement, and enforce environmental measures. The regulations include solid waste management, earthmoving, erosion control, and aboveground storage tank regulations.					
Notable Changes:	No notable changes were made to the laws and regulations of the last 5 years. The Commonwealth continues to improve online access to permits and the permitting process. The BECQ developed *The Permitting Process* website and the *BECQ Permitting Application* to assist development project proponents comply with Commonwealth environmental laws and regulations throughout the permitting process.					
Opportunities:	Per the *Guidance Manual for Smart, Safe Growth (SSG)* (NES, 2018), several Title 65 regulation require revision to effectively guide contemporary and future activities in accordance with *SSG* principles.					
Challenges:	Many of the environmental regulations have not been updated recently.					
Effect on Future Conditions:	Environmental laws and regulations guide development in a manner that supports healthy public environment and protects natural and cultural resources. These law and regulations are often aligned with and support mitigation actions that reduce risks from natural hazards Through implementation of the current and/or updates laws and regulations the commonwealth can continue to protect the environment and have a positive impact on hazard risk reduction.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Water, Shelter, Water Systems, Hazardous Materials					
Hazards:	Typhoon, Drought, Flood, Extreme Heat, Wildfire, Volcanic Activity					
Supports SHMP Objectives:	5, 6					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Member of Environmental Council of States	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Administrative and Technical					
Description:	The Environmental Council of States (ECOS) is the national nonprofit, nonpartisan association of state and territorial environmental agency leaders. The purpose of the ECOS is to improve the capability of state environmental agencies and their leaders to protect and improve human health and the environment. ECOS provides leadership on environmental issues of national importance and plays a critical role in facilitating a quality relationship among and between Federal and State agencies.					
Notable Changes:	In April 2024, ECOS released the 2023–2024 priorities which include building state capacity, saving the State Revolving Funds, funding/managing per– and polyfluoroalkyl substances (PFAS) responsibilities, accelerating the economy, and advancing innovation/productivity.					
Opportunities:	Gather information and resources to help efficiently and effectively address important topics relevant to public health and the environment.					
Challenges:	None identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Hazardous Materials, Energy, Water Systems					
Hazards:	Flood, Health Risk					
Supports SHMP Objectives:	3, 4					

Flood Hazard Assessment	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The CNMI Climate Impact Viewer v2022 is a map collating all available spatial data related to potential and existing climate impact or hazards in the CNMI. The map is an active project that is updated as new data becomes available. The BECQ Open Data Portal for Flood Hazard Zones in the CNMI delineates flood hazard zones for the islands of Saipan, Tinian, and Rota. The layers represent A, AE, AO, V and VE flood hazard zones as designated by FEMA Flood Insurance Rate Maps (FIRMs).					
Notable Changes:	The dataset was last updated on June 6, 2019.					
Opportunities:	Opportunity to update FIRMs based on projected future conditions and/or 100 year sea level extremes and an updated flood study to re-delineate flood zone boundaries and re-establish base flood elevations (BFEs) for the CNMI.					
Challenges:	Outdated FIRMs are being used to identify flood risk for planning and development practices.					
Effect on Future Conditions:	New FIRMs will allow communities in the CNMI to have updated flood risk information that can inform support Smart, Safe Growth planning and guide coastal development, public access management and permitting for the Coastal Management Program and other efforts to reduce the impact of flooding to structures, lower flood insurance premiums, plan mitigation risk and reduce losses, understand flood hazard data, support staff training, and assist with hazard mitigation grant projects					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Hydration, Shelter, Energy, Transportation, Hazardous Materials, Water Systems					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	1, 2, 3, 4, 8					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Hazardous Waste Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Planning and Regulatory					
Description:	The Hazardous Materials Program is responsible for conducting inspections of waste generators that include auto dealers and repair shops, heavy equipment shops, medical clinics, printing/photo shops, golf resorts, dry cleaners, garment factories and commercial establishments including government facilities (DPW, DLNR, CUC, PSS, Office of the Mayor) to determine the facility's compliance with Hazardous Waste Management Regulations. Facility compliance with the Hazardous Waste Management Regulations (Chapter 65-50) is determined by the DEQ.					
Notable Changes:	In 2021, the US Environmental Protection Agency awarded $5,693,217 to support effective hazardous and solid waste management to further address impacts of 2018 Super Typhoon *Yutu*. The funding allows for repairs to the Marpi Landfill and improve waste management resilience to minimize future damage, complete disaster debris clean up, increase the capacity of the BECQ to conduct regulatory and outreach activities for the solid and zero waste programs, develop a Comprehensive Integrated Solid Waste Management Plan that covers the islands of Saipan, Tinian and Rota, and a Zero Waste Management Plan for the island of Tinian. A multi-agency Emergency Response team, which includes DEQ, Emergency Management, the Departments of Public Safety and Public Works, Coastal Resources Management, Office of the Mayor, and Common Ports Authority–Aircraft Rescue and Fire Fighting, is equipped to response to natural and human-caused disasters such as typhoons, earthquakes, and chemical and oil spills. The importance of such emergency response capabilities was highlighted by Typhoon *Soudelor*, which ruptured a fuel tank at the Mobil Oil facility at the Saipan Port on August 5, 2015.					
Opportunities:	Opportunity to build capabilities to deploy HazMat teams to conduct assessments and execute response operations to control the release and effects of contaminants at bulk fuel facilities, utility facilities, inundated sites, and other sources of contaminant release within 24-hours. Opportunity to improve water quality, wastewater treatment and safe reuse by eliminating dumping and minimize release of hazardous chemicals and materials.					
Challenges:	There is no current HazMat Task Force established in the CNMI.					
Effect on Future Conditions:	Holistic approach to infrastructure resiliency includes the reduction and safe management of hazardous waste and disaster debris with waste reduction, reuse, recycling, composting, and solid and hazardous waste disposal infrastructure.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Hazardous Materials					
Hazards:	Typhoon, Tsunami, Flood, Wildfire					
Supports SHMP Objectives:	1, 3, 4, 5, 6					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Hazardous Waste Regulations	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	In 2008, DEQ promulgated new Hazardous Waste Management Regulations that repealed and replaced the regulations originally codified in Chapter 65-50 § 001. These regulations are intended to address potential sources of pollution that may result from hazardous waste. To ensure the proper management of hazardous waste from cradle to grave, handlers of hazardous waste are required to meet acceptable standards and practices applicable to their specific waste type and quantity. These regulations are promulgated by the Division of Environmental Quality pursuant to the Commonwealth Environmental Protection Act, 1982, 2 CMC §§ 3101 to 3135, Public Law 3-23 and Public Law 11-103. Waste is considered hazardous if it appears on one of four lists published in the Code of Federal Regulations (40 CFR Part 261). Currently, more than 500 wastes are listed.					
Notable Changes:	Since 2020, representatives from BECQ, DPW, Offices of the Mayors of Tinian and Rota, and the US Environmental Protection Agency have been working together as an Inter-island Solid Waste Management Taskforce.					
Opportunities:	Opportunity to achieve environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.					
Challenges:	Illegal dumping and release of hazardous chemicals and materials.					
Effect on Future Conditions:	Responsible consumption and production of hazardous waste to protect the built and natural environment.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Hazardous Materials					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	1, 2, 5, 6					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

NPDES Wastewater Discharge Permits	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Clean Water Act prohibits discharging pollutants through a point source into a water of the US unless a National Pollutant Discharge Elimination System (PDES) permit is issued. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure the discharge does not hurt water quality or people's health. US Environmental Protection Agency, Pacific Southwest (Region 9) issues all NPDES permits within the CNMI.					
Notable Changes:	Sadog Tasi Wastewater Treatment Plan, Agingan Wastewater Treatment Plant, Mañagaha Island Wastewater Treatment Plant, and Mobil Oil Saipan Terminal permits issued since the 2018 SSMP update. CUC received local and federal funds from the CNMI and US government to rehabilitate and repair existing wastewater infrastructure to include wastewater lift station and treatment plant rehabilitations. These improvements will assist CUC to comply fully with the NPDES requirements.					
Opportunities:	Opportunity to ensure availability and sustainable management of water and sanitation for all.					
Challenges:	CNMI remains under federal stipulated orders for violating the Clean Water Act and the Safe Water Drinking Act issues in 2008. Implementing provisions in the stipulated orders remains challenging.					
Effect on Future Conditions:	Continue to regulate pollutants to ensure water quality does not degrade further and works towards quality improvements.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Water Systems					
Hazards:	Typhoon, Tsunami, Flood, Wildfire					
Support SHMP Objectives:	5, 6					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Costal Resources Management Regulation Title 15-10	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category and	Planning and Regulatory					
Description:	Title 15-10 Coastal Resources Management Rules and Regulations of the CNMI Administrative Code provides regulations for permitting minor and major developments and/or projects that are situated within and around the DCRM designated Areas of Particular Concern (APC). In 2018, to encourage better building practices that minimize impacts to coastal resources, § 15-10-205 (h)(5)(i)(A) and (B) was amended to establish discounted permit fees for qualifying low impact development projects.					
Notable Changes:	The *Better Buildings Practices in the CNMI: Addressing Coastal Hazards Through Responsible Development and Resiliency* (2022) guide incentivizes the use of more environmentally friendly development and building practices in the CNMI. The low-impact development (LID) building practices and enhancements will be promoted to developers as incentives built into DCRM's permitting system. This strategy includes cooperative efforts with other regulatory and permitting agencies as well as the CNMI legislature with the goal of implementing similar incentives and practices outside of DCRM.					
Opportunities:	Opportunity for inter-agency coordination. Incorporate *Smart, Safe Growth Principles* in permitting to ensure promote development that is resilient to future natural hazards. Opportunity to sequence projects to ensure adequate oversight and inspections and enforcement (NES, 2018).					
Challenges:	The CRM Board, composed of appointed representatives from DCRM, DEQ, Department of Public Work (DPW), Department of Land and Natural Resources (DLNR), Historic Preservation Office (HPO), and the Commonwealth Utilities Corporation (CUC), review and approve permits for all major development in the CNMI. The current permit review and approval processes are essentially done independently by each agency with little coordination (i.e., "stove pipes")					
Effect on Future Conditions:	Support more resilient projects and communities in the CNMI.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Water, Shelter, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Wildfire					
Supports SHMP Objectives:	2, 3, 4					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

One Start Permit Process	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The One Start permitting process was implemented in 2023 to streamline the permitting process for minor land clearing to reduce the review/decision timeline for applicants. Through the One Start permit process, permittees are assured that all regulatory requirements from CRM, HPO, DFW, DEQ, and their respective federal counterparts have been met. A Zoning permit is a prerequisite.					
Notable Changes:	In 2023 a Memorandum of Agreement was established by Governor Palacios and the Secretaries of DLNR, DCCA, and BECQ to implement the One Start permit process.					
Opportunities:	The streamlined permit process expedited the permit review process while allowing required regulatory review. The new process will facilitate hazard mitigation projects and other federally funded infrastructure projects move proceed in a more timely manner.					
Challenges:	The pace of regulatory review often stalls the pace of federally funded infrastructure projects, including hazard mitigation projects.					
Effect on Future Conditions:	Expediting permit issuance can improve the pace of infrastructure and hazard mitigation projects. Completing hazard mitigation and infrastructure projects will help to improve the resilience of the built environment and reduce the risk from natural hazards.					
Equitable Outcomes:	Federally funded projects often have criteria to improve service to historically underserved communities. By increasing the number of federally funded projects completed can have a positive impact on underserved communities.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Public Safey, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Extreme Heat, Wildfire, Earthquake					
Supports SHMP Objectives:	1, 2, 3, 6					

Permitting Application and Hazard Assessment Tool	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category and	Planning and Regulatory					
Description:	The BECQ Permitting App hosts public information that can help inform development decisions. Layers include locations of Areas of Particular Concern (APCs) as well as other environmental data such as groundwater protection zone designations, soil maps, and fault lines. BECQ continues to add layers as new data becomes available.					
Notable Changes:	New hazards layers for wildfire and tsunami were added to the application.					
Opportunities:	Incorporate *Smart, Safe Growth Principles* in the permitting process.					
Challenges:	None identified.					
Effect on Future Conditions:	Support more resilient projects and communities in the CNMI.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Water, Shelter, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	2, 3, 4					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Safe Drinking Water Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Safe Drinking Water program is responsible for regulating public water system through the training, testing and certification of water treatment plant operators, inspecting public water systems on a periodic basis, reviewing designs of new or modified public water systems, tracking the water monitoring and compliance activities of public water systems, and investigating drinking water violations and responding to drinking water complaints.					
Notable Changes:	The Commonwealth Utilities Corporation (CUC) has improved its water transmission and distribution systems (i.e. new water mains, water tanks, booster stations, etc.). Improvements were funded by local and federal partners such as OIA, EPA, EDA. CUC continues to work with BECQ to improve its standards of operations and the quality of water supplied to the community.					
Opportunities:	None identified.					
Challenges:	None identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Water Systems					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	1, 6					

Shoreline Monitoring Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Shoreline Monitoring Program measures changes in beach contour over time to identify erosion, accretion, stable or undetermined beach sites. The program aims to inform coastal planning and development by providing data on beach dynamics. The BECQ Open Data Portal displays headstakes, identified objects serving as the starting point of a beach transect, used for shoreline monitoring.					
Notable Changes:	None identified.					
Opportunities:	Opportunity to integrate LiDAR for capturing sediment volumes pre and post storms.					
Challenges:	Storm-driven erosion is the primary cause of beach loss in the CNMI, and it threatens infrastructure close to the waterline and endangers beach users. As sandy beaches are lost, the vulnerability of beach front communities and infrastructure to storm surge and coastal erosion increases. Sea level rise is expected to cause retreat of coastlines worldwide. The stretch between Micro Beach and Fiesta on the island of Saipan continues to erode during high wave conditions, presenting itself as a priority for management and planning actions.					
Effect on Future Conditions:	Ongoing beach monitoring.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Transportation, Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	4, 8					

Table E.1-2. Bureau of Environmental & Coastal Quality capabilities (*cont'd*).

Water Quality Surveillance and Non-Point Source Monitoring Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Water Quality Surveillance and Non-Point Source (WQS/NPS) program is funded by the US EPA via the Clean Water Act. Funding is used to monitor and evaluate the health of marine waters and freshwater streams, lakes and wetlands through regular sampling and analysis, and ground-truthed assessments. Waters that fail to meet quality standards are considered impaired and are listed in the 303(b) report. Impaired waters are further studied by the Stream Dream Team, who conduct watershed sanitary survey assessments, map streams using GPS and ArcGIS, and test water quality to identify and map the sources of pollutants.					
Notable Changes:	The updated *2021–2025 Section 309 Assessment and Strategy Report* (2020) outlines progress toward goals outlined in the 2016–2020 plan.					
Opportunities:	Opportunity to reduce the impacts of stormwater runoff and non-point source pollution on the CNMI's shoreline and coastal waters by promoting Better Building and Development Practices through DCRM Permit Incentives.					
Challenges:	The most common sources of Enterococci contamination are from point sources and non-point sources. Wastewater can enter coastal waters at discrete locations, such as sewage outfalls (i.e., point source pollution), or diffusely across a relatively large area (i.e., non-point source pollution).					
Effect on Future Conditions:	Ongoing monitoring efforts.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Wildfire					
Supports SHMP Objectives:	5, 6, 8					

Watershed Management	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Division of Coastal Resources and Management (DCRM) leads watershed management planning as a tool to reduce pollution and protect coral reefs. Management is done in partnership with the BEQC DEQ, which is responsible for monitoring inland and marine waters. Saipan has 11 watersheds and three have management plans. The Talakhaya watershed on Rota also has a management plan.					
Notable Changes:	The Army Corps of Engineers produce the *CNMI Final Post-Disaster Watershed Management Plan* (2022).					
Opportunities:	Watershed management helps improve inland and marine waters and reduce the frequency and severity of wildfires, improving native species habitats. Coordination with the Division of Fish and Wildlife can enhance native species management within watersheds.					
Challenges:	Climate change will likely stress forests making management more challenging.					
Effect on Future Conditions:	Healthy watersheds are essential to provide clean water.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Flood, Wildfire					
Supports SHMP Objectives:	6					

E.1.3 Department of Public Works Mitigation Capabilities

The Department of Public Works (DPW) was created by Public Law 1-8 and is committed to providing efficient and reliable service by maintaining the public roadways, providing solid waste management, and encouraging energy conservation, ensuring compliant construction, and meeting the public works' needs of residents and guests of the CNMI. The DPW is composed of the Administrative Services, Building Code, Technical Services, Solid Waste Management, Energy, and Roads & Grounds Divisions. Table E.1-3 includes information on hazard mitigation related capabilities for the DPW.

Table E.1-3. Department of Public Works Capabilities.

Building Safety Code Division (BSCD)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Category: Description:	The DPW Building Safety Code Division is dedicated to upholding Public Law 21-14 to ensure buildings meet the minimum safety standards of the International Building Codes (IBC) and International Residential Code (IRC).					
Notable Changes:	On December 19, 2019, Governor Ralph Deleon Torres signed into law Public Law No. 21-14 adopting the 2018 International Building Codes (IBC) as the standard Building Safety Code for the CNMI. The DPW updated the Building Safety Code Rules and Regulations (Sec. 155-10.1-601) to use the 2018 IBC and 2018 International Residential Code (IRC). The CNMI appropriately updated Section 155-10.1-601 of the Building and Safety Code Rules and Regulations.					
Opportunities:	Adopt the latest IBC on a reoccurring three-year basis, with amendments specific to the Commonwealth. Identify the specific edition, year, amendments, and code volumes with the codes adopted in the CNMI Building Safety Code. The creation of a Building Code Council would establish a formal process to suggest and comment on Commonwealth specific amendments to the IBC as well as identify opportunities to strengthen building construction and propose amendments to the CNMI Building Safety Code. Work with ICC and FEMA to train new and existing staff on the requirements of the adopted building codes and standards. Reference the seismic provisions of the adopted I-Codes or specify the minimum Seismic Design Category per the IBC and IRC in the CNMI Building and Safety Code Rules and Regulations. Make building code information readily available to the public in multiple types of media (print, website, etc.).					
Challenges:	The Commonwealth does not regularly adopt the most recent edition of the International Building Codes, which leaves the infrastructure of the CNMI lagging behind national standards. There is no formal process for IBC amendments. The CNMI Building and Safety Code Rules and Regulations (Section 155-10.1-615) have earthquake and typhoon amendments that conflict with the adopted IBC and referenced standards. Training is needed for BSCD staff to become familiar with the adopted 2018 I-Codes, allowing for more effective implementation and enforcement.					
Effect on Future Conditions:	One of the most effective ways to safeguard the Commonwealth against natural disasters is to adopt and enforce the latest hazard-resistant building codes and referenced standards.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Safety and Security, Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	2, 4, 8					

Table E.1-3. Department of Public Works Capabilities (*cont'd*).

Comprehensive Highway Master Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖	❖	
Category:	Capital Project and Maintenance					
Description:	The *CNMI 20–Year Highway Master Plan* (GHD, 2023) focuses on transportation issues related to mobility, safety, and congestion on the islands of Saipan, Tinian, and Rota. The plan identifies goals, policies, and improvement needs over the next 20 years for the CNMI transportation system with the aim to accommodate the need of each island while integrating their common needs into a unified transportation plan. The plan establishes a roadway classification scheme to assist the DPW in prioritizing transportation improvements and identifying deficiencies and constraints in the existing and expected future transportation networks.					
Notable Changes:	The *Highway Master Plan* was released on April 3, 2023. The plan is an update to the *2009 Comprehensive Highway Master Plan* (Brinckerhoff, 2009).					
Opportunities:	Opportunity to implement action steps identified in the Walkability Assessments for Saipan, Tinian, and Rota.					
Challenges:	Many drainage systems on Saipan and Tinian, and to some extent Rota, were built during the Japanese Period. Many concrete culvert systems were used to drain wetlands and reroute water to support agricultural activities. This along with steep erosive slopes and periodic monsoon level rain events is a challenge for stormwater management. DPW is working to ensure water that flows down streets in storm events does not cause flooding that can be dangerous to people.					
Effect on Future Conditions:	Ongoing monitoring efforts.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Transportation					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	1, 8					

Damage Assessments (DPW)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:		❖	❖	❖		
Category:	Disaster Response / Recovery					
Description:	The Department of Public Works has engineering staff in the Technical Services Division and the Building Code Safety Division. This staff may be capable of supporting damage assessments to buildings and structures damaged after an event.					
Notable Changes:	None identified.					
Opportunities:	Damage assessments would be more readily available and provided data for Disaster Declarations and to help guide post-disaster response more effectively and efficiently.					
Challenges:	Staff workload would need to be managed for this additional task. Staff would require training and staff time would need to be reimbursed.					
Effect on Future Conditions:	May prevent damage from higher intensity storms.					
Equitable Outcomes:	None Identified.					
Community Lifelines:	Communications, Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	1, 2, 4, 5, 7					

Table E.1-3. Department of Public Works Capabilities (*cont'd*).

National Flood Insurance Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The National Flood Insurance Act of 1968 and its implementing regulations provides flood insurance to individual property owners, businesses, and government agencies in flood-prone areas where insurance is either not available or prohibitively expensive. The law requires communities to adopt and enforce floodplain management regulations that contribute to protecting lives and reducing the risk of new construction and substantial improvements from future flooding. CNMI Public Law 6-45 was enacted in February of 1990, which directed the Director of the Department of Public Works with bringing the Commonwealth into compliance with provisions of the National Flood Insurance Act. The BSCD also enforces floodplain management regulations to minimize flood damage in accordance with Public Law 8-7. For all new construction, elevation standards are applied so the lowest floor is at least 2 feet above the 1% annual floodplain elevation.					
Notable Changes:	Buildings in designated Flood Hazard Zones are required to comply with regulations adopted by DPW that meet or exceed the minimum National Flood Insurance Program (NFIP) criteria and adopt the Flood Insurance Rate Maps (FIRMs).					
Opportunities:	Update the CNMI Flood Damage Prevention Regulations and integrate the regulations with the flood provisions of the I-Codes using the FEMA model code-coordinated ordinance (FEMA, 2021). Update FIRMs based on projected future conditions and/or 100 year sea level extremes and an updated flood study to re-delineate flood zone boundaries and re-establish base flood elevations (BFEs) for the Commonwealth (FEMA, 2021). The new FIRMs will allow communities in the CNMI to have updated flood risk information that can inform support Smart, Safe Growth planning and guide coastal development, public access management and permitting for the Coastal Management Program and other efforts to reduce the impact of flooding to structures, lower flood insurance premiums, plan mitigation risk and reduce losses, understand flood hazard data, support staff training, and assist with hazard mitigation grant projects					
Challenges:	The Flood Damage Prevention Regulations in Subchapter 155-10.2 of the Northern Mariana Islands Administrative Code have not been updated since 19936, even as the building code has been updated to the 2009 I-Codes and then, more recently, the 2018 I-Codes. Only four NFIP policies were in force in the Commonwealth (FEMA, 2024). The low participation rate is due in part to several factors: low percentage of households with mortgages, high rate of residents that rent rather than own, prohibitive premiums and no licensed flood insurance agents in the CNMI.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	2, 4, 8					

Table E.1-3. Department of Public Works Capabilities (*cont'd*).

Risk MAP (DPW)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Administrative and Technical; Planning and Regulatory					
Description:	The Risk Mapping, Assessment, and Planning (MAP) program, administered by FEMA in partnership with federal, state, territory, tribal, and local partners across the nation, is used to identify flood risk using the best available data and tools to promote informed planning and development practices. The Risk MAP program specializes in high-quality flood hazard modeling, which includes community FIRMs.					
Notable Changes:	In January 2021, FEMA published the findings from the discovery phase of the Risk MAP program. During this phase FEMA listened to CNMI planning experts, public safety officials, water resource managers and engineers, as well as other community decision-makers, federal agencies, and FEMA's mitigation specialists to identify top hazards and needs (FEMA, 2021).					
Opportunities:	Opportunity to update FIRMs based on projected future conditions and/or 100 year sea level extremes and an updated flood study to re-delineate flood zone boundaries and re-establish base flood elevations (BFEs) for the CNMI. LiDAR data used for formal flood analysis and additional natural resources and hazards planning is currently available for this update.					
Challenges:	Challenges identified by CNMI stakeholders during the MAP planning sessions included: 1) outdated Flood Insurance Rate Maps, 2) lack of other flood hazards such as depth and velocity information, 3) identification of critical infrastructure of concern, 4) flood prone areas, 5) lack of information about the impact of projected future conditions on flooding.					
Effect on Future Conditions:	New FIRMs will aid future land use planning and development.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Food, Water, Shelter, Transportation, Hazardous Materials, Water Systems					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	2, 3, 4, 8					

Table E.1-3. Department of Public Works Capabilities (*cont'd*).

Territorial Transportation Improvement Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory; Disaster Response/Recovery					
Description:	The *CNMI Territorial Highway Implementation Plan & Commonwealth Office of Transportation Authority Transportation Improvement Plan* (Nadeau & Mapp, 2015), which prioritizes planning, design, and construction of highway and public transportation projects, was adopted in July 2018 by DPW and the Commonwealth Office of Transit Authority (COTA) to support comprehensive transportation planning and project implementation. During Super Typhoon *Yutu*, COTA supported mass evacuation and recovery support efforts for a total of 679 individuals. During recovery, COTA transported individuals to the FEMA Disaster Relief Center, American Red Cross, medical facilities, and back to their residences, providing a vital health and social services to community members in need of transportation.					
Notable Changes:	In 2019, COTA received $6,387,346 grant funding to support construction of COTA Administrative Building and Maintenance Facility, construction/installation of 37 prefabricated solar bus shelters along the Fixed Route System, procurement of 12 ADA Compliant transit buses for the Fixed Route System for the island of Saipan, and procurement of one ADA accessible van for the islands of Rota and Tinian.					
Opportunities:	Opportunity for public-private partnerships to offset operations and maintenance costs. Development and implementation of a Sustainable Comprehensive Transportation Master Plan and addressing next steps flagged in the Fixed Flex-Route Paratransit System Feasibility Report and subsequent COTA plans and policies will help to further guide investment in and expansion of the public transit system.					
Challenges:	Although public transportation systems are not profitable, they provide important services that have the ability to reach and support socio-economic needs of the most underserved and vulnerable areas in the community.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Support socio-economic needs of the most underserved and vulnerable areas in the community.					
Community Lifelines:	Transportation					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	1, 3, 4, 7					

E.1.4 Homeland Security and Emergency Management.

The CNMI Office of Homeland Security and Emergency Management (HSEM) coordinates emergency management functions between the federal, Commonwealth, and local levels pursuant to Public Law 18-4 (Homeland Security and Emergency Management Act of 2013). HSEM is supported by numerous agencies and nongovernmental planning partners in leading CNMI's Disaster Mitigation Planning Process. HSEM prepares for, prevent, respond to, and recovers from all threats, crimes, hazards, and emergencies through coordinated efforts of the first response community. Table E.1-4 includes information on hazard mitigation related capabilities for the HSEM.

Table E.1-4. Homeland Security and Emergency Management capabilities.

Homeland Security and Emergency Management Operations Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response/Recovery					
Description:	The HSEM is responsible for preparation and updates to the CNMI All-Hazards Emergency Operation Plan and associated annexes, the Threat Hazard Identification and Risk Assessment (THIRA) on a 3-year cycle, and the Stakeholder Preparedness Review (SPR) report annually.					
Notable Changes:	In previous years the HSEM was responsible for preparing the CNMI Standard State Hazard Mitigation Plan. In 2018, this responsibility shifted to the CNMI Hazard Mitigation Grants Program. Updates to the THIRA and SPR were finalized (2024b, 2024a).					
Opportunities:	In the next update, develop Incident Annexes for additional natural hazards to include drought, earthquake, flood, health risk, tsunami, volcanic activity, and wildfire.					
Challenges:	Response to several real-world events in the past 5 years has limited time to further develop the plan.					
Effect on Future Conditions:	Continued planning emergency response for less common natural hazards, such as earthquake or tsunami, will improve preparedness and help manage post-event response.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes.					
Community Lifelines:	Safety and Security					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3, 4					

Table E.1-4. Homeland Security and Emergency Management capabilities (*cont'd*).

All-Hazards Training and Exercise Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response/Recovery					
Description:	The HSEM maintains and updates the *CNMI All-Hazards Emergency Operation Plan* (EOP) in accordance with all applicate laws, regulations, and executive orders. The CNMI EOP covers a full range of requirements prior to, during, and following an emergency or disaster. It directs and assigns functional responsibilities to all CNMI departments, agencies, volunteer and private groups with emergency operations responsibilities, roles, and functions to promptly respond and efficiently support the protection of life and property and assist in recovery from a disaster. To promote interagency cooperation and coordination, departments and agencies are responsible for updating and maintaining their respective annex(es) to the CNMI EOP.					
Notable Changes:	The EOP was updated in 2021. It is currently being updated to include the Essential Support Function Annexes, and the base plan is being reviewed to make changes to response processes.					
Opportunities:	Provide more training to ensure responders understand the roles and duties as well as chain of command during an incident. Exercises will test and validate the role of the PIO, the effectiveness and efficiency of Early Alert Warning Systems to be installed, and the information relayed to the public.					
Challenges:	Conduct exercises of all types throughout the calendar year to ensure that the process of relaying information to the public is efficient and effective. Exercises like full scale typhoon or tsunami offer a great opportunity to practice. Smaller scale exercises will be developed. .					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	All Community Lifelines					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3, 4,					

Table E.1-4. Homeland Security and Emergency Management capabilities (*cont'd*).

CNMI Catastrophic Typhoon Plan (2017)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response/Recovery					
Description:	The *2017 CNMI Typhoon Catastrophic Plan* (2018) is a capabilities-based plan that follows the National Incident Management System/ Incident Command System principles, and it facilitates effective and efficient response and recovery operations in the response to a catastrophic typhoon strike within CNMI.					
Notable Changes:	Tabletop exercises (TTX) allow emergency managers and first responders to test and validate emergency operating procedures and plans. To test the *2017 CNMI Typhoon Catastrophic Plan*, the HSEM conducted a "Typhoon Pakyo TTX" as part of a workshop series. The "2022 Disaster Financial Management Plan TTX" designed to test the Nation's first-ever Disaster Financial Management Plan used to establish and implement sound disaster financial management practices (2021).					
Opportunities:	Since the 2017 plan was developed, Super Typhoon *Yutu* and several other typhoons have struck CNMI. The plan can be updated with real-world data and information to reflect scenarios that include a direct strike of a Super Typhoon.					
Challenges:	The greatest challenge to disaster response in CNMI is time a distance. When a disaster strikes, it is difficult to coordinate and mobilize resources including materials/supplies, equipment, and skilled labor.					
Effect on Future Conditions:	Updating the plan to reflect real-world experience from the direct strike of a super typhoon, can help improve planning to yield a more effective and efficient response and rapid recovery.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes.					
Community Lifelines:	All Community Lifelines					
Hazards:	Typhoon, Flood					
Supports SHMP Objectives:	1, 3, 4					

Emergency Operations Center	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Administrative and Technical					
Description:	The Saipan Emergency Operations Center is designed to comply with FEMA and US Department of Homeland Security requirements for an emergency operations facility within includes a secure operations room within the facility. The facility has excellent computer and communications connectivity and serves as the central hub for all emergency response.					
Notable Changes:	In 2023, an updated weather station engineered to measure, monitor, and manage weather data at the CNMI Emergency Operation Center (EOC) was installed. In 2022, the floor plan and new furniture layout were updated to mimic the arrangement used during an incident response.					
Opportunities:	Continue to integrate communications and interoperability with other CNMI agencies to improve response time and coordination.					
Challenges:	None identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None Identified.					
Community Lifelines:	Safety and Security, Food, Water, Shelter, Health and Medical, Communications, Transportation, Hazardous Materials, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1,3					

Table E.1-4. Homeland Security and Emergency Management capabilities (*cont'd*).

Emergency Management Warning Point Social Media Outlets	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The HSEM recognizes that social media plays an integral role in how people communicate, share information, and connect. They are availing themselves of social outlets such as Facebook, Instagram, YouTube, X (formerly Twitter) or through mobile device apps to reach larger audiences of all ages and spread information more rapidly. The HSEM, CNMI EOC State Warning Point uses Facebook as a supplemental channel to disseminate information and promote awareness of disaster preparedness. The HSEM is also using @cnmi_hsem on Instagram to broadcast updates on tropical disturbances, earthquakes, and tsunami watches. The Ready CNMI mobile app, available for Android and iPhone devices, features real time alerts and notifications from the CNMI Emergency Operations Center–State Warning Point, and includes preparedness information, maps of emergency shelters in the CNMI and links to preparedness partners. Launched in December 2017, the HSEM's CPM Committee & MDTV directed and produced a commercial to push emergency preparedness and encourage the CNMI #liveprepared. The commercial is available at https://youtu.be/xU8U4oajG_Q?feature=shared. The public can find more information on the on the CNMI Office of Homeland Security and Emergency Management Official YouTube Channel (2023) at www.youtube.com/@CNMIHomelandSecurity.					
Notable Changes:	The CNMI hired personnel specifically to ensure reliable and actionable information is disseminated. Personnel work cohesively to ensure information is disseminated in a timely manner.					
Opportunities:	Thirty-one (31%) of community stakeholders who participated in the 2024 SHMP survey reported social media as the best way for them to receive information about how to protect themselves and their families and prepare their homes and businesses against natural hazards. Leveraging social media as a broadcasting tool to enhance natural hazard awareness and preparedness presents an opportunity to further public engagement. Opportunity for the CNMI to identify resources on island to aid in translation of alerts and warnings to be culturally and linguistically appropriate. Opportunity to develop Standard Operating Procedures or Disaster Public Information Plan.					
Challenges:	The CNMI lacks Standard Operating Procedures for delivering actional guidance, alerts, and warnings, culturally and linguistically appropriate messaging, and inclusiveness of the entire public.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Leveraging social media platforms to disseminate information fosters community engagement, promotes inclusive dialog, and reaches a broader audience for more equitable and resilient communities.					
Community Lifelines:	Safety and Security, Communications					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	3, 4					

Table E.1-4. Homeland Security and Emergency Management capabilities (*cont'd*).

Multi-Agency Coordination (MAC) Group	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Special Assistant to Homeland Security and Emergency Management (SAHSEM) coordinates all public and private emergency services within the CNMI. The SAHSEM activates and staffs the Emergency Operations Center (EOC). The SAHESM convenes the Multi-Agency Coordination Group (MAC Group formerly the Response Activity Coordinators [RAC]). The MAC Group includes members from the Government Cabinet appointees and stakeholders (e.g., VOAD, American Red Cross, Salvation Army, etc.), who have been delegated authority and provide essential management decisions for the state coordination to ensure a smooth and steady disaster operations. The MAC Group deliberates on policy and legal issues that arise in a complex, multi-agency response to an emergency or disaster. The MAC Group advises the SAHSEM to ensure that coordinated incident planning and operations occur through the EOC.					
Notable Changes:	The MAC is a new entity since the 2018 SSMP (formerly the RAC).					
Opportunities:	Because the MAC includes Government Cabinet appointees with decision-making authority, response and recovery efforts can be streamlined and coordinated among agencies.					
Challenges:	None identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	By including underserved communities in response and recovery efforts, equitable outcomes can be increased.					
Community Lifelines:	Safety and Security					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	3					

Stakeholder Preparedness Report (SPR)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response/Recovery					
Description:	HSEM prepares the Stakeholder Preparedness Review (SPR) annually. The SPR is a self-assessment of the Commonwealth's current capability levels against the targets identified in the Threat and Hazard Identification and Risk Assessment. The SPR aids in identifying capability gaps, sustainment requirements, and intended approaches for addressing those gaps while maintaining existing capabilities.					
Notable Changes:	The HSEM completed the Stakeholder Preparedness Report (2024a).					
Opportunities:	The SPR allows the Commonwealth to review existing response capabilities and to identify the gaps.					
Challenges:	Sustaining funding to maintain capabilities and to develop new capabilities.					
Effect on Future Conditions:	Response capabilities are often closely related to mitigation capabilities. As response capabilities wax and wane, mitigation capabilities will likely follow a similar pattern.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes.					
Community Lifelines:	Safety and Security					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3					

Table E.1-4. Homeland Security and Emergency Management capabilities (*cont'd*).

Threat Identification and Risk Assessment (THIRA)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response/Recovery					
Description:	The Threat and Hazard Identification and Risk Assessment (THIRA) is a critical tool for improving resilience by putting the National Preparedness System into action. The THIRA process helps communities identify the threats and hazards that could impact them including natural disasters and human-made incidents (e.g., industrial accidents or terrorist attacks), evaluate the potential impacts of these threats and hazards, and determine the capabilities needed to address the challenges. Capabilities include planning, organization, equipment, training, and exercises. The THIRA provides a foundation for understanding capability gaps and informs preparedness efforts. The HSEM is responsible for preparation and updates to the THIRA on a 3-year cycle.					
Notable Changes:	The HSEM completed the THIRA review process for the entire Commonwealth (2024b).					
Opportunities:	Future updates of the THIRA can be expanded to include additional natural hazards such as earthquake, extreme heat/heatwave, volcanic activity, and wildfire					
Challenges:	Response to several real-world events in the past 5 years has limited time to further develop the plan.					
Effect on Future Conditions:	Planning for additional natural hazards can improve response and help to develop capabilities.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes.					
Community Lifelines:	Communications, Energy, Food, Water, Shelter, Hazardous Materials, Health and Medical, Safety and Security, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3, 4, 8					

E.1.5 Department of Fire and Emergency Services Capabilities

The mission of the CNMI Department of Fire and Emergency Medical Services (DFEMS) is to preserve life, property, and the environment through decisive action, strong leadership, teamwork, and faithful community partnership. They partner with other government and private agencies to administer quality public services through innovative training, education, and equipment. Table E.1-5 includes information on hazard mitigation related capabilities for the DFEMS.

Table E.1-5. Department of Fire and Emergency Services Capabilities.

Wildland Fire Strike Team	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response / Recovery					
Description:	DFEMS ensures fire fighters are trained and equipped to fight wildland fires. Within the department, the CNMI Wildland Fire Strike Team is trained and prepared to not only fight fires in the CNMI, but to deploy to other states when a federal disaster is declared, and support is requested.					
Notable Changes:	The strike team received training in FY 2023.					
Opportunities:	Integrate and coordinate wildland fire program and public awareness with CNMI agencies such as the Bureau of Environmental Quality and the Department of Land and Natural Resources.					
Challenges:	Changing vegetation and climate conditions are contributing to more frequent and intense wildland fires. The Department of Public Lands has proposed to develop new homesteads in are adjacent to areas with a high probability of supporting fire in the future.					
Effect on Future Conditions:	The wildland fire strike team can help minimize impacts from wildfire on the natural and built environments. However, as environmental conditions continue to change and become more conducive to wildfire, negative impacts from wildfires may increase.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes. The placement of homesteads near fire-prone areas should be evaluated.					
Community Lifelines:	Safety and Security, Transportation, Water Systems					
Hazards:	Wildfire					
Supports SHMP Objectives:	3, 4, 6					

Emergency Response	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Disaster Response / Recovery					
Description:	DFEMS provides emergency response year-round and especially following a natural hazard incident. In terms of mitigation capabilities, their responsibilities can include, but are not limited to transportation of functionally challenged people to shelters in advance of severs weather, emergency medical response following an incident, control of fire, and hazardous materials response, .					
Notable Changes:	Several projects were planned and executed to improve fire station resilience including generator repair/replacement projects and plans to harden the roofs at several stations.					
Opportunities:	Continue to build capabilities to respond to hazardous materials pre- and post-disaster to protect the public, personnel, and the environment.					
Challenges:	Interoperable communications continue to hamper on-island and between-island communications.					
Effect on Future Conditions:	No identified.					
Equitable Outcomes:	Ensuring underserved communities are included in planning and response efforts will improve equitable outcomes.					
Community Lifelines:	Hazardous Materials, Health and Medical, Safety and Security					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3, 4, 5					

E.1.6 Department of Land and Natural Resources

The Department of Lands and Natural Resources (DLNR) was established by Public Law No. 10-57. The department is subdivided into 4 departments—Agriculture, Fish and Wildlife, Parks and Recreation, and Division of Land and Survey. The Division of Agriculture implements the Foresty Program, which includes three forestry programs: 1) Forest Health, 2) Forest Stewardship, and 3) Urban and Community. The Division of Fish and Wildlife is tasked with conserving, protecting and enhancing the fish, game and wildlife life resources for the benefit of CNMI citizens. Table E.1-6 includes information on hazard mitigation related capabilities for the DLNR.

Table E.1-6. Department of Land and Natural Resources Capabilities.

Division of Agriculture–Forestry Program–Wildfire Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:						
Description:						
Notable Changes:						
Opportunities:						
Challenges:						
Effect on Future Conditions:						
Equitable Outcomes:						
Community Lifelines:						
Hazards:	Wildfire					
Supports SHMP Objectives:	None					

Division of Agriculture–Forestry Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	CNMI Foresty implements the CNMI Foresty Stewardship Program (FSP) to aid and influence landowners to promote good land and forest stewardship practices. FSP also aims to establish, restore, protect, manage, maintain, and enhance habitat for flora, soil, water, and air quality, wetland, and riparian buffer. The Forest Health Protection and Invasive Plant Management program addresses forest pests, plant diseases, and the suppression of invasive plants and determinate species. The *CNMI Statewide Assessment and Resource Strategy 2010–2015* was published in 2010 and no update was publicly available.					
Notable Changes:	None identified.					

Division of Agriculture–Forestry Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Opportunities:	Updating the statewide forest assessment to include climate change and climate adaptation could provide new insights to management objectives and priorities. Incorporating ridge to reef concepts to help improve watershed function can help improve water quality.					
Challenges:	Climate change is altering weather patterns and invasive species are changing vegetation communities and ecosystem dynamics.					
Effect on Future Conditions:	Loss or degradation of biodiversity reduces ecosystem resilience and may erode ecosystem services such as attenuation of severe weather effects.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None					
Hazards:	Extreme Heat / Heatwave, Flood, Typhoon, Wildfire					
Supports SHMP Objectives:	6					

Division of Fish and Wildlife–Wildlife Action Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The Commonwealth supports an array of wildlife species that are found nowhere else in the world. CNMI waters contain some of the most pristine marine ecosystems in the US. The *Wildlife Action Plan for the CNMI 2015-2025* (Liske-Clark, 2015) builds on the 2005 plan and sets conservation priorities and specific objectives for species of conservation concern, including species listed as threatened or endangered under the Endangered Species Act (ESA).					
Notable Changes:	The US Fish and Wildlife published a proposed rule to designated critical habitat for 9 species that were listed as endangered in 2015 under the ESA.					
Opportunities:	The *Wildlife Action Plan for the CNMI 2015-2025* is scheduled for an update in 2025. The update is an opportunity to include climate considerations and climate adaptation in the action plan.					
Challenges:	Information regarding life history traits, population status and trajectory, effects of climate change, suitable habitat parameters is often lacking and challenging to obtain for some species of conservation concern.					
Effect on Future Conditions:	Loss or degradation of biodiversity reduces ecosystem resilience and may erode ecosystem services such as attenuation of severe weather effects.					
Equitable Outcomes:	Endangered species issues may impact homestead development for people of Northern Mariana descent.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Flood, Extreme Heat / Heatwave, Wildfire					
Supports SHMP Objectives:	None					

Table E.1-6. Department of Land and Natural Resources Capabilities (*cont'd*).

Division of Fish and Wildlife–Native Ecosystems Protection and Management	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The Division of Fish and Wildlife has designated seven Marine Protected Areas (MPAs) in the ocean and nearshore waters to protect living, non-living, cultural and/or historical resources. Five of the MPAs are no take reserves and two are species-specific reserves. These conservation zones protect fish, coral, and invertebrates. The MPAs are created via legislative act, local law, and regulations.					
Notable Changes:						
Opportunities:	Planning can protect and enhance the natural infrastructure and protective ecosystem services provided by coral reefs.					
Challenges:	None identified.					
Effect on Future Conditions:	Preserving coral reefs can help attenuate storm surge and help reduce storm-surge flooding (Storlazzi et al., 2019).					
Equitable Outcomes:	None identified.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Flood					
Supports SHMP Objectives:	None					

E.1.7 Department of Public Lands Capabilities

The Department of Public Lands (DPL) was created under Public Law 15-2 as part of the Executive Branch. DPL oversees the homesteading program, commercial leasing and permitting public lands, settlement of land claims, and land use planning for government and public uses. As stewards and trustees of public lands, the DPL updates and administers the strategic public land use plan to manage, use, dispose, and develop public lands to foster cultural and economic growth for current and future generations. Table E.1-7 includes information on hazard mitigation related capabilities for the DPL.

Table E.1-7 Department of Public Lands Capabilities.

Public Land Use Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖	❖	
Category:	Planning and Regulatory					
Description:	The *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (2019) documents objective outlined in Public Law 15-02 which are necessary to consider and plan capital improvements. The plan includes a long range implementation program to ensure that CIP projects are scheduled, financed, and constructed in a timely manner.					
Notable Changes:	The previous public use plan was adopted in 1989. The update in 2019 greatly improved public engagement and participation. Land use data were updated in databases and the geographic information system (GIS). Projections for future population growth and land use were updated. Maps of projected future land use were created for use in the 5–10 year planning horizon.					
Opportunities:	During the next plan update, climate change and natural hazards can be incorporated to help guide future land use planning. Also, lands slated for development can be evaluated for exposure natural hazards risks and development can be designed to resist the hazards or relocated to areas with less risk. Future plans can incorporate design and construction requirements to address natural hazards risks.					
Challenges:	Natural hazards from severe weather events are increasing. Some areas proposed for development in the current plan are in areas exposed to natural hazards. For example, some areas designated for potential homesteads are in or adjacent to areas with elevated fire risk.					
Effect on Future Conditions:	Public Use Planning is a powerful tool to ensure exposure to natural hazards is considered when designating public uses for parcels and that development occurs in areas that are less prone to natural hazard risks.					
Equitable Outcomes:	Improving public use planning and administration will benefit people of Northern Mariana descent.					
Community Lifelines:	Communications, Energy, Food, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 2, 3					

E.1.8 Department of Community and Cultural Affairs Capabilities

The Department of Community and Cultural Affairs (DCCA) oversees human and social services, historical and landmark preservation and conservation, activities to preserve cultural heritage and traditions, public art, and sports programs. Table E.1-8 includes information on hazard mitigation related capabilities for the DCCA.

Table E.1-8 Department of Community and Cultural Affairs Capabilities.

Emergency and Preparedness Response and Recovery Plan for Childcare	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The CNMI Emergency Operations Plan designates the Department of Community and Cultural Affairs (DCCA) as the agency to support the Emergency Support Function–EFS6 (Mass Care and Emergency Sheltering Assistance) during emergencies. The Child Care and Development Fund (CCDF) carries out the mission and supports families with childcare needs and the childcare community before, during, and after emergencies and disasters. In 2019, the CCDF developed the *Emergency Preparedness, Response, and Recovery Plan* (CCDFP, 2019) to establish procedures for before, during, and following emergencies. The plan aligns DDCA/CCDF actions with the CNMI Homeland Security actions.					
Notable Changes:	To meet provisions of the Child Care Development Block Grant Reauthorization Act of 2016, NCMI provides childcare facilities with annual training that highlights the *Emergency Preparedness, Response and Recovery Plan* (CCDF, 2019. Training in 2024 for 15 care facilities covered new federal requirements and health and safety standards for emergency preparedness and planning, different kinds of emergencies, natural and human-caused events to be addresses by providers, and the 6 steps of emergency planning.					
Opportunities:	The CCDF coordinates with the zoning board and the DPW-BSCD to ensure facilities meeting zoning and building safety to minimize establishment of new care facilities outside disaster prone areas and that buildings are typhoon resistant. CCDF can work with HMGP to develop mitigation projects to help improve the resilience of care facilities and shelters.					
Challenges:	It may be difficult to locate all care facilities outside areas prone to effects from natural hazards. For facilities that cannot be relocated, plans can be developed to ensure care operations can continue in the event some facilities are affected and not operational following a disaster (e.g., facilities in low lying areas become flooded following heavy rain).					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Consistent quality day care, specifically subsidized care for lower income families, helps to increase services and safety of underserved communities.					
Community Lifelines:	Food, Water, Shelter					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 2, 4					

Table E.1-8. Department of Community and Cultural Affairs Capabilities(*cont'd*).

Commonwealth Historic Preservation Act (Public Law 3-39)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The CNMI Historic Preservation Office (HPO) is mandated under the Commonwealth Historic Preservation Act of 1982 (Public Law 3-39) to promote the preservation of the historic and cultural heritage of the NMI and to regulate activities that have potential to adversely affect historic and cultural properties. The HPO is responsible to 1) implement the Commonwealth Historic Preservation Act of 1982 and the US National Historic Preservation Act of 1966; 2) implement duties and responsibilities of the DCCA established by CNMI law and regulation, 3) carry out; 3) carryout federal laws and regulations, Governor's Executive orders, and Commonwealth regulations pertaining to historic and cultural preservation, 4) survey to identify historical and cultural resources, 5) educate the public about sites and other properties significant to the CNMI, 6) protect, preserve, and regulate access to places, artifacts, and things of historical significance, 7) issue or deny permits for use, access, and development of land with					
Notable Changes:	To streamline the permit review process, DCCA/HPO is one of the agencies participating in the One State permitting process that was instituted in 2023. The process allows permit applicants to submit all required documents, including site maps and land titles, to DEQ and then DEQ routes these application packages to all relevant agencies. In FY 2023 HPO reviewed 352 One Start applications, conducted 146 Section 106 consultations, reviewed 5 major siting permits, and performed other reviews as needed.					
Opportunities:	Ensure regulatory review for projects that require permits are adequately reviewed for historical and cultural resources. This process will help enhance the opportunities to protect these resources.					
Challenges:	Capacity to review and respond to the high volume of permit requests. Modernization of HPO information into a Geographic Information System (GIS) to facilitate project review and response.					
Effect on Future Conditions:	A robust project review process will help facilitate project implementation while ensuring the protection of protected and valued historical and cultural resources.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 2, 3					

E.1.9 Commonwealth Utilities Corporation Capabilities

The Commonwealth Utilities Corporation (CUC) of the CNMI is an independent agency that is self-funded and regulated by the Commonwealth Public Utilities Commission. CUC is responsible for providing power, water, and wastewater services on Saipan, Tinian, and Rota. CUC programs include Administration, Power Generation, Power Transmission and Distribution, and Water and Wastewater. The CUC secures funds to implement major infrastructure projects to improve essential service reliability and resilience to natural hazards. Table E.1-9 includes information on hazard mitigation related capabilities for CUC.

Table E.1-9 Commonwealth Utilities Corporation Capabilities.

Strategic Energy Plan	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The *CNMI Strategic Energy Plan* (Conrad & Ness, 2012) presents alternatives for energy production including renewable energy options. Due to the location of the CNMI, the costs of energy production are high. All powerplants in the CNMI burn diesel fuel and there are few renewable energy production resources. This plan provides a strategic approach to diversifying energy production in the CNMI.					
Notable Changes:	None					
Opportunities:	Implementing recommendations in the strategy can help the CNMI diversify energy production means and build redundance and resilience into the power production sector.					
Challenges:	Long-term fossil fuel contracts and low cost to benefit ratio for developing/installing renewable energy projects.					
Effect on Future Conditions:	Relying more on renewable energy can reduce the CNMI dependance on fossil fuel and help lower the Commonwealth's greenhouse gas emissions.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Energy					
Hazards:	Typhoon, Tsunami, Flood, Wildfire, Earthquake					
Supports SHMP Objectives:	1					

Typhoon Preparedness and Safety Tips	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	CUC developed a website to educate the public and provide preparedness and safety tips to help prepare for typhoons. The website provides tips for general planning, electrical, water, water treatment, and other safety measures. The website also provides information for how to prepare a typhoon kit and contacts for the American Red Cross.					
Notable Changes:	None					
Opportunities:	None identified.					
Challenges:	None identified.					
Effect on Future Conditions:	Public education and outreach can help increase the number of CNMI residents that are prepared for severe impacts from typhoon and know how to respond to remain safe following an event, Increased levels of preparedness among the public can help decrease secondary effects, such as structure fires due to electrical lines or prevention of water borne illness, following a disaster.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Energy, Food, Shelter, Water, Water Systems					
Hazards:	Typhoon, Flood					
Supports SHMP Objectives:	1, 4					

Table E.1-9. Commonwealth Utilities Corporation Capabilities (*cont'd*).

Underground Storage Tank Regulations	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	Regulates underground storage tanks that store petroleum or other hazardous substances.					
Notable Changes:	None identified.					
Opportunities:	None identified.					
Challenges:	None identified.					
Effect on Future Conditions:	Reduced the likelihood of hazardous contaminants in the ground and aquifers.					
Equitable Outcomes:	Reduced likelihood of exposure to hazardous contaminants.					
Community Lifelines:	Health and Medical, Hazardous Materials, Safety and Security					
Hazards:	Typhoon, Tsunami Drought, Flood,					
Supports SHMP Objectives:	1, 2					

Sustainable Water Infrastructure Management Strategy (SWIMS) Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	A comprehensive planning, investigation, design, construction, and operations approach to manage non-revenue water and deliver 24-hour safe and affordable drinking water to meet secondary standards for the CNMI, which meet the sustainable development goals established by the CNMI.					
Notable Changes:	CUC developed and implemented a workshop in 2022 that described the SWIMs program and provide information on goals, objectives, and project progress.					
Opportunities:	Pathway to providing palatable and safe drinking water in the CNMI. Through the planning process the needs for a Comprehensive Drought Plan and Water Budget Studies were identified.					
Challenges:	Aging infrastructure continues to challenge the water system. Compliance with the Stipulated Order continues to direct agency efforts.					
Effect on Future Conditions:	Safe reliable drinking water supports community resilience.					
Equitable Outcomes:	All communities have access to reliable, safe drinking water per CNMI sustainable development goals.					
Community Lifelines:	Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Health Risk Extreme Heat, Wildfire, Earthquake					
Supports SHMP Objectives:	1					

E.1.10 Commonwealth Healthcare Corporation Capabilities

The Commonwealth Healthcare Corporation (CHCC) was created by Public Law 16-51 in 2009. The Act combined the hospital, public health, behavioral health, and the community guidance centers and related programs. CHCC is intended to be a professionally managed, nationally accredited, independent public health care institution that is as financially self-sufficient and independent of the Commonwealth government as possible. To this end CHCC strives to improve the quality of life for the CNMI Community through innovative preventative/urgent care services and to foster responsible lifestyles. Table E.1-10 includes information on hazard mitigation related capabilities for CHCC.

Table E.1-10 Commonwealth Healthcare Corporation Capabilities.

Commonwealth Healthcare Corporation Preparedness Program	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Planning and Regulatory					
Description:	The mission of the public health and hospital emergency preparedness program is to prepare for and respond effectively to public health threats and emergencies, including both natural and man-made disasters, which could impact the health and safety of CNMI residents.					
Notable Changes:	The program developed the capacity to monitor and report information for the COVID-19 pandemic.					
Opportunities:	Continue to provide surveillance and investigation of diseases to identify future health risks for the CNMI population.					
Challenges:	None identified.					
Effect on Future Conditions:	Reduce exposure to emergent diseases and coordinate vaccinations and care.					
Equitable Outcomes:	Reduce exposure of underserved or vulnerable populations.					
Community Lifelines:	Health and Medical, Safety and security,					
Hazards:	Health Risk					
Supports SHMP Objectives:	1, 6					

Table E.1-10 Commonwealth Healthcare Corporation Capabilities (*cont'd*).

Immunization Programs	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The immunization program aims to prevent the introduction and spread of vaccine preventable communicable diseases by increasing and maintaining high immunization coverage, expanding access to vaccines, and enforcing public health immunization laws.					
Notable Changes:	Development of an online vaccination record portal.					
Opportunities:	Support the CNMI population in the event of a future health risk.					
Challenges:	None identified.					
Effect on Future Conditions:	Reduce illness due to the introduction and spread of vaccine preventable communicable diseases.					
Equitable Outcomes:	Help to reduce impacts to vulnerable populations					
Community Lifelines:	Health and Medical					
Hazards:	Public Health Risk					
Supports SHMP Objectives:	4					

E.1.11 Northern Marianas College and Northern Mariana Technical Institute Capabilities

The Northern Mariana College (NMC) provided high quality affordable and accessible educational programs and services. NMC is a land-grant institution that is accredited by the Senior College and University Commission of the Western Association for Schools and Colleges. NMC strategic goals include: 1) community investment, 2) student empowerment for success, 3) cultivation of employees, 4) secure financial vitality, 5) ensure quality, and 6) foster a spirit of stewardship. The Northern Mariana Technical Institute (NMTech) provides education in the technical and trade fields. NMTech offers certificates in several fields including 1) the American Hotel and Lodging Educational Institute, 2) the National Center for Construction Education and Research, 3) Automotive Technology, 4) Cosmetology, 5) Culinary Arts, 6) Baking and Pastry, and 7) Google Carrer Services. Table E.1-11 includes information on hazard mitigation related capabilities for NMC and NMTech.

Table E.1-11 Northern Marianas College and Northern Mariana Technical Institute Capabilities.

Northern Mariana College, Community Development Institute	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The Community Development Institute is a department within the NMC that provides training and services directly to individual residents, businesses, government agencies, and community organizations.					
Notable Changes:	None identified.					
Opportunities:	Provide training and capacity building to support economic diversity and resiliency. Partnerships to promote hazard awareness and resiliency can be developed.					
Challenges:	None Identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Provides additional resources training and capacity to communities on Tinian and Rota.					
Community Lifelines:	None					
Hazards:	Typhoon, Health Risk					
Supports SHMP Objectives:	4					

Northern Mariana Trade Institute	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The NMTech invests in students by providing advanced trades, careers, and technical education to produce skilled individuals and strengthen the CNMI workforce.					
Notable Changes:	None Identified.					
Opportunities:	Provide training and capacity building to support economic diversity and resiliency. Partnerships to promote hazard awareness and resiliency can be developed.					
Challenges:	None Identified.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Provides additional resources training and capacity to communities on Tinian and Rota.					
Community Lifelines:	None					
Hazards:	Typhoon, Health Risk					
Supports SHMP Objectives:	4					

E.1.12 Other program and partnerships capabilities.

Table E.1-12. Other program and partnerships capabilities.

Infrastructure Investment and Jobs Act	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Public Law					
Description:	The Infrastructure Investment and Jobs Act, commonly known as the Bipartisan Infrastructure Law, was signed into law in November 2021. Various funds are expected to be made available through this Act to support hazard mitigation.					
Notable Changes:	None identified.					
Opportunities:	Funds are expected to be made available to support hazard mitigation projects.					
Challenges:	None identified.					
Effect on Future Conditions:	Improve resilience of the built environment and reduce risks for natural hazards.					
Equitable Outcomes:	Implementing infrastructure projects can improve the built environment and reduce risks from natural hazards in underserved communities.					
Community Lifelines:	Communications, Energy, Food, Shelter, Water, Hazardous Materials, Health and Medical, Safety and Security, Transportation, Water Systems					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 5, 6, 7					

Economic Resiliency Center	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Financial / Capital Project and Maintenance					
Description:	In 2021, the US Economic Development Administration awarded CNMI Finance $19.6 million for the construction of a new Economic Resiliency Center that is needed to ensure continuity of government operations and to support business growth. Construction of the facility is projected for 2024.					
Notable Changes:	Construction is slated to begin in 2024.					
Opportunities:	Provide a new facility to ensure continuity of government operations in the wake of a disaster.					
Challenges:	Completion of the contracting process.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	1, 3					

Table E.1-12. Other program and partnerships capabilities (*cont'd*).

Fiscal Response Team	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The Fiscal Response Team prioritizes the fiscal stabilization of government finances; works to reconcile expenses that had not been properly recorded and accounted for in the past administration. The team also initiated a revision of the ARPA Spending Plan with the US Treasury.					
Notable Changes:	The Lt. Governor met with and secured assistance from federal partners for audits, financial strategic planning and technical assistance to enhance revenue and taxation capacity.					
Opportunities:	Ensure fiscal discipline and improve collections, efficiency, and reversing past spending habits.					
Challenges:	None identified.					
Effect on Future Conditions:	Health fiscal budget and spending to support the economy and ongoing recovery efforts.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None identified.					
Hazards:	None					
Supports SHMP Objectives:	None					

Pacific Mosquito Surveillance Strengthening for Impact (PacMOSSI)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The Pacific Mosquito Surveillance Strengthening for Impact program support Pacific Island countries to strengthen vector surveillance and control to prevent, contain, and control mosquito-borne diseases and improve the health and wellbeing of Pacific communities.					
Notable Changes:	None identified.					
Opportunities:	Monitor the presence of mosquito species in the CNMI that spread disease. Develop control programs as needed.					
Challenges:	None identified.					
Effect on Future Conditions:	Monitor the presence and spread of mosquito species that spread communicable diseases.					
Equitable Outcomes:	Reduce exposure to vector borne communicable diseases.					
Community Lifelines:	Health and Medical					
Hazards:	Public Health Risk					
Supports SHMP Objectives:	None					

Table E.1-12. Other program and partnerships capabilities (*cont'd*).

Pacific Research on Islands Solutions for Adaptation (RISA)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	The Pacific Research on Island Solutions for Adaptation (RISA) program is a NOAA Climate Adaptation Partnership (CAP). The NOAA CAP network was created to pioneer innovative mechanisms for enhancing the value of climate information and products for understanding and responding to a variety of challenges associated with climate variability and change at the regional scale.					
Notable Changes:	None Identified.					
Opportunities:	Partnerships can continue to assist CNMI develop climate products and information and to develop adaptation strategies.					
Challenges:	Downscaled climate data for CNMI and the Western Pacific is still largely lacking.					
Effect on Future Conditions:	Improved adaptation strategies can reduce the risks associated with natural hazards even under changing and variable climate conditions.					
Equitable Outcomes:	Improved community and natural system resilience for the CNMI.					
Community Lifelines:	None					
Hazards:	Typhoon, Drought, Flood, Health Risk, Extreme Heat, Wildfire					
Supports SHMP Objectives:	6					

Pacific Risk Management Ohana (PRiMO)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		
Category:	Education, Outreach, and Capacity Building					
Description:	PRiMO is a platform to bring together people and organizations in the Pacific Islands to address natural and man-made challenges and channel their efforts toward common goals. PRiMO helps make the Pacific Islands more resilient to the impacts of natural hazards.					
Notable Changes:	The 2024 PRiMO conference was held on Saipan.					
Opportunities:	Collaboration between Pacific Island communities, non-governmental organizations, and government agencies continues to address natural hazards, reduce risks from these hazards, and promote resilience.					
Challenges:	Climate change.					
Effect on Future Conditions:	Improving community and natural system resilience can help reduce the effects of future weather conditions / climate on Pacific Island communities.					
Equitable Outcomes:	Improve Pacific Island community resilience.					
Community Lifelines:	None					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	3					

Table E.1-12. Other program and partnerships capabilities (*cont'd*).

Rebuilding America Infrastructure with Sustainability and Equity (RAISE) program.	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Capital Project and Maintenance					
Description:	The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) discretionary grant program provides an opportunity for the US Department of Transportation (DOT) to invest in road, rail, transit, and port projects that promote national objectives that have a significant local or regional impact.					
Notable Changes:	None identified.					
Opportunities:	Additional funds to increase hazard mitigation for essential transportation infrastructure.					
Challenges:	Developing competitive bids for this discretionary grant program.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	Improve transportation networks for the CNMI, an underserved community.					
Community Lifelines:	Transportation					
Hazards:	Typhoon, Tsunami, Flood, Earthquake					
Supports SHMP Objectives:	1					

Resilient Food System Infrastructure Program (USDA)	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Education, Outreach, and Capacity Building					
Description:	The Resilient Food System Infrastructure (RFSI) program is to build resilience in the middle of the food supply chain, to provide more and better markets to small farms and food businesses, to support the development of value-addded products for consumers, fair prices, fair wages, and new and safe job opportunities.					
Notable Changes:	None identified.					
Opportunities:	Funds are available via this program for the CNMI.					
Challenges:	Capacity to develop grant proposals.					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	Health and Medical					
Hazards:	Drought					
Supports SHMP Objectives:	None					

Table E.1-12. Other program and partnerships capabilities (*cont'd*).

CNMI Silver Jackets Team	Type of Hazard Management Capability		Effect on Loss Reduction			Provides Funding for Mitigation
	Pre-Disaster	Post-Disaster	Support	Facilitate	Conflict	
Summary:	❖	❖	❖	❖		❖
Category:	Financial					
Description:	Silver jackets tams in state across the US bring together multiple, state, federal, and local agencies to learn from one another and apply their knowledge to reduce the risk of flooding and other natural disasters in the US and enhance response and recovery efforts when such events do occur. Silver Jackets are supported by the USACE Flood Risk Management Program.					
Notable Changes:						
Opportunities:	None identified.					
Challenges:	None Identified					
Effect on Future Conditions:	None identified.					
Equitable Outcomes:	None identified.					
Community Lifelines:	None identified.					
Hazards:	Typhoon, Tsunami, Drought, Flood, Health Risk, Extreme Heat, Wildfire, Earthquake, Volcanic Activity					
Supports SHMP Objectives:	2, 3					

E.2 FEMA Funded Projects from Previous Years

E.2.1 CNMI Hazard Grant Mitigation Program Project Tracker

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023.

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Sub-recipient Mgt. Cost	Completion Date	% Comp
Commonwealth Healthcare Corporation (DR-4404-MP)											
12	DR-4404-25-14R	CHCC	Tin	CHCC Tinian Health Center Generator	$731,813	$637,313	$94,500		$4,725	1/30/2024	**0%**
21	DR-4404-53-19R	CHCC	Spn	CHCC Hospital Generators	$1,391,655		$128,400		$6,420	1/5/2024	**0%**
Commonwealth Ports Authority (DR-4396-MP)											
2	DR-4396-01	CPA	Rota	Rota Airport Rescue and Fire Facility Shutter Project	$29,051			$20,995		12/14/2023	**0%**
1	DR-4396-04	CPA	Tin	Tinian International Airport Shutter Project	$263,507			$263,507	$13,157	9/9/2024	**0%**

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023 (*cont'd*).

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	**Project No.**	**Agency**	**Mun**	**Project Title**	**Requested Amount**	**Phase 2 Estimate**	**Phase 1 Award Amount**	**Award Amount**	**Sub-recipient Mgt. Cost**	**Completion Date**	**% Comp**
Commonwealth Utilities Corporation (DR-4404-MP)											
9	DR-4404-20-13R	CUC	Spn	CUC Water System Mitigation Project Phase II–Generators	$4,426,546	$3,707,433	$719,113		$25,000	10/11/2023	**60%**
11	DR-4404-02-12R	CUC	Spn	CUC CHCC Hospital Underground Power	$12,131,229	$11,410,429	$720,800		$25,000	3/25/2024	**10%**
8	DR-4404-71-06R	CUC	Tin	CUC Tinian Concrete Power Poles	$2,702,812	$2,408,812	$293,622		$14,681	3/25/2024	**35%**
10	DR-4404-74-07R	CUC	Rota	CUC Rota Concrete Power Poles	$1,530,569	$1,343,269	$166,800		$8,340	3/25/2024	**35%**
24	DR-4404-12-25R	CUC	Spn	CUC Sadog Tasi Office & Lift Stations Generator	$1,060,455		$72,798		$3,640	1/5/2024	**0%**
Department of Community and Cultural Affairs (DR-4404-MP)											
1	PDMC-PJ-09-MP-2018-004	DCCA	Spn	Saipan Office on Aging Storm Readiness Project–Generator	$160,674			$160,674		12/30/2023	**100%**

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023 (*cont'd*).

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Sub-recipient Mgt. Cost	Completion Date	% Comp
				Saipan Office on Aging Storm Readiness Project–Shutters							**0%**
3	DR-4396-02	DCCA	Rota	Rota DYS Sinapalo Youth Center Shutter Project	$42,261			$42,261	$2,113	10/9/2024	**0%**
Department of Fire and Emergency Medical Services (DR-4404-MP)											
15	DR-4404-21-23R	DFEMS	Spn	DFEMS Fire Station 1 & 5 Concrete Roof	$4,023,340	$3,810,840	$212,500			10/12/2023	**95%**
16	DR-4404-14-31F	DFEMS	Tin	DFEMS Tinian Fire Station 7 Generator	$321,477		$41,525				**0%**
Department of Public Works (DR-4404-MP)											
3	DR-4404-06-26R	DPW	Spn	DPW Garapan Downtown Flood Management	$9,040,076	$8,256,323	$783,750		$25,000	1/29/2024	**60%**
7	DR-4404-51-03R	DPW	Spn	Adv. Asst.- DPW, Planning-Road Condition & Flood Hazard Mapping	$811,740			$686,010	$25,000	5/24/2024	**0%**
2	EMF-2020-BR-180-002	DPW	Spn	Dandan Flood and Stormwater Drainage Improvement	$254,973			$254,973		12/20/2025	**0%**

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023 (*cont'd*).

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Sub-recipient Mgt. Cost	Completion Date	% Comp
Office of the Governor (DR-4404-MP)											
1	DR-4404-01-R	GOV-HM	Spn	Adv. Asst.–Planning and Technical Assistance to Assess, Identify & Develop Mitigation Opportunities for the CNMI	$5,000,000			$4,500,000		3/23/2024	
6	DR-4404-40-10R	GOV-SAAR	Spn	SAAR HOPE Recovery Center Shutters SAAR HOPE Recovery Center Generator	$264,488			$293,548	$14,677	12/13/2023	**0%** **15%**
19	DR-4404-33-32F	GOV	Spn	**5% Initiative-** American Red Cross Building-Generator	$169,716	$140,764	$28,952			12/30/2023	**95%**
1	PDMC-PJ-09-MP-2019-001	GOV-HM	Spn	CNMI Standard State Mitigation Update	$300,000			$300,000			**0%**
2	PDMC-PJ-09-MP-2019-001	GOV-HM	Spn	FY19 PDM Management Cost				$30,000			**0%**

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023 (*cont'd*).

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	**Project No.**	**Agency**	**Mun**	**Project Title**	**Requested Amount**	**Phase 2 Estimate**	**Phase 1 Award Amount**	**Award Amount**	**Sub-recipient Mgt. Cost**	**Completion Date**	**% Comp**
4	EMF-2020-BR-180-004	GOV-HM	Spn	FY20 CNMI BRIC Management Cost	$60,000			$59,997		12/20/2025	**0%**
Mayor's Office Tinian (DR-4404-MP)											
18	DR-4404-31-29F	MOT	Tin	**5% Initiative-** OMTA, Tinian–Loudspeaker Early Warning System	$1,299,457		$259,615		$12,981	1/5/2024	**0%**
Northern Marianas Housing Corporation (DR-4404-MP)											
2	DR-4404-03-04R	NMHC	Spn	NMHC Koblerville & Mihaville Estate Shutters	$525,826			$525,826		2/29/2024	**0%**
20	DR-4404-47-17R	NMHC	Tin	NMHC Tinian Broadway Estates Shutters	$404,572			$404,572	$20,229	12/9/2024	
Office of Planning & Development (BRIC)											
1	EMF-2020-BR-180-001	OPD	Spn	CNMI Blighted Buildings Hazard Mitigation	$200,000			$200,000		12/20/2025	**0%**
3	EMF-2020-BR-180-003	OPD	Spn	Micro Beach Mitigation Scoping Assessment	$145,000			$145,000		12/20/2025	**0%**

Table E.2-1. Awarded FEMA funding by disaster declaration and grant program 2018–2023 (*cont'd*).

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Sub-recipient Mgt. Cost	Completion Date	% Comp
				Totals:		$31,715,183	$3,522,375	$7,887,363	$200,963		

Source: CNMI Hazard Mitigation Grant Program, 2024.

Table E.2-2. FEMA-awarded projects completed by disaster declaration and grant program 2018–2023.

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Subrecipient Management Cost	Completion Date	% Comp.
Commonwealth Ports Authority (DR-4404-MP)											
4	DR-4404-08-11R	CPA	Spn	CPA Saipan International Airport Tower Office Shutters	$33,000			$21,147	$1,057.35	12/28/2021	**100%**
5	DR-4404-10-27R	CPA	Tin	CPA Tinian Seaport Office-Shutters	$70,000			$26,177		12/30/2022	**100%**
Department of Community and Cultural Affairs (DR-4404-MP)											
13	DR-4404-44-09R	DCCA	Spn	DCCA DYS Tanapag Youth Center Shutters	$36,600			$31,645	$1,562.52	8/5/2023	**100%**

Table E.2-2. FEMA-awarded projects completed by disaster declaration and grant program 2018–2023 (*cont'd*)

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020											
No	**Project No.**	**Agency**	**Mun**	**Project Title**	**Requested Amount**	**Phase 2 Estimate**	**Phase 1 Award Amount**	**Award Amount**	**Subrecipient Management Cost**	**Completion Date**	**% Comp.**
Commonwealth Utilities Corporation (DR-4404-MP)											
3	PDMC-PJ-09-MP-2017-008	CUC	Spn	CUC Sadog Tasi Wastewater Facility Storm Shutter Project	$29,061			$29,061		7/15/2023	**100%**
	DR-4235-01-09R	CUC	Spn	CUC Water System Mitigation Project–Phase I	$7,264,231			$4,596,513		6/30/2023	**100%**
Department of Public Safety (DR-4404-MP)											
14	DR-4404-46-08R	DPS	Spn	DPS Susupe Office Buildings Shutters	$42,500			$37,223		8/5/2023	**100%**
Department of Public Works (DR-4235-MP											
2	DR-4235 Kannat Tabla	DPW	Spn	DPW Kannat Tabla Flood Control and Drainage System				$2,123,650		5/30/2022	**100%**
Department of Community and Cultural Affairs (PDM FY 17-MP)											
1	PDMC-PJ-09-MP-2017-006	DCCA	Tin	Tinian Aging Center Storm Shutter Project	$33,270			$33,270		2/27/2023	**100%**

Table E.2-2. FEMA-awarded projects completed by disaster declaration and grant program 2018–2023 (*cont'd*)

DR-4404 | DR-4396 | DR-4235 | DR-4511 COVID | PDM FY-17,18,19 | BRIC 2020										
No	Project No.	Agency	Mun	Project Title	Requested Amount	Phase 2 Estimate	Phase 1 Award Amount	Award Amount	Subrecipient Management Cost	Completion Date	% Comp.
2	PDMC-PJ-09-MP-2017-007	DCCA	Tin	Tinian Youth Center Storm Shutter Project	$38,610			$38,610		2/28/2023	**100%**
Northern Marianas Housing Corporation (DR-4404-MP)											
3	PDMC-PJ-09-MP-2018-002	NMHC	Spn	Storm Readiness Project	$132,595			$132,595		1/2/2023	**100%**
							Total Award Amount:	**$7,069,892**			

Source: CNMI Hazard Mitigation Grant Program, 2024.

Table E.2-3. Project funding requests under review by FEMA 2018–2023

No.	Project No.	Agency	Mun	Project Title	Requested Amount
22	DR-4404-66-R	CUC	Spn	CUC Saipan Concrete Power Poles	$17,445,475
23	DR-4404-11-28F	MOR	Rota	**5% Initiative**- OMR, Rota-Loud Speaker Early Warning System	$901,024
25	DR-4404-22-22R	PSS	Spn	PSS Six Campuses Typhoon Windows and Doors	$1,458,665
1	DR-4511	GOV-HMGP	Spn	Shutters and Generator	$2,000,000
				Total Amount Requested	**$21,805,164**

Source: CNMI Hazard Mitigation Grant Program, 2024.

Table E.2-4. Commonwealth of the Northern Mariana Islands Completed List Federally Funded Projects 2018–2023.

	All Projects	CEDS/EDA	CDBG-DR	HM-4404	CIP	PA	NGOs	BIL	IRA
Estimated Total Project Costs (Funded and unfunded Requests)	$2,501,257,713	$1,349,469,695	$825,457,251	$121,089,675	$34,789,881	$305,314,713	$73,305,000	$8,700,000	$0
% of Total Estimated Project Cost	100%	54%	33%	4.8%	1.4%	12.2%	2.9%	0.3%	0
Total Grant Amounts Received									
Total CEDS Priority Projects under EDA		$96,919,695							
Total CDBG-DR Priority Projects			$127,844,878						
Total HMGP Projects				$82,648,794					
Total CIP Projects					$22,393,425				
Total Public Assistance for DR-4396						$5,566,665			
Total Public Assistance for DR-4404						$226,443,048			
TOTAL UNFUNDED PROJECTS (All Islands)		$1,174,990,000	$693,113,473	$35,640,881	$0	$0	$0		
Total Costs for All Requested Projects									
Total Project Request for Northern Islands		$9,000,000	$0	$0	$0	$0	$0		
Total Project Request for Rota		$230,860,000	$13,825,650	$8,255,486	$3,902,460	$5,566,665	$0		
Total Project Request for Tinian		$237,250,000	$61,780,900	$16,711,588	$3,902,460	$16,970,208	$0		
Total Project Request for Saipan		$867,359,695	$741,349,658	$96,122,602	$26,984,961	$209,472,840	$0		
Total Project Request for NGOs		$0	$0	$0	$0	$73,305,000	$73,305,000		
Total Project Requests		**$1,344,469,695**	**$816,956,208**	**$121,089,675**	**$34,789,881**	**$305,314,713**	**$73,305,000**	**$0**	**$0**

Source: CNMI Hazard Mitigation Grant Program, 2024.

E.2.2 CNMI Public Assistance Grants for Super Typhoon *Yutu*

Table E.2-5 lists the mitigation projects that were identified following Super Typhoon *Yutu* and have been award FEMA funding or are in being considered for grant awards.

Table E.2-5. Public Assistance Program DR-4404-MP, Typhoon Yutu Project Worksheet 2018–2023.

Title	CRC Gross Cost ($)	Total 406 HMP Cost ($)	Total Insurance Reductions ($)	Total Federal Share Obligated ($)	CRC Net Cost ($)
BECQ Vehicle Damage	28,746.94	-	-	25,872.25	28,746.94
Buildings-9 separate buildings	131,433.05	15,303.80	-	132,063.17	146,736.85
Buildings-10 buildings	305,353.15	-	-	274,817.84	305,353.15
Vehicles and Equipment-39-SUV's, 6-Trucks, 6-Motorcycles and 1 Gator	232,211.46	-	-	208,990.31	232,211.46
Contents damage in 10 separate buildings	183,534.16	-	-	165,180.74	183,534.16
Tinian Judiciary	83,827.22	-	-	75,444.50	83,827.22
Contents	17,679.93	-	-	15,911.94	17,679.93
Saipan Building and Equipment	2,020,928.00	167,821.98	-	1,969,874.98	2,188,749.98
Kagman Head Start	35,590.89	-	-	32,031.80	35,590.89
San Antonio Head Start	66,059.54	-	-	59,453.59	66,059.54
Pupil Transportation Facility	19,454.40	-	-	17,508.96	19,454.40
Tanapag Head Start	21,616.44	-	-	19,454.80	21,616.44
Oleai Head Start	44,683.32	-	-	40,214.99	44,683.32
Tinian Jr/Sr. High School	119,607.56	-	-	107,646.80	119,607.56
Tinian Elementary School	677,503.00	-	-	609,752.70	677,503.00
Da'ok Academy PAAP 428	1,776,600.00	-	-	1,598,940.00	1,776,600.00
Dandan Head Start	58,914.28	-	-	53,022.85	58,914.28
Joaquina Mareham Head Start	27,719.37	-	-	24,947.43	27,719.37
Tinian Head Start	52,913.90	-	-	47,622.51	52,913.90
Saipan Administrative Buildings	98,649.10	1,822.32	-	90,424.28	100,471.42
PSS-Wide Schools Building Contents 428	3,346,137.90	-	-	3,011,524.11	3,346,137.90
Chalan Kanoa Head Start/Early Head Start	377,584.00	-	-	339,825.60	377,584.00
Garapan Elementary School	442,569.00	-	(98,851.00)	309,346.20	343,718.00
Tanapag Middle School	243,191.00	41,155.00	-	255,911.40	284,346.00
Kagman High School	150,767.89	-	-	135,691.10	150,767.89
Dandan Middle School	556,720.00	-	-	501,048.00	556,720.00
Gregorio T. Camacho Elementary School	37,754.44	2,152.83	(10,002.37)	26,914.41	29,904.90
Saipan Southern High School	791,784.00	-	(6,926.00)	706,372.20	784,858.00
Marianas High School	1,497,190.00	-	(256,838.71)	1,116,316.16	1,240,351.29
Koblerville Elementary School	3,786,394.00	-	-	3,407,754.60	3,786,394.00
Building T PAAP 428 Marianas High School	4,220,700.00	429,829.00	(47,373.00)	4,142,840.40	4,603,156.00
Kagman Elementary School 428	832,649.00	63,841.00	-	806,841.00	896,490.00
Chacha Oceanview Middle School	404,334.00	19,564.00	-	381,508.20	423,898.00

Table E.2-5. Public Assistance Program DR-4404-MP, Typhoon Yutu Project Worksheet 2018–2023 (*cont'd*).

Title	CRC Gross Cost ($)	Total 406 HMP Cost ($)	Total Insurance Reductions ($)	Total Federal Share Obligated ($)	CRC Net Cost ($)
Francisco M. Sablan Middle School	1,271,249.00	-	-	1,144,124.10	1,271,249.00
Susupe Early Head Start	83,943.62	-	-	75,549.26	83,943.62
Francisco M. Sablan 428 PAAP Building C Project	1,356,640.00	-	-	1,220,976.00	1,356,640.00
William S. Reyes Elementary School PAAP 428 Auditorium	1,798,938.93	-	-	1,619,045.04	1,798,938.93
William S. Reyes Elementary School	2,296,875.00	12,666.00	-	-	2,309,541.00
William S. Reyes Building C Replacement Project	2,175,196.00	609,984.00	-	2,506,662.00	2,785,180.00
428-Hopwood Middle School	24,669,277.00	442,921.00	-	22,600,978.20	25,112,198.00
Oleai Elementary School	2,266,788.00	-	-	2,040,109.20	2,266,788.00
San Vicente Elementary School	3,597,587.00	232,997.00	-	3,447,525.60	3,830,584.00
CAT E- Tinian Health Clinic	204,430.00	-	-	183,987.00	204,430.00
CAT E- Saipan Hospital	243,203.21	-	(200,090.30)	38,801.62	43,112.91
DR4404 COTA Bus Stops, Contents and Vehicles Repair	16,478.30	-	-	14,830.47	16,478.30
Saipan Seaport	397,356.85	-	(107,087.00)	261,242.87	290,269.85
Saipan Airport Commuter Terminal	2,048,736.00	-	(1,703,240.00)	310,946.40	345,496.00
Buildings and Equipment	1,672,569.76	-	(956,236.27)	644,700.14	716,333.49
Buildings and Equipment-Airport Terminal	22,219,925.25	-	(16,418,250.53)	5,221,507.25	5,801,674.72
Contents at the Tinian Seaport, Airport, AAS Building, AARFF Building and Saipan Warehouse	90,435.76	-	(80,435.76)	9,000.00	10,000.00
Buildings and Equipment-Tinian Airport and Seaport	881,921.11	-	(555,222.59)	294,028.67	326,698.52
Vehicles at Tinian Seaport and Saipan Seaport and Airport	227,905.37	-	-	205,114.83	227,905.37
CNMI Power Transmission and Distribution Restoration	84,409,894.48	-	-	75,968,905.03	84,409,894.48
Building and Sub-Stations for Power Generation	69,989.77	-	-	62,990.79	69,989.77
Vehicles and Equipment Damage	175,191.89	-	-	157,672.70	175,191.89
CUC Buildings	115,975.98	55,918.63	-	154,705.15	171,894.61
Utilities-Water & Wastewater Department	928,195.91	-	-	835,376.32	928,195.91
CAT E- Department of Commerce	283,759.38	20,034.94	-	273,414.89	303,794.32
Department of Commerce-Damage Contents Only	5,068.00	-	-	4,561.20	5,068.00
DCCA DYS Shelters	14,702.60	536.84	-	13,715.50	15,239.44
DCCA Office Buildings and Contents	84,409.45	-	-	75,968.51	84,409.45
DCCA HPO Office	225,946.05	-	-	203,351.45	225,946.05
DFEMS Fire Station 1-5 & 7 Vehicle damage	51,962.63	-	-	46,766.37	51,962.63

Table E.2-5. Public Assistance Program DR-4404-MP, Typhoon Yutu Project Worksheet 2018–2023 (*cont'd*).

Title	CRC Gross Cost ($)	Total 406 HMP Cost ($)	Total Insurance Reductions ($)	Total Federal Share Obligated ($)	CRC Net Cost ($)
Fire Station 1-5 & Station 7 Contents	776,778.98	-	-	699,101.08	776,778.98
CAT E- Department of Fire and Emergency damaged fire stations	865,789.43	16,865.38	-	794,389.33	882,654.81
DHS Substance Abuse Center Generator Equipment Replacement	15,085.00	-	-	13,576.50	15,085.00
DR4404 DHS EOC Building and Contents Repair	275,639.16	36,202.20	-	280,657.22	311,841.36
DR4404 DHS Admin Building & Contents Repairs	50,369.13	-	-	45,332.22	50,369.13
4404 DHS Mt. Tapochau Communications Tower	156,524.00	-	-	140,871.60	156,524.00
Department of Fish and Wildlife Docks	134,648.66	6,219.87	-	126,781.68	140,868.53
As Perdido Agricultural and Dog Quarantine Facilities	393,725.27	-	-	354,352.74	393,725.27
Brown Tree Snake Program Facilities Contents	6,768.00	-	-	6,091.20	6,768.00
Department of Fish and Wildlife Tinian Docks	709,121.00	-	-	638,208.90	709,121.00
Parks and Recreation Facilities and Contents	410,072.04	47,916.32	-	412,189.52	457,988.36
DLNR- Agricultural Buildings and Contents	252,050.62	20,743.96	-	245,515.12	272,794.58
Island-Wide Pala Palas	251,269.00	35,627.00	-	258,206.40	286,896.00
428 Guma Sakman Building and Contents	636,711.15	170,156.00	-	726,180.44	806,867.15
Ponding Basin Fencing	98,028.43	-	-	88,225.59	98,028.43
DPW Roads and Grounds Traffic Branch Office	28,304.35	-	-	25,473.92	28,304.35
Road Signs and Traffic Control Devices on Saipan	289,850.00	33,289.39	-	290,825.45	323,139.39
CAT G Grace Christian Academy- Park Equipment	91,126.86	10,022.81	-	91,034.70	101,149.67
Grace Christian Academy- CAT E Building Repairs	69,649.76	6,700.36	-	68,715.11	76,350.12
DR4404 Joeten Kiyu Public Library Building, Contents and Vehicles Repair/Replacement	500,559.66	202,106.22	(22,775.00)	611,901.79	679,890.88
Men's Shelter and Fencing	390,666.00	17,831.18	(156,184.98)	227,080.98	252,312.20
Sister Remedios Building and Contents	180,451.18	326.00	-	162,699.46	180,777.18
Saipan and Tinian MVA Facilities and Equipment	98,355.01	6,302.06	(89,660.00)	13,497.36	14,997.07
MVA Tourist Site/Directional/Warning Signs	10,260.28	-	-	9,234.25	10,260.28
Sugar King Bldg.	38,111.37	15,256.50	-	48,031.08	53,367.87
Building A-Classrooms and Library	394,529.00	-	(318,029.00)	68,850.00	76,500.00
Building C, and Fence line	282,900.00	-	(215,475.00)	60,682.50	67,425.00
Building B	197,284.00	-	(147,284.00)	45,000.00	50,000.00
Gymnasium Complex	1,511,059.00	-	-	1,359,953.10	1,511,059.00

Table E.2-5. Public Assistance Program DR-4404-MP, Typhoon Yutu Project Worksheet 2018–2023 (*cont'd*).

Title	CRC Gross Cost ($)	Total 406 HMP Cost ($)	Total Insurance Reductions ($)	Total Federal Share Obligated ($)	CRC Net Cost ($)
DR4404 NMC Tinian Building Damages	128,981.00	21,454.24	-	135,391.72	150,435.24
NMC-Campus Wide Contents from all Buildings	2,464,235.79	-	-	2,217,812.21	2,464,235.79
Buildings K,M,N,O,P,U,V,L-2	888,569.60	56,996.87	-	851,009.82	945,566.47
NMC 428 Buildings A,A-1,B, B-1, C, I, L, L-1, Q,R,S,T,W, and Exterior Components	19,633,455.00	2,259,679.00	(6,361,012.07)	13,978,909.74	15,532,121.93
Buildings D, E, F, G, H, J and Gymnasium	16,755,373.00	2,266,158.00	-	17,119,377.90	19,021,531.00
Carolinian Affairs Office	88,076.18	-	-	79,268.56	88,076.18
Northern Marianas Housing Corporation-Koblerville and Mihaville Complexes	331,082.00	-	-	297,973.80	331,082.00
Board of Parole	55,397.53	-	-	49,857.78	55,397.53
Pedro P. Tenorio Multi-Purpose Building	66,993.16	30,372.00	-	87,628.64	97,365.16
Northern Marianas Housing Corporation	35,543.73	34,620.00	-	63,147.36	70,163.73
Department of Corrections	183,964.00	160,965.00	-	310,436.10	344,929.00
Development Disabilities Council	48,890.10	-	(23,598.99)	22,762.00	25,291.11
Governor's Administration Building	101,346.95	-	(97,954.23)	3,053.45	3,392.72
Youth Affairs	365,207.00	3,162.03	-	331,532.13	368,369.03
Commonwealth Election Commission	37,300.96	-	-	33,570.86	37,300.96
Department of Finance-Division of Customs	133,188.33	-	-	119,869.50	133,188.33
DR 4404-Oleai Sports Complex	1,065,154.00	-	-	958,638.60	1,065,154.00
DR 4404-Office of the Governor-428 Sports Complex	1,846,596.00	18,716.77	-	1,678,781.49	1,865,312.77
CAT E- Tinian Youth Center	135,000.00	13,224.85	-	133,402.37	148,224.85
CAT E- PAAP 428 Department of Public Works (DPW)	2,819,015.00	1,176,312.65	-	3,595,794.89	3,995,327.65
Tinian Mayors Office-Municipal Baseball field & Little league Baseball field	139,750.00	28,149.17	-	151,109.25	167,899.17
CAT E- PAAP 428 Mayors office (Tinian Public Market)	2,188,494.00	-	-	1,969,644.60	2,188,494.00
Office of the Mayor- Vehicle Damage Only	111,120.00	-	-	100,008.00	111,120.00
CAT E- 428 Tinian Municipal Council and Delegation Building	1,359,814.00	306,112.07	-	1,499,333.46	1,665,926.07
Tinian Mayors Office- Water Reservoir	90,849.09	-	-	81,764.18	90,849.09
CAT E-Mayors Office (Dog Kennel)	28,730.99	14,978.73	-	39,338.75	43,709.72
CAT E- Mayors Office (Pavilion)	265,567.00	-	-	239,010.30	265,567.00
Tinian Guest House (Small Project Certification)	6,580.84	-	-	5,922.76	6,580.84

Table E.2-5. Public Assistance Program DR-4404-MP, Typhoon Yutu Project Worksheet 2018–2023 (*cont'd*).

Title	CRC Gross Cost ($)	Total 406 HMP Cost ($)	Total Insurance Reductions ($)	Total Federal Share Obligated ($)	CRC Net Cost ($)
Office of the Mayor Tinian (Maintenance Shed)	31,604.16	17,941.44	-	44,591.04	49,545.60
CAT E- Department of Community Culture Affairs	983,618.42	304,008.24	-	1,158,863.99	1,287,626.66
CAT E- Department of Land and Natural Resources	467,060.59	-	-	420,354.53	467,060.59
Office of the Mayor-Tinian Public Library	27,028.27	15,791.85	-	38,538.11	42,820.12
Office of the Mayor-Antonio M. Borja Amphitheatre	186,904.42	-	-	168,213.98	186,904.42
Tinian Mayors Office- 428 Social Hall Building	3,437,001.00	-	-	3,093,300.90	3,437,001.00
Office of the Mayor Tinian (Tennis Court)	66,322.83	-	-	59,690.55	66,322.83
Tinian Office of the Mayor CAT E- Contents Only	186,786.12	-	-	168,107.51	186,786.12
Sugar King Park and Fencing	24,678.92	-	-	22,211.03	24,678.92
Chalan Kanoa Shop Buildings, Nursery Green House, and Vehicles	325,988.00	6,736.61	-	299,452.15	332,724.61
Building 1 and Building 1 contents	21,657.81	1,093.58	-	20,476.25	22,751.39
Building 7 and Building 7 Contents	44,553.71	101.82	-	40,189.98	44,655.53
Playground Area and Fence	131,422.84	4,964.80	-	122,748.88	136,387.64
Building 3 and Building 3 contents	40,000.02	5,493.05	-	40,943.76	45,493.07
Building 6	4,358.64	712.80	-	4,564.30	5,071.44
Building 2 and Building 2 contents	266,033.93	6,699.92	-	245,460.47	272,733.85
428 Building 4	411,402.00	27,370.00	-	394,894.80	438,772.00
Building 8 and Building 8 Contents	38,376.06	1,820.59	(31,606.85)	7,730.82	8,589.80
Building 5 and Building 5 contents	107,264.93	33,826.53	-	126,982.31	141,091.46
Building 9	71,362.20	-	-	64,225.98	71,362.20
Building Damages-Elementary School, Middle School, High School, and Music Building	566,859.73	-	-	510,173.76	566,859.73
Elementary School Contents	25,163.13	-	-	22,646.82	25,163.13
DR4404-SNIMC-Chalan Kanoa Kiosk Park	84,458.64	-	-	76,012.78	84,458.64
Buildings and Equipment	123,836.78	3,864.18	-	114,930.86	127,700.96
Total	**244,739,057.98**	**9,563,440.38**	**(27,904,133.65)**	**201,679,941.40**	**226,398,364.71**

Source: CNMI Hazard Mitigation Grant Program, 2024.

E.3 Integration with Other CNMI Planning Mechanisms and Documents

E.3.1 CNMI Comprehensive Sustainable Development Plan

E.3.1.1 Comprehensive Sustainable Development Plan

Under Public Law 20-20 § 2013(a), the OPD was directed to establish a Comprehensive Sustainable Development Plan (CSDP) that would serve as a guide for future long-range development using and improving on existing plans, maps, and other resources. To support an interagency framework envisioned by Public Law 20-20, the PDAC was established to identify priority projects and implement applicable visions, themes, goals, and objectives outlined in the *2021–2030 Comprehensive Sustainable Development Plan (CSDP) for the CNMI* (OPD, 2021) in coordination with planning partners. The PDAC membership includes the Bureau of Environmental & Coastal Quality, Commonwealth Utilities Corporation, Department of Public Works, Department of Public Lands, Department of Lands and Natural Resources, the CNMI Department of Commerce, the Commonwealth Zoning Board, the Office of Planning and Development, the Marianas Visitors Authority, the Office of the Mayors, and the Chamber of Commerce.

The OPD, in partnership with the PDAC members, continues to review existing laws and regulations and propose policies that foster and promote planning activities and sustainable development outcomes. Environmental reporting and planning have been largely segmented across numerous resource management agencies and divisions in the past. For this reason, the OPD prepared the first *2019–2020 Resource Report*, also known as State of Environment (SoE), which analyzes the current state of the environment—built, economic, as well as ecosystems and associated natural resources—to provide well-researched information to support local, state, and regional planning discussions in *planning areas* identified in Public Law 20-20. The OPD and members of PDAC, planning partners, agency heads, and members of the public use the findings of the Resources Report to develop appropriate steps in comprehensive planning. The *Draft—2023 Resources Report* (OPD, in prep.) is currently being finalized. The *Draft—2023Resources Report* also serves as a progress report for the CSDP.

In January 2019, taskforces were formed, and *Smart, Safe Growth* and sustainable development goals were shared with the PDAC and other partners. By June 2019, community scoping and information sharing meetings were conducted. The draft CSDP was shared and reviewed, and community engagement was ongoing in the Spring 2020. The categories assessed for the plan include land use, community design, transportation, public facilities, public lands, public buildings, housing redevelopment, conservation, recreation, safety, tourism, development policy, capital improvements, labor work force, specific policies, and other elements related to the physical development of the CNMI. In October 2021, the CSDP (OPD, 2021) was adopted, and implementation of the plan is ongoing.

E.3.2 CNMI Land Use Plan

Department of Public Lands

The *CNMI Comprehensive Public Land Use Plan for Rota, Tinian, Saipan, and the Northern Islands* (PLUP) was published in 2019 by the Department of Public Lands (2019). To assess the suitability of areas for future development for the 2025 PLUP update, high hazard areas identified in the 2024 Standard State Hazard Mitigation Plan (SHMP) and Climate Vulnerability Assessments should be incorporated into the Public Lands GIS. Hazard mitigation actions, and smart, safe growth principles should be part of future land use plans. OPD further recommends coordination between OPD, DPL, the Office of Homeland Security and Emergency Management, and other key CNMI agencies (e.g., built infrastructure and development regulation) to ensure projects identified in the plan are sited and designed to withstand future impacts expected under conditions of a changing climate (OPD, in prep.).

E.3.3 Permits

The CRM Board approves permits for all major development in the CNMI. Although the Board has inter-agency representation, the current permit review and approval processes are essentially done independently by each agency with little coordination (i.e., stove pipes). For example, the capacity or sequencing ability of CUC to provide essential services for all approved development permits is not considered by all Board members. The sheer volume of development project proposals and pressure for action make the situation more challenging. Increased interagency coordination and communication can help to ensure permit reviews and approvals consider and find solutions to second and third order effects of multiple, major development activities occurring simultaneously (e.g., disrupted or increased traffic, inadequate power or water, inadequate inspection support, etc.). Increasing cooperation within the Board will help to ensure development proceeds at a pace that protects CNMI's natural resources and limits stress on facilities and infrastructure.

References

[BECQ] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2016). *2016-2020 Section 309 assessment and strategy report* (p. 135). Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management.

[BECQ] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2020). *2021-2025 Section 309 Assessment & Strategy Report Commonwealth of the Northern Mariana Islands*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/CNMI_2021-2025_309-AS-Report_Final.pdf

[BECQ] Bureau of Environmental and Coastal Quality, Division of Coastal Resources Management. (2022). *Better Building Practices in the CNMI: Addressing Coastal Hazards Through Responsible Development and Resiliency*. CNMI Office of the Governor. https://dcrm.gov.mp/wp-content/uploads/crm/DCRM-Better-Buildings-Guidebook-v.1_July252022-2.pdf

Brinckerhoff. (2009). *Final Comprehensive Highway Master Plan*. Department of Public Works.

Child Care and Development Fund Program. (2019). *Emergency Preparedness, Response, and Recovery Plan (Draft)* (p. 91). Department of Community and Cultural Affairs.

[HSEM] CNMI Homeland Security and Emergency Management. (2018). *2017 CNMI Catastrophic- Typhoon Plan, Annex to the FEMA Region IX All-Hazards Plan* (p. 417). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2021). *FY 2021 Citizen Centric Report*. CNMI Office of the Governor.

[HSEM] CNMI Homeland Security and Emergency Management. (2024a). *2023 CNMI Stakeholder Preparedness Review (SPR)* (p. 228). CNMI Homeland Security and Emergency Management.

[HSEM] CNMI Homeland Security and Emergency Management. (2024b). *2023 CNMI Threats and Hazards Identification Risk Assessment (THIRA)*. CNMI Homeland Security and Emergency Management.

Conrad, M. D., & Ness, J. E. (2012). *Commonwealth of the Northern Mariana Islands strategic energy plan* (p. 26). National Renewable Energy Laboratory.

Department of Public Lands. (2019). *CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan, and the Northern Islands* (p. 143). CNMI Department of Public Lands. https://www.dpl.gov.mp/land-use-plan-resources/

[FEMA] Federal Emergency Management Agency. (2021). *Codes, Standards, and Permitting: Mitigation Assessment Team Summary Report and Recommendations, Commonwealth* *of the Northern Mariana Islands, Super Typhoon Yutu* (p. 23). US Department of Homeland Security.

[FEMA] Federal Emergency Management Agency. (2024). *National Flood Insurance Program (NFIP)*. PIVOT System. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fnfipservices.floodsmart.gov%2Fsites%2Fdefault%2Ffiles%2Fnfip_policy-information-by-state_20240229_0.xlsx&wdOrigin=BROWSELINK

GHD. (2023). *CNMI 20-Year Highway Master Plan, Final Report* (p. 200). CNMI Department of Public Works.

Liske-Clark, J. (2015). *Wildlife Action Plan for the Commonwealth of the Northern Mariana Islands 2015-2025* (p. 292). CNMI, Division of Fish and Wildlife.

Nadeau, G., & Mapp, K. (2015). *Territorial highway program implementation and stewardship agreement, Federal Highway Administration—Puerto Rico and US Virgin Islands Federal-Aid Division and the Government of the US Virgin Islands* (p. 33). US Federal Highways Administration.

[NES] Nimbus Environmental Services. (2018). *Guidance Manual for Smart, Safe Growth Commonwealth of the Northern Mariana Islands* (p. 295). Federal Emergency Management Agency.

Office of Planning and Development. (2021). *2021-2030 CNMI Comprehensive Sustainable Development Plan (CSDP) for the CNMI*. CNMI Office of the Governor. https://opd.gov.mp/assets/2021-2030_cnmi_csdp.pdf

[OPD] Office of Planning and Development. (in prep.). *Draft—2023 Resources Report* (p. 687) [Planning for Sustainability in the Commonwealth of the Northern Mariana Islands]. CNMI Office of the Governor.

Storlazzi, C. D., Reguero, B. G., Cole, A. D., Lowe, E., Shope, J. B., Gibbs, A. E., Nickel, B. A., McCall, R. T., van Dongeren, A. R., & Beck, M. W. (2019). *Rigorously Valuing the Role of US Coral Reefs in Coastal Hazard Risk Reduction* (Open-File Report 2019–1027; Open-File Report). US Geological Survey.

[USACE] US Army Corps of Engineers. (2022). *The Commonwealth of the Northern Mariana Islands Final Post Disaster Watershed Plan* (p. 166). US Army Corps of Engineers, Honolulu District.

Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan

Appendix F Mitigation Strategies Supplement

28 July 2024

Appendix F Mitigation Strategies Supplement

Table of Contents

List of Tables

F.1 Introduction

This appendix includes detailed information that supports the Mitigation Strategy discussion presented in Chapter 6.0 (Mitigation Strategy) of this document.

F.1.1 2018 Standard State Mitigation Plan Mitigation Goals, Objectives, and Actions

The following Hazard Mitigation goals were identified in the 2018 Standard State Mitigation Plan. (SSMP).

1) Save lives and minimize injuries against all hazards but recognizing that the CNMI is most vulnerable to impacts from typhoons and tropical storms.
2) Reduce potential damage to public and private property.
3) Reduce adverse impacts on the environment and natural resources.
4) Reduce the financial burden on the community, businesses and government.

From these goals the following 8 mitigation objectives and actions were developed. The mitigation objectives are listed below.

Objective 1: Secure, strengthen, and maintain essential government facilities, identified lifeline utility systems and access for emergency medical assistance and response, and transportation systems to ensure the delivery of necessity goods and fuel.

- Action 1-1: Harden essential critical facilities.
- Action 1-2: Identify essential facilities and governmental facilities that must maintain operations and assess hardening and retrofit requirements.
- Action 1-3: Develop proposals to harden and retrofit facilities and seek funding from the Federal Emergency Management Agency (FFEMA) and other federal, state agencies and organizations.
- Action 1-4: Convert the overhead power distribution system to an underground system over a period of time, earmarking a specific amount to be used for this purpose, and prioritizing the segments to be converted. Set policy governing requirements for new line installations.
- Action 1-5: Replace wood poles with concrete poles over a period of time, earmarking a specific amount to be used for this purpose, and prioritizing the segments to be converted. Set policy governing requirements for new concrete pole installations.

- Action 1-6: Secure buildings, trees and plant materials affecting power lines to reduce damage to the power distribution system. Encourage legislation to prohibit the planting of certain types of trees under power lines and along the rights of ways.

Objective 2: Review and improve polices and enforcement of building standards and codes, particularly the International Building codes (IBC), Uniform Facilities Criteria (UFC), and National Flood Insurance Program (NFIP) requirements.

- Action 2-1: Review and recommend improvements in the building codes enforcement and increase inspections.
- Action 2-2: Ensure a valid Commonwealth of the Northern Mariana Islands (CNMI) land use plan is in place and enforced.
- Action 2-3: Encourage the use of concrete in residential construction.
- Action 2-4: Prepare and adopt public education materials regarding private sector buildings.
- Action 2-5: Encourage homeowners and businesses to install typhoon shutters on windows and glass doors to prevent damage from strong winds, flying debris, and wind driven rain.

Objective 3: Improve inter-agency and inter-island coordination and communication.

- Action 3-1: Review and update existing master plans for land use designations.
- Action 3-2: Continue to promote interagency communication across all sectors and levels of government, including CNMI agencies, federal agencies, private sector organizations and private non-profit organizations.

Objective 4: Participate in public awareness and education activities that improve implementation of the strategy and in activities promoted by the CNMI Homeland Security and Emergency Management (HSEM) and preparedness partners at all sectors and levels of government.

- Action 4-1: Use risk and vulnerability assessment and maps to improve the quality of public awareness materials distributed within the CNMI.
- Action 4-2: Use agency and committee interactions to gather feedback on this plan to make improvements over the next year.
- Action 4-3: Develop a public awareness program in coordination with Federal, State and local offices. The information gathered would be disseminated among the local communities, integrated into the public school curriculum, and incorporated into the existing disaster awareness activities currently employed.

- Action 4-4: Implement the Public Awareness Program to disseminate all-hazard mitigation information for earthquake or hurricane retrofits, hazard warning information, evacuation procedures, protective measures, and preventive techniques.
- Action 4-5: Use the local multi-media approach and encourage media, community, and other agency involvement through the following activities: develop public radio stations on Tinian and Rota to expand existing community education initiatives; hold workshop and/or public information meetings; use properly secured billboards or sides of buildings to relay important information; use website sources to display hazard reduction community information; translate educational materials to many of the islands' prevalent languages; use the American Red Cross to develop and distribute literature and facilitate public education events.

Objective 5: Address post-disaster pollution control.

- Action 5-1: Label and properly secure stored hazardous materials and hazardous waste so that it is safe from wind and rain.
- Action 5-2: Develop a surface water quality control program that should include the installation of ponding basins to control and filter surface water runoff. Program should promote the control sedimentation and other forms of pollution that destroy the inner reef areas by installing drainage and seepage tanks to control non-point source pollution during heavy rains.

Objective 6: Improve freshwater resources.

- Action 6-1: Explore and quantify water sources on all islands.
- Action 6-2: Institute a system of storm water runoff management.
- Action 6-3: Develop ponding basins to enhance aquifers.
- Action 6-4: Develop a program of conservation among businesses, communities, and individual residences. The program should include the development of public information material and the installation and monitoring of water meters.
- Action 6-5: Propose legislation to implement rainwater catchment systems in homes, businesses, and public buildings.
- Action 6-6: Improve the collection of water in existing springs.
- Action 6-7: Develop a water-recycling program. Support the development of wastewater treatment that produces effluents that can be recycled for industrial process, irrigation, and other non-drinking uses.
- Action 6-8: Encourage the Army Corps of Engineers to develop and update the water master plan for Saipan, Tinian and Rota, and the Confidence Consumer Report for water quality.

Objective 7: Ensure that adequate shelter is available to all residents and visitors.

- Action 7-1: Harden and retrofit identified typhoon shelter facilities (under the Public School System [PSS] and the Department of Community and Cultural Affairs [DCCA]) to include storm shutters, lighting, backup generators, water tanks and water pumps, enclosed walkways and adequate bathroom facilities that are compliant with Americans with Disabilities Act (ADA) requirements for people with disabilities.
- Action 7-2: Encourage residents and hotels to harden, retrofit and build safe rooms to take responsibility for sheltering.

Objective 8: Build and maintain geographic information system and data to improve upon existing risk assessment data.

- Action 8-1: Improve the database and geographic information systems developed for the risk and vulnerability assessment to make decisions for disaster response plans and mitigation activities.
- Action 8-2: Develop a protocol for accessing information and for improving information sharing among CNMI agencies. Develop a protocol for sharing information with community organizations that could benefit from using Geographic Information Systems (GIS) in community planning activities.
- Action 8-3: Continue to identify missing data and gaps in the risk and vulnerability assessment and incorporate these into the CNMI GIS system.
- Action 8-4: Enable use of the GIS systems including hazard risk and vulnerability assessment information for the building and land use permit system.

F.1.1.1 2018 SSMP Categories for Hazard Mitigation Actions

The 2018 SSMP identified ongoing priorities that built off the mitigation actions in the 2014 SSMP update. New sets of hazard mitigation activities were identified during the 2014 update, and FEMA Region 9 provided technical assistance to the HSEM and facilitated discussions with CNMI stakeholders over a range of topics concerning the plan update. The result was a set of mitigation actions that span 13 government agencies across all 4 CNMI municipalities, as well as the American Red Cross. Four categories were created in 2014 to streamline priority ratings and key resources, facilities, and other (e.g., warning systems, communications, mapping systems, health and safety maintenance programs, public education, and outreach) and carried over in the 2018 SSMP update.

In the 2018 SSMP update, the Statewide Emergency Response Commission(SERC) was tasked with scoring each hazards mitigation actions by assigning a priority score based on a scale of 1–4 for project criticality, with 1 = critical, 2 = important, 3 = moderately important, and 4 = low priority. The results are as follows:

1. Shelter Hardening and Retrofitting
2. Critical Infrastructure and Key Resources
3. Facilities
4. Others

F.1.1.2 2018 SSMP Criteria to Prioritize Funding for Mitigation Actions

Using the STAPLE/E methodology in the FEMA State and Local Mitigation Planning Guide, the following mitigation actions were identified (when funding is available):

- Protect critical/lifeline facilities and services–the proposed action recognizes facilities or lifeline services identified as critical must be protected from potential threats from identified hazards.
- Project costs withing available funding–the proposed action has completed plans, scope of work, and estimated costs that promote effective and efficient implementation while reducing overruns and delays.
- Project addresses historical damage–the proposed action accounts for historical trends and vulnerabilities to repetitive damage from known hazards based on risk analysis and assessments.
- Benefits multiple agencies and hazards–the proposed action provides tangible benefit to multiple agencies or core capabilities across all islands and the spectrum of identified hazards; streamline overall project costs and implementation process.
- Preserves environmental, cultural, and historical resources–the proposed action can be implemented in a manner that does not degrade significant elements of natural, cultural, and historical importance.
- Provides economic benefit–the proposed action directly or indirectly spurs economic development and may potentially provide long-lasting economic benefit.

F.1.1.3 Comprehensive Review and Evaluation of Progress for the 2018 SSMP Mitigation Actions.

The 2018 SSMP identified 34 mitigation actions. However, several major disasters occurred between 2018 and 2024, disrupting implementation of the mitigation actions. To address pressing post-disaster recovery needs, an additional 42 mitigation projects were submitted to FEMA for funding. Table F.1-1 is a comprehensive review of the 34 mitigation actions from the 2018 SSMP and the 42 post-disaster mitigation actions with progress information. The 42 post-disaster mitigation projects were associated with an objective and action from the 2018 SSMP to demonstrate how the post-disaster mitigation projects are contributing towards the mitigation strategy established in 2018.

Table F.1-1. Progress toward mitigation actions identified in the 2018 State Standard Mitigation Plan.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Objective 1 Secure, strengthen, and maintain essential government facilities, identified lifeline utility systems and access for emergency medical assistance and response, and transportation systems to ensure the delivery of necessity goods and fuel.							
Action 1-1: Harden essential critical facilities	2018-1-01	Earthquake, Flood, Typhoon, Tsunami, Wildfire					Ongoing
Saipan Airport Tower office shutter		Typhoon	CPA	DR-4404-08-11R	12/28/21	100%	Completed
Tinian seaport office shutter		Typhoon	CPA	DR-4404-10-27R	12/30/22	100%	Completed
Sadog Tasi Wastewater Facility Storm Shutter Project		Typhoon	CUC	PDMC-PJ-09-MP-2017-008	7/15/23	100%	Completed
Susupe Office Buildings Shutters		Typhoon	DPS	DR-4404-46-08R	8/5/23	100%	Completed
Water System Mitigation Project - Phase		All	CUC	DR-4235-01-09R	6/30/23	100%	Completed
FY19 PDM Management Cost		All	GOV-HM	PDMC-PJ-09-MP-2019-001	None Set	0%	In progress
FY20 CNMI BRIC Management Cost		All	GOV-HM	EMF-2020-BR-180-004	12/20/25	0%	In progress
Action 1-2: Assess hardening and retrofit requirements for critical facilities that must remain operational.	2018-1-2	Earthquake, Flood, Typhoon, Tsunami, Wildfire					Ongoing
Adv. Asst.- Planning and Technical Assistance to Assess, Identify & Develop Mitigation Opportunities for the CNMI		All	GOV-HM	DR-4404-01-R	3/23/24	Unk	In Progress
CNMI Standard State Mitigation Update		All	GOV-HM	PDMC-PJ-09-MP-2019-001	7/31/24	95%	Contract awarded to Nimbus Environmental Services, Ref No. HM-23-0646

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Action 1-3: Develop proposals to harden and retrofit facilities and seek funding.	2018-1-3						Ongoing
Rota Airport Rescue and Fire Facility Shutter Project		Typhoon	CPA	DR-4396-01	12/14/2023	0%	Budget Modification request to FEMA on 06/27/2023 (HM-23-0341).
Tinian International Airport Shutter Project		Typhoon	CPA	DR-4396-04	9/9/2024	0%	FEMA Award 11/09/2023
Water System Mitigation Project Phase II - Generators		All	CUC	DR-4404-20-13R	10/11/23	60%	HEC submitted a 60% design to HMGP; Pending Budget Modification request approval by FEMA (HM-23-0366).
Sadog Tasi Office & Lift Stations Generator		All	CUC	DR-4404-12-25R	1/5/24	0%	06/05/23 Project awarded; Kick-off meeting was held on 10/23/2023
Saipan Office on Aging Storm Readiness Project- Generator		Typhoon	DCCA	PDMC-PJ-09-MP-2018-004	12/30/23	100%	Project completed, awaiting shutter portion prior to closeout
Saipan Office on Aging Storm Readiness Project- Shutters		Typhoon	DCCA	PDMC-PJ-09-MP-2018-004	12/30/23	0%	Installation of windows and doors in progress, 80% complete
Rota DYS Sinapalo Youth Center Shutter Project		Typhoon	DCCA	DR-4396-02	10/9/23	0	FEMA Award 11/09/2023: Awaiting DCCA's availability for kick-off meeting
Fire Station 1 & 5 Concrete Roof		Typhoon, Wildfire	DFEMS	DR-4404-21-23R	10/12/23	95%	Final design complete; HMGP to Phase 2 application
Tinian Fire Station 7 Generator		All	DFEMS	DR-4404-21-23R	None Set	0%	Budget Modification Request under FEMA review
SAAR HOPE Recovery Center Shutters		Typhon	GOV-HM	DR-4404-40-10R	12/13/23	0%	Project to be re-advertised
SAAR HOPE Recovery Center Generator		Typhoon	OV-HM	DR-4404-40-10R	12/13/23	15%	Contract processing in progress
5% Initiative- American Red Cross Building - Generator		All	OV-HM	DR-4404-33-32F	12/30/23	95%	Final design complete; HMGP working on Phase 2 application
Koblerville & Mihaville Estate Shutters		Typhoon	NMHC	DR-4404-03-04R	2/29/2024	0%	Contract processing complete, pending NTP
Tinian Broadway Estates Shutters		Typhoon	NMHC	DR-4404-47-17R	12/9/2024	Unk	NMHC to begin advertising

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Micro Beach Mitigation Scoping Assessment		Flood, Typhoon	OPD	EMF-2020-BR-180-003	12/20/25	0%	RFP process
Action 1-4: Convert the overhead power distribution system to an underground system. Set policy governing requirements for new line installations.	2018-1-4						Ongoing
Hospital Underground Power		Typhoon	CUC / CHCC	DR-4404-02-12R	3/25/24	10%	CUC procurement Request for Proposal in progress.
Underground Power System		Typhoon, Wildfire	CUC	DR INF 015	Not Set	Unk	A&E Design initial meeting completed with CUC, HEC and NMHC. HEC and CUC will be in Tinian to create a blueprint approach identifying each phase of the A&E Design package. Dr. Peavey of CUC is facilitating this project.
Action 1-5: Replace wood poles with concrete poles. Set policy governing requirements for new concrete pole installations.	2018-1-5						Ongoing
Tinian Concrete Power Poles		Typhoon	CUC	DR-4404-71-06R	3/25/24	35%	CUC issued a contract to HKPALLC; Design phase in progress.
Rota Concrete Power Poles		Typhoon	CUC	DR-4404-74-07R	3/25/24	35%	CUC issued a contract to HKPALLC; Design phase in progress.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Action 1-6: Reduce threats that may damage the power distribution system. Encourage legislation to prohibit planting certain vegetation under power lines and along the rights of ways.	2018-1-6	N/A					No Progress
Objective 2: Review and improve polices and enforcement of building standards and codes, particularly the IBC, UFC, and NFIP requirements.							
Action 2-1: Review and recommend improvements in the building codes enforcement and increase inspections.	2018-2-1	Earthquake, Flood, Typhoon, Tsunami, Wildfire					Ongoing
Blighted Buildings Hazard Mitigation		All	OPD	EMF-2020-BR-180-001	12/20/25	0%	RFP process
Assessment of Risk, Vulnerability and Disaster Bonding/Insurance Feasibility to Support Comprehensive Sustainable Development Planning and Disaster Risk Reduction		All	OPD	DR-4404-49	Not Set	Unk	1/27/20 Application and Art submitted to FEMA; 1/27/20 Acknowledged by FEMA
Completion of the CNMI Comprehensive Development Plan		All	OPD		2022	100%	The CNMI CSDP addresses building codes and adopts a *Smart, Safe Growth* framework for new development.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Action 2-2: Ensure a valid CNMI land use plan is in place and enforced.	2018-2-2	All					Ongoing. An update to the Public Use Plan is pending.
Assessment, Capacity Building, and Property Acquisition and Risk Remediation Project		All	OPD	DR-4404-48	Not Set	Unk	1/27/20 Application and Art submitted to FEMA;
Completion of the Public Land Use Plan in 2019		All	DPL			100%	The Public land Use Plan identifies current land use policies and projects future population growth, development, and land use.
Action 2-3: Encourage the use of concrete in residential construction.	2018-2-3	Flood, Typhoon, Tsunami					No Progress
Action 2-4: Prepare and adopt public education materials regarding private sector buildings.	2018-2-4	Earthquake, Flood, Typhoon, Tsunami, Wildfire					No Progress
Action 2-5: Encourage typhoon shutters installation by homeowners and businesses.	2018-2-5	Typhoon					No Progress
Objective 3 Improve inter-agency and inter-island coordination and communication							
Action 3-1: Review and update existing master plans for land use designations.	2018-3-1	All					Ongoing
Watershed Action and Master plans		Flood, Typhoon, Drought, Wildfire	BECQ			100%	Several watershed action plans as well as the post-disaster watershed master plan (USACE) were updated during the plan period.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Draft Highways Master plan and Walkability plans			DPW			50%	Plans outline land use for the transportation network
Completion of the Statewide Comprehensive Outdoor Recreation Plan		Flood	OPD			100%	The SCORP discusses recreational needs, land use, socio-economic trends, and wetland conservation.
Action 3-2: Promote interagency communication.	2018-3-2	All					Ongoing
Established the Planning and Development Council		All	OPD	N/A	N/A	N/A	The PDAC meets regularly to discuss planning and development issues. There are several sub-taskforces with one focused on socio-economic and disaster risk reduction issues.
HSEM regularly hosts exercises to improve communication and coordination in emergency response.		All	HSEM	N/A	N/A	N/A	
Objective 4 Participate in public awareness and education activities that improve implementation of the strategy and in activities promoted by the CNMI HSEM and preparedness partners at all sectors and levels of government.							
Action 4-1: Improve public awareness materials for hazards.	2018-4-1	All					Ongoing
Tsunami readiness materials		Tsunami	HSEM	NOAA Tsunami mitigation funding	Not Set	Unk	Tsunami outreach materials were updated to reflect accurate and current information. Children's activity booklets were created and printed to educate the youth on tsunami-related terms and concepts.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Action 4-2: For the next update, gather feedback from agencies to improve next plan update.	2018-4-2	All					Complete
Public and agency stakeholder hazards questionnaires		All	HMGP	PDMC-PJ-09-MP-2019-001	7/31/24	95%	Surveys were collected and analyzed. Results will be presented in the 2024 SHMP Update.
Action 4-3: Develop a public awareness program for hazards in partnership.	2018-4-3	All					Ongoing
Storm Readiness Project		Typhoon, Flood	NMHC	PDMC-PJ-09-MP-2018-002	1/2/23	100%	Completed
Action 4-4: Implement the Public Awareness Program.	2018-4-4	All					Ongoing
Tinian - Loud Speaker Early Warning System		All	MOT	DR-4404-31-29F	1/5/24	0%	RFQ Advertisement
Action 4-5: Develop and use multiple approaches to disseminate hazard awareness information to the public.	2018-4-5	All					Ongoing
National Weather Service and Northern Mariana College outreach to underserved communities for weather warnings.		ALL	NMC/ NWS				The NMC and NWS have created an outreach program to increase the reach and effectiveness of communication, information briefs, and weather warning during severe weather events.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Objective 5 Address post-disaster pollution control.							
Action 5-1: Improve hazardous material and waste storage.	2018-5-1	Flood, Typhoon				0%	No Progress
Action 5-2: Develop a surface water quality control program.	2018-5-2	Flood				0%	No Progress
Objective 6 Improve freshwater resources.							
Action 6-1: Explore and quantify water sources on all islands.	2018-6-1	Drought, Flood					Ongoing
Dan Dan Water Tank Replacement		Drought	CUC	DR INF 003	Not Set	Unk	A&E Design Completion Feb 2023. Then 3 years for Construction estimate. Project is being amendment from CDBG-DR to CDBG-MIT grant funding.
Kagman Water Tank Replacement		Drought	CUC	DR INF 004	Not Set	Unk	A&E Design Completion Feb 2023. Then 3 years for Construction estimate.
Tinian Carolinas Water Tank Replacement		Drought	CUC	DR INF 005	Not Set	Unk	A&E Design Completion Feb 2023. Then 3 years for Construction estimate. Project is being amendment from CDBG-DR to CDBG-MIT grant funding.
Action 6-2: Institute a system of storm water runoff management.	2018-6-2	Flood, Typhoon					Ongoing
Kannat Tabla Flood Control and Drainage System		Flood	DPW	DR-4235 Kannat Tabla	5/30/23	100%	Completed

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Garapan Downtown Flood Management		Flood	DPW	DR-4404-06-26R	1/29/24	60%	60 % Preliminary Design in progress
Dandan Flood and Stormwater Drainage Improvement		Flood	DPW	EMF-2020-BR-180-002	12/20/25	0%	RFP draft process
Action 6-3: Develop ponding basins to enhance aquifers.	2018-6-3	Flood, Typhoon	CUC				No Progress
Action 6-4: Develop a water conservation program including public awareness materials.	2018-6-4	Drought	CUC / DPW				No Progress
Action 6-5: Propose legislation to implement rainwater catchment systems in homes, businesses, and public buildings.	2018-6-5	Drought	CUC / OPD				No Progress
Action 6-6: Improve the collection of water in existing springs.	2018-6-6	Flood, Typhoon	CUC				Ongoing
Water (Rota)		Flood, Drought	CUC	DR-4396-MP,	Not Set	0%	No drawdown of funds noted.
Action 6-7: Develop a water-recycling program.	2018-6-07	Drought	OPD				No Progress
Action 6-8: Develop and update the water master plan for Saipan, Tinian and Rota, and the Confidence Consumer Report for water quality.	2018-6-08	Flood, Typhoon	CUC				No Progress

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Objective 7 Ensure that adequate shelter is available to all residents and visitors.							
Action 7-1: Harden and retrofit identified typhoon shelter facilities (under PSS & DCCA) to include storm shutters, lighting, backup generators, water tanks and water pumps, enclosed walkways and adequate bathroom facilities that are compliant with ADA requirements for people with disabilities.	2018-1-7	All	HMGP / All Agencies				Ongoing
Tanapag Youth Center Shutters		Typhoon	DCCA DYS	DR-4404-44-09R	8/5/2023	100%	Completed
Tinian Aging Center Storm Shutter Project		Typhoon	DCCA	PDMC-PJ-09-MP-2017-006	2/27/23	100%	Completed
Tinian Youth Center Storm Shutter Project		Typhoon	DCCA	PDMC-PJ-09-MP-2017-007	2/28/23	100%	Completed
PSS Six Campuses Typhoon Windows and Doors		Typhoon	PSS	DR-4404-22-22R	None set	0%	Pending FEMA Review
Shutters and Generator		Typhoon	GOV-HMGP	DR-4511	None set	0%	Pending FEMA Review
Tinian Health Center Generator		Typhoon	CHCC	DR-4404-25-14R	1/30/2024	0%	Pending design and cost proposal
Hospital Generators		Typhoon	CHCC	DR-4404-53-19R	1/5/2024	0%	Project awarded
Action 7-2: Encourage residents and hotels to harden, retrofit and build safe rooms for typhoon sheltering.	2018-7-2	Typhoon	HMGP				

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Objective 8 Build and maintain geographic information system and data to improve upon existing risk assessment data.							
Action 8-1: Improve the database and GIS for hazard risk and vulnerability assessment to make decisions for disaster response plans and mitigation activities.	2018-8-1	All					Ongoing
Improved GIS layers for commonwealth assets and hazards		All	HMGP	PDMC-PJ-09-MP-2019-001	7/31/24	80%	Major updates were completed for the 2024 SHMP Update to GIS layers for commonwealth and general building assets that will facilitate future hazard risk analysis
Action 8-2: Develop a protocol to access and share information among CNMI agencies. Develop a protocol to share GIS information with community organizations involved in community planning activities.	2018-8-2	All	OPD		None Set	0%	No Progress
Action 8-3: Identify missing data and gaps in the risk and vulnerability assessment and incorporate these into the CNMI GIS system.	2018-8-3	All	HMGP / OPD				Ongoing
Missing data and data gaps were identified and documented.		All	HMGP	PDMC-PJ-09-MP-2019-001	7/31/24	80%	As part of the 2024 SHMP Update, data needed to improve hazard risk assessments was identified and gaps documented.

Action Description	Action No. (new)	Hazard	Lead/ Support Agency	Funding Source	Target Completion Date	% Comp.	Status
Action 8-4: Enable use of the GIS systems including hazard risk and vulnerability assessment information for the building and land use permit system.	2018-8-4	All	OPD/ DPW	Not identified	None Set	0%	Ongoing
Adv. Asst.- DPW, Planning - Road Condition & Flood Hazard Mapping		Flood, Typhoon	DPW	DR-4404-51-03R	5/24/24	0%	Contract processing to DCA in progress.

F.2 2024 SHMP Update Mitigation Action Plan Prioritization

As discussed in Chapter 6.0 (Mitigation Strategy), each action in the 2024 SHMP Update was ranked based on the following criteria:

- Will the action result in lifeline safety?
- Will the action result in property protection of vulnerable state assets?
- Will the action be cost-effective? (future benefits exceed cost)
- Is the action technically feasible?
- Will the action mitigate impacts from climate change?
- Does the CNMI have the legal authority to implement?
- Is funding available for the action?
- Will the action have a positive impact on the natural environment?
- Does the action benefit socially vulnerable communities?
- Does the state have the administrative capability to execute the action?
- Will the action reduce risk to more than one hazard?
- Can the action be completed in less than 5 years?
- Is there an agency/department local champion for the action?
- Will the action support other local objectives (such as capital improvements, economic development, environmental quality, or open space preservation?) or policies of other plans and programs?

The answers to each of these questions are weighted as follows:

- Yes = 3 points
- Not sure, could be either yes or no, or question is difficult to quantify = 1 point
- No = 0 points

Following scoring of each action, priorities are assigned based on the following metrics:

- 35 or more = High Priority
- 20 to less than 35 = Medium Priority
- 0 to less than 20 = Low Priority

This prioritization process was applied to hazards identified by the risk assessment conducted for the 2024 SHMP Update. It was also applied based on updates to the capabilities assessed in Chapter 5.0 (Capability Assessment) and Appendix E (Capability Assessment Supplement), as shown in the prioritization questions above.

Thirteen responses were received from the following 12 agencies: the CNMI Council on Developmental Disabilities, the Commonwealth Health Corporation(CHCC), the Commonwealth Port Authority (CPA), the Commonwealth Utilities Corporation (CUC), the Department of Fire and Emergency Services (FFEMS), the Division of Coastal Resources Management (DCRM), the Department of Public Works (DPW), the CNMI Office of Homeland Security and Emergency Management (HSEM), the CNMI Office of Planning and Development (OPD), and the Mayor’s Offices of Rota, Tinian and Aguiguan, and the Northern Islands.

To determine the priority of the mitigation actions, the average scores for each mitigation action criteria were summed to provide the total score. The total score was used to rank the mitigation actions from high to low priority based on the criteria presented above. Not all agencies provided scores for each mitigation action. Therefore, scores for each action criteria were averaged based on the number of responses received for each action. For example, if the criteria for a mitigation action was scored by 11 agencies, then the combined scores for each criterion were divided by 11 to yield the average score. However, if the criteria for a mitigation action was scored by 7 agencies, then the combined scores for each criterion were divided by 7 to yield the average. Table F.2-1 summarizes the prioritization of the mitigation actions.

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization.

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2018-01-06	CUC	Reduce threats that may damage the power distribution system. Encourage legislation to prohibit planting certain vegetation under power lines and along the rights of ways.	3.0	2.8	3.0	3.0	2.7	2.0	1.7	1.8	3.0	2.6	3.0	2.4	2.8	3.0	41.3	H
2024-04-08	DFEMS / BECQ	Provide wildfire awareness, preparedness, and prevention education to the public.	3.0	2.7	2.8	2.8	3.0	2.4	1.9	2.8	3.2	2.6	3.0	2.8	3.2	3.2	39.3	H
2024-01-13	HMGP	Collaborate with the State Hazard Mitigation Officer (SHMO), HMGP, and stakeholders to evaluate and update the State Hazard Mitigation Plan on an annual basis.	2.7	2.4	3.0	3.0	2.7	2.8	2.3	2.7	3.0	2.6	3.0	2.7	3.0	3.0	38.8	H
2024-06-15	DPW / DFEMS	Reduce/convert hazardous fuel in the wildland urban interface to reduce the threat of wildfire to communities and conservation land.	2.9	3.1	2.5	2.9	2.8	2.5	1.6	3.1	2.9	2.6	2.9	2.6	3.1	3.0	38.5	H
2024-02-06	DPW	Building code amendments to reduce existing and future building stock vulnerable to coastal hazards and climate impacts.	3.0	2.8	2.6	3.0	3.0	2.5	1.4	2.7	3.0	2.4	3.0	2.5	3.0	3.0	37.9	H
2024-02-07	DPW	Develop a Flood Hazard Mitigation Plan per the CNMI Flood Damage Prevention Regulations (§155-10.2-015).	3.0	3.0	2.6	2.8	3.0	2.2	1.4	2.7	3.0	2.4	3.0	2.5	3.0	2.7	37.3	H
2024-01-11	CUC	By 2030 CUC and planning partner support wastewater treatment sustainability assessment to inform future plan updates.	3.0	2.6	2.8	3.0	2.8	2.4	1.7	3.0	3.0	2.3	2.8	1.8	3.0	3.0	37.1	H

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2024-06-10	DLNR / BECQ	Improve and maintain coral reefs as natural infrastructure.	2.7	2.3	2.3	3.0	3.0	2.3	1.7	3.0	3.0	2.4	2.8	2.4	3.0	3.0	37.0	H
2024-01-12	CUC	By 2030, CUC will endorse a Comprehensive Energy Plan detailing the steps to make progress towards renewable energy standards.	2.8	2.3	3.0	3.0	3.0	2.5	1.8	2.6	3.0	2.4	2.7	1.9	2.8	3.0	36.8	H
2024-06-12	OPD	Develop a green infrastructure feasibility study (green infrastructure includes living shorelines, resiliency hubs, rain gardens, etc.).	2.4	2.6	2.9	2.9	2.9	2.2	1.6	2.9	2.9	2.4	2.9	2.4	2.9	2.9	36.8	H
2018-04-01	HSEM	Include risk and vulnerability assessments and maps to improve public awareness materials for hazards (e.g., tsunami evacuation maps).	3.0	2.6	2.6	3.0	2.8	2.3	1.4	1.9	3.0	2.6	3.0	2.3	3.0	3.0	36.5	H
2018-07-01	PSS / DCCA	Harden and retrofit identified typhoon shelter facilities (under PSS & DCCA) to include storm shutters, lighting, backup generators, water tanks and water pumps, enclosed walkways and adequate bathroom facilities that are compliant with ADA requirements for people with disabilities.	3.0	3.0	2.6	3.0	2.8	2.4	1.7	1.6	3.0	2.2	3.0	2.2	3.0	3.0	36.4	H

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2018-02-01	DPW BSCD	Review and recommend improvements in the building codes enforcement and increase inspections.	3.0	3.0	2.8	3.0	2.5	2.5	1.6	1.8	2.8	2.5	3.0	2.2	2.8	2.8	36.4	H
2024-01-10	CUC	Include prioritized water and wastewater management community projects in capital improvement funding requests.	3.0	2.3	2.4	3.0	2.7	2.5	1.6	2.7	3.0	2.4	2.8	2.3	2.8	2.8	36.3	H
2018-04-04	HSEM	Implement the Public Awareness Program to disseminate all-hazard mitigation information for earthquakes or typhoon retrofits, hazard warning information, evacuation procedures, protective measures, and preventive techniques.	2.9	2.5	2.7	2.9	2.9	2.5	1.7	1.8	2.9	2.3	2.9	2.5	2.9	2.9	36.3	H
2024-08-06	HMGP	Conduct a feasibility study and identify opportunities and obstacles for improving data sharing with national databases and tools to help assess natural hazards and facilitate future risk assessment (e.g., Hazus, National Risk Index, SLOSH, etc.).	2.7	2.7	2.4	2.9	2.9	2.4	1.6	2.2	2.9	2.4	2.9	2.4	2.9	2.9	36.2	H

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2024-01-09	OPD	By 2030, the Office of Planning and Development has launched Smart, Safe Growth toolkit on the OPD website to support integration of climate impacts and adaptation opportunities into early planning and project scoping activity with at least 2 SSG trainings held for CNMI agencies and stakeholders by 2028.	2.7	2.7	2.2	2.9	2.6	2.7	1.8	2.6	2.9	2.4	2.9	2.1	2.9	2.9	36.1	H
2018-01-03	HMGP	Develop proposals to harden and retrofit facilities and seek funding.	2.8	3.0	3.0	2.8	2.5	2.3	1.3	2.4	2.8	2.3	2.7	2.2	2.8	3.0	35.9	H
2018-04-03	HSEM	Develop a public awareness program for hazards in coordination with Federal, State, and local offices. The information gathered would be disseminated among the local communities, integrated into public school curriculum, and incorporated into the existing disaster awareness activities currently employed.	2.9	2.5	2.9	2.9	2.3	2.5	1.7	2.0	2.9	2.3	2.7	2.5	2.9	2.9	35.9	H
2018-04-02	HMGP	For the next update, gather feedback from agencies to improve next plan update.	2.3	2.3	2.6	3.0	2.5	2.3	1.6	2.5	3.0	2.6	3.0	2.5	2.8	2.8	35.8	H

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2018-01-01	Various	Harden essential facilities, such as installing a concrete roof or storm shutters to reduce damage from natural hazards.	3.0	2.8	2.4	2.8	2.6	2.5	1.1	2.1	3.0	2.5	3.0	2.3	2.8	2.8	35.8	H
2024-01-08	DPW COTA	Improve existing roads, lighting, drainage, and amenities to support safe and accessible roads for active, and accessible transportation.	3.0	2.7	2.5	3.0	3.0	2.4	1.2	2.2	3.0	2.5	3.0	2.0	2.8	2.5	35.7	H
2024-01-07	BECQ	By 2030 CNMI permitting system includes a mechanism to track current and proposed future water and wastewater demand and locations.	3.0	2.2	2.8	2.8	2.4	2.2	1.4	2.4	3.0	2.2	2.7	2.4	3.0	3.0	35.7	H
2018-01-05	CUC	Replace wood poles with concrete poles. Set policy governing requirements for new concrete pole installations.	3.0	2.8	2.6	3.0	2.3	2.2	1.3	2.1	3.0	2.3	3.0	2.2	2.8	3.0	35.7	H
2018-02-03	DPW BSCD	Encourage the use of concrete in residential construction.	3.0	3.0	2.2	3.0	2.8	2.4	1.3	2.0	2.8	2.5	2.9	2.3	2.7	2.7	35.6	H
2018-04-05	HSEM	Develop and use multiple approaches to disseminate hazard awareness information to the public, including use radio and television announcements, social media, billboards, public outreach/meetings, etc. Ensure messages are provided in languages prevalent in communities.	2.9	2.4	2.7	2.9	2.9	2.5	1.4	1.5	2.9	2.3	2.9	2.5	2.9	2.9	35.6	H

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2024-08-05	OPD	Adopt a sea level rise standard for the CNMI.	2.9	3.0	2.3	2.7	3.0	2.5	1.4	2.3	2.7	2.1	2.9	2.3	2.7	2.7	35.5	H
2018-03-02	OPD	Promote interagency communication.	2.5	2.1	2.5	2.9	2.4	2.5	1.9	2.6	2.7	2.5	2.7	2.5	2.7	2.7	35.5	H
2024-06-14	HSEM / DLNR	Coordinate with federal partners to update seismic hazard maps and soil mapping.	2.9	2.9	2.5	2.7	2.6	1.9	1.7	2.4	2.9	2.1	2.7	2.5	2.9	2.7	35.4	H
2018-01-02	Various	Assess hardening and retrofit requirements for critical facilities that must remain operational.	2.8	2.8	2.7	2.7	2.8	2.3	1.1	2.3	2.8	2.5	2.8	2.2	2.8	3.0	35.3	H
2018-02-04	OPD	Prepare and adopt public education materials regarding private sector buildings, such as seek funding to update the 2015 Homeowner's manual to prepare for natural disasters.	2.9	2.6	2.7	2.9	2.6	2.4	1.6	1.7	2.7	2.4	2.9	2.4	2.7	2.9	35.2	H
2018-06-03	CUC	Develop a program to develop ponding basins to enhance aquifers.	2.7	2.7	2.2	2.9	2.4	2.1	1.3	2.9	2.9	2.1	2.9	2.2	2.9	2.9	35.1	H
2018-08-01	OPD	Improve the database and GIS for hazard risk and vulnerability assessment to make decisions for disaster response plans and mitigation activities.	2.6	2.9	2.5	2.9	2.7	2.3	1.5	2.1	2.7	2.3	2.9	2.3	2.7	2.7	35.1	H
2018-05-01	BECQ/ DPW	Improve hazardous material and waste storage.	2.9	2.7	2.3	2.7	2.0	2.2	1.2	2.9	2.9	2.4	2.9	2.3	2.9	2.6	34.9	M

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2018-06-02	DPW	Institute a system of storm water runoff management.	2.7	2.7	2.3	2.7	2.3	2.2	1.4	2.7	2.9	2.4	2.9	2.2	2.9	2.6	34.9	M
2018-03-01	OPD	Review and update existing master plans for land use designations (e.g., Highway Master Plan, SCORP, PLUP, etc.).	1.9	2.1	2.2	2.3	2.4	2.5	1.1	2.2	2.7	2.0	2.6	2.2	2.6	2.6	34.9	M
2018-06-04	CUC	Develop a water conservation program including public awareness materials.	2.7	1.8	2.4	2.9	2.4	2.1	1.3	2.9	2.9	2.3	2.9	2.4	2.9	2.9	34.9	M
2018-01-04	CUC	Convert the overhead power distribution system to an underground system. Set policy governing requirements for new line installations.	3.0	3.0	2.2	2.7	2.4	1.8	1.2	2.4	3.0	2.3	3.0	1.9	2.8	3.0	34.8	M
2018-06-01	BECQ / CUC	Explore and quantify water sources on all islands.	2.8	1.8	2.3	2.8	2.2	2.2	1.4	2.8	3.0	2.2	3.0	2.2	3.0	3.0	34.8	M
2024-06-09	DPW / DEQ	Revise the 2006 Stormwater Management Manual to integrate BMPs across planning sectors and projects.	2.5	2.2	2.5	2.7	2.3	2.2	1.4	2.4	2.7	2.4	2.9	2.3	2.9	2.9	34.3	M
2018-06-08	CUC	Develop and update the water master plan for Saipan, Tinian and Rota, and the Confidence Consumer Report for water quality.	2.6	1.4	2.2	2.9	2.4	2.1	1.6	2.7	2.9	2.3	2.9	2.2	2.9	2.9	34.0	M

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2018-08-03	OPD	Identify missing data and gaps in the risk and vulnerability assessments and incorporate these into the CNMI GIS system.	2.4	2.3	2.7	2.9	2.6	2.1	1.5	2.1	2.7	2.1	2.9	2.3	2.7	2.7	34.0	M
2024-04-07	HSEM	Provide drought public education awareness and outreach.	2.4	2.0	2.5	2.7	2.7	2.0	1.4	2.1	2.9	2.1	2.7	2.5	2.9	2.9	33.8	M
2018-08-02	OPD	Develop a protocol to access and share information among CNMI agencies. Develop a protocol to share GIS information with community organizations involved in community planning activities.	2.4	2.3	2.7	2.9	2.7	2.1	1.3	2.2	2.7	2.0	2.9	2.5	2.4	2.7	33.8	M
2018-06-05	CUC / BECQ	Propose legislation to implement rainwater catchment systems in homes, businesses, and public buildings.	2.9	1.8	2.5	2.7	2.7	2.1	1.3	2.4	2.9	2.0	2.9	2.3	2.5	2.7	33.7	M
2018-06-06	CUC / BECQ	Improve the collection of water in existing springs.	3.0	1.3	2.2	2.4	2.8	1.9	1.3	2.7	2.9	2.1	2.9	2.4	2.7	2.9	33.6	M
2018-06-07	CUC / DPW	Develop a water-recycling program.	2.6	1.5	2.2	2.5	2.9	1.9	1.2	2.7	2.9	2.2	2.9	2.1	2.9	2.9	33.4	M
2018-02-02	DPL	Ensure a valid CNMI land use plan is in place and enforced.	1.9	2.3	2.4	2.7	2.1	1.9	1.6	2.4	2.9	2.2	2.7	2.2	2.9	2.9	33.1	M
2024-08-07	OPD	Support development of a social vulnerability mapping tool that reflects the characteristics of the CNMI.	2.3	2.0	2.4	2.9	2.2	2.2	1.3	1.7	2.9	2.2	2.9	2.4	2.7	2.9	33.1	M

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2024-07-03	MVA	By 2030 update the MVA Strategic Plan and address natural hazard response and sheltering needs for CNMI visitors.	2.9	2.3	2.9	2.7	2.7	2.3	1.6	1.3	2.3	2.1	2.7	1.6	2.9	2.7	32.9	M
2018-08-04	OPD	Enable use of the GIS system including hazard risk and vulnerability assessment information for the building and land use permit system.	2.6	2.6	2.4	2.6	2.4	2.0	1.4	1.9	2.6	2.2	2.6	2.2	2.6	2.6	32.7	M
2018-05-02	BECQ	Develop a surface water quality control program.	2.7	1.9	2.3	2.4	2.5	2.2	1.2	2.7	2.6	1.9	2.6	2.0	2.9	2.6	32.5	M
2024-06-11	DLNR / BECQ	Improve and maintain natural resiliency hubs as natural infrastructure.	2.3	2.2	2.1	2.6	2.6	2.1	1.4	2.6	2.6	2.0	2.6	2.1	2.6	2.6	32.2	M
2024-07-05	HSEM	Evaluate vertical evacuation sites for schools.	2.6	2.0	2.6	2.6	2.1	2.1	1.6	1.4	2.6	2.1	2.6	2.2	2.6	2.6	31.7	M
2018-07-02	HSEM / MVA	Encourage residents and hotels to harden, retrofit and build safe rooms for typhoon sheltering.	2.9	2.6	2.1	2.7	2.3	1.9	1.2	1.6	2.5	1.9	2.9	1.9	2.5	2.7	31.7	M
2024-06-13	DCCA / HPO	Obtain GIS information from DCCA about the locations and recourse types for cultural assets to increase the accuracy of vulnerability analyses.	1.8	2.3	2.4	2.9	1.9	2.2	1.3	2.0	2.3	2.1	2.3	2.2	2.9	2.9	31.7	M
2024-02-05	HMGP	Encourage typhoon shutter installation by homeowners and businesses.	2.4	2.4	2.2	2.5	2.4	2.1	1.4	1.6	2.7	2.1	2.7	2.2	2.5	2.2	31.4	M

Table F.2-1. 2024 SHMP Update Mitigation Action Plan prioritization (*cont'd*).

Action No	Tentative Lead Agency	Action Description	Lifeline Safety	Property Protection	Cost-Effective	Technically Feasible	Climate Change	Legal Authority	Funding Available	Env. Impact	Social Vulnerability	Administrative Capacity	Multi-hazard	Timeline	Local Champion	Other Objectives or Policies	Total Score	Priority
2024-07-04	HSEM	Supply chain disruption preparation (e.g., develop tabletop exercise).	2.6	1.9	2.4	2.4	2.1	1.7	1.6	1.4	2.6	1.9	2.6	2.2	2.6	2.4	30.4	M
2024-04-06	HMGP	Support and/or coordinate with non-governmental organizations working to mitigate natural hazards (e.g., MANGO).	1.9	1.6	1.8	2.4	2.2	1.8	1.6	1.6	2.6	2.1	2.2	2.1	2.5	2.5	28.9	M

H=High, M=Medium

F.3 Funding and Technical Assistance for the 2024 SHMP Mitigation Action Plan

The following section outlines assistance programs that may be used to fund hazard mitigation projects or planning activities as well as recovery operations post-disaster.

F.3.1 Commonwealth Funding

Legislative Appropriations funds are allocated each fiscal year to departments to carry out respective duties and responsibilities. Earmarks are made toward specific projects (e.g., storm water drainage).

The Capital Improvement Program (CIP) is a federal program under the Office of the Governor which funds and manages a variety of capital improvement projects that share the same goal of developing the Commonwealth's economy and infrastructure to create a better quality of life for the people of the Commonwealth. CIP supports these projects through annual funding from the Office of Insular Affairs, Department of Interior, through Section 702 of the CNMI Covenant. The annual allocation is determined by a grading system set by the Federal Government. Funds are allocated towards new construction or renovation, maintenance, or rehabilitation of existing facilities and infrastructure. Funds can also cover major equipment with prolonged useful lifespans. Funding is allocated to all three of the Commonwealth's populated islands as follows: Saipan 75%, Rota 12.5% and Tinian 12.5% (CIP, 2023).

F.3.2 Federal Funding

The primary source of mitigation funding for flood mitigation projects is through FEMA's Hazard Mitigation Assistance grant programs which provide funding for eligible mitigation activities that reduce disaster losses and protect life from future disaster damages. Technical assistance and/or training on FEMA programs including Environmental and Historic Preservation and the NFIP are available by FEMA (FEMA, 2023). Four FEMA funding opportunities require an approved SHMP and are listed below.

- Pre-Disaster Mitigation (PDM)
- Building Resilient Infrastructure and Communities (BRIC)
- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)

F.3.2.1 FEMA Pre-Disaster Mitigation Program

The Pre-Disaster Mitigation Grant Program (PDM) makes federal funds available to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazard, while also reducing reliance on federal funding from future disasters. The program is authorized by Section 203 of the Stafford Act.

F.3.2.2 FEMA Building Resilient Infrastructure and Communities

The planning benefit of pre-disaster mitigation is there are few constraints posed on time and resources. The Building Resilient Infrastructure and Communities (BRIC) makes federal funds available to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while reducing reliance on federal funding from future disasters. This type of funding is offered in addition to funds provided through other FEMA grant programs that support mitigation needs. Since the approval of the 2004 SSMP, the CNMI has applied and received pre-disaster mitigation grants for several mitigation projects.

BRIC is an annual grant program that shifts the federal focus away from reactive disaster spending to proactive investment in community resilience. BRIC funding supports implementation of hazard mitigation projects that meet multiple priorities by incentivizes natural hazard risk reduction activities to mitigate risks to public infrastructure and disadvantage communities, incorporates nature based solutions, enhances climate resilience and adaptation, and increases funding for adoption and enforcement of building codes (FEMA). For example, the OPD was awarded $200,000 to support the Nuisance Abatement & Blighted Property Maintenance Act of 2018.

BRIC Direct Technical Assistance (BRIC DTA) offers a wide range of non-financial direct technical assistance support to communities, including climate risk assessments, community engagement, partnership building, and mitigation and climate adaptation planning. There is no requirement for a previous BRIC grant sub-application or award or an approved hazard mitigation plan to be considered for this initiative. BRIC Direct Technical Assistance | FEMA.gov

F.3.2.3 FEMA Hazard Mitigation Grant Program

The federal Hazard Mitigation Grant Program (HMGP) provides funding to develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses. This grant funding is available after a presidentially declared disaster. Eligible risk reduction projects include Planning & Enforcement, Flood Protection, Retrofitting, and Construction.

- Planning & Enforcement includes acquisition of hazard prone homes and businesses which enable owners to relocate to safe areas (acquisition) and post-disaster code enforcement.

- Flood Protection includes protecting homes with permanent barriers, elevating structures above known flood levels, reconstructing damaged dwellings on an elevated foundation to prevent future loss, and drainage improvement projects.
- Retrofitting includes structures, utilities, and other infrastructure to enhance resistance to natural hazards.
- Construction includes slope stabilization projects to prevent and reduce losses to structures and the construction of safe rooms for communities and individual residences.

F.3.2.4 FEMA Flood Mitigation Assistance Grant Program

The Flood Mitigation Assistance (FMA) grant program provides funding to states, federally recognized Tribal governments, US territories, and local governments. Since the National Flood Insurance Reform Act of 1994 was signed into law, funds are used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. To date, only four NFIP policies are in force in the Commonwealth.

F.3.2.5 Fire Management Assistance Grant

Section 1204 of the Disaster Recovery Reform Act (DRRA), Public Law 115-254 enacted in 2018 amended Section 404 of the Robert T. Stafford Relief and Emergency Assistance Act (Stafford Act) to allow FEMA to provide HMGP Fire Management Assistance Grant (FMAG) assistance for hazard mitigation measures that substantially reduce the risk of future damage, hardship, loss, or suffering in any area affect by a major disaster, or any area affected by fire for which assistance was provided under Section 420.

Wildfires can destroy homes, businesses, infrastructure, natural resources, and agriculture. They can also increase secondary hazards and leave areas prone to floods, erosion, and mudflows for years. Post fire assistance is available to help communities implement hazard mitigation measures after wildfire disasters. Projects are required to be cost effective, meaning future benefits must equal or exceed the project cost. Cost-effectiveness is analyzed using the Benefit-Cost Analysis (BCA) software toolkit. To streamline the grant application process, FEMA has determined that certain post-wildfire mitigation project types such as soil stabilization, flood diversion, and restoration projects that meet specific criteria are cost-effective. Projects that qualify for these pre-calculated benefits do not require a separate BCA.

F.3.2.6 FEMA Safeguarding Tomorrow Revolving Loan Fund Program

The Safeguarding Tomorrow Revolving Loan Fund Program is authorized under Section 205 of the Robert T. Stafford Disaster Relieve and Emergency Assistance Act to provide capitalized grants to establish revolving loan funds that provide hazard mitigation assistance to reduce risks from natural hazards and climate change. The Safeguarding Tomorrow through Ongoing Risk Mitigation Act (STORM Act), Public Law 116-284, allows FEMA to award capitalized grants for the Commonwealth to make funding decisions and award loans directly to local communities. The revolving loan funds will help the local government carry out hazard mitigation projects that reduce disaster risks for homeowners, businesses, nonprofit organizations, and communities to help them build climate resilience. The goal of the program is that 40% of the overall benefits generated by the Commonwealth loan funds flow to underserved communities.

Federal agencies, such as FEMA, HUD, and the Department of Energy, are tasked with ensuring programs and policies employ and require the use modern building codes to the greatest extent possible. Communities that adopt modern building codes may be better positioned to secure federal grant funds.

F.3.2.7 US Department of Energy

The US Department of Energy compiled a list of available federal assistance opportunities to inform crucial decisions about mitigation and resilience projects within a pre- or post- disaster framework, across all critical infrastructure sectors including energy, water, health, communication, transportation, etc. These federal funds, when leveraged, highlight the value of identifying and promoting investments that reduce the risks of natural hazards. These funding resources can be leveraged, layered, and used simultaneously with other federal or non-federal sources of funds. While the scope of the information is financial assistance programs, in some cases, the identified programs also address federal guidance and technical assistance for resilience planning.

F.3.3 Federal Technical Assistance

F.3.3.1 US Department of Housing and Urban Development

The US Department of Housing and Urban Development (HUD) Community Resilience Toolkit provides recipients of HUD funds identify opportunities to use their Community Planning and Development dollars to mitigate the impacts of natural hazards. It provides information and case studies of strategies used to mitigate natural hazards including increasing temperatures, sea level rise and coastal storms, inland flooding, wildfires, drought, and erosion. A financing section with other funding opportunities is also provided. HUD Community Resilience Toolkit (hudexchange.info)

F.3.3.2 US Environmental Protection Agency

The US Environmental Protection Agency (EPA) Planning for Natural Disaster Debris provides a comprehensive planning process for natural disaster debris including conducting pre-planning activities, developing a Pre-incident Debris Management Plan, implementing the plan during a natural disaster. Lessons learned from past disasters are provided with Best Management Practices and numerous case studies. Guidance about Planning for Natural Disaster Debris | US EPA

The EPA provides information on how to change land use and building codes and policies to prepare for climate change and how to overcome barriers to climate adaptation. Adaptation to flooding and extreme precipitation, sea level rise, extreme heat, drought, and wildfire are covered along with numerous case studies Smart Growth Fixes for Climate Adaptation and Resilience | US EPA.

In June 2022, the Biden-Harris Administration announced a National Initiative to Advance Building Codes to help state, local, Tribal, and territorial governments adopt the latest building codes and standards to improve climate resilience and reduce energy costs. FACT SHEET: Biden-Harris Administration Launches Initiative to Modernize Building Codes, Improve Climate Resilience, and Reduce Energy Costs | The White House

F.3.4 Strategy-based Initiatives

The US DOT provides an implementation guide for nature-based solutions for coastal highway resilience along with numerous case studies and pilot projects. Nature-Based Solutions for Coastal Highway Resilience | FHWA (dot.gov)

Commonwealth and local capabilities for funding and implementing hazard mitigation strategies and actions are the basis for an effective SHMP. As discussed in Chapter 5.0 (Mitigation Capabilities), the CNMI HMGP administers the hazard mitigation program, with the SHMO serving as the official point of contact.

As discussed in this plan, the HMGP recognizes that plan maintenance identified in the 2018 SSMP update have been limited due to the frequency of natural hazard events, the COVID-19 pandemic, and staffing. The frequency of natural hazard events necessitated the Commonwealth to redirect attention to disaster response and recovery, diverting attention and resources away from the outlined 2018 SSMP maintenance process. The 2024 SHMP Updated mitigation strategies re-emphasizes the Commonwealth's commitment to mitigating and reducing future disaster losses.

F.3.5 Mitigation Funding Programs

Cost share percentages across FEMA mitigation funding streams are detailed in Table F.3-1. Eligible activities under the HMGP, BRIC, FMA, and HHPD grant programs are listed in Table F.3-2.

Table F.3-1. FEMA Hazard Mitigation Assistance Grant Program cost share.

Programs	Mitigation Activity (Percent of Federal/Non-Federal Share)	Recipient Management Costs (Percent of Federal/Non-Federal Share)	Subrecipient Management Costs (Percent of Federal/Non-Federal Share)
HMGP	75/25	100/0	-/- (1)
BRIC	75/25	75/25	75/25
BRIC–subrecipient is small and impoverished community	90/10	100/0	90/10
PDM	75/25	95/5	95/5
PDM– subrecipient is small and impoverished community	90/10	95/5	95/5
FMA–insured properties and planning grants	75/25	75/25	75/25
FMA–repetitive loss property	90/10	90/10	90/10
FMA–severe repetitive loss property[2]	100/0	100/0	100/0

1 Sub applicants should consult their State Hazard Mitigation Officer (SHMO) for the amount or percentage of HMGP subrecipient management cost funding their State has determined to be passed through to subrecipients.

2 To be eligible for an increased Federal cost share, a FEMA-approved State or Tribal (Standard or Enhanced) Mitigation Plan that addresses RL properties must be in effect at the time of award, and the property that is being submitted for consideration must be a RL property.

Table F.3-2. FEMA Hazard Mitigation Grant Program eligible activities.

Eligible Activities	HMGP	BRIC	FMA
Property Acquisition and Structure Demolition	✓	✓	✓
Property Acquisition and Structure Relocation	✓	✓	✓
Structure Elevation	✓	✓	✓
Mitigation Reconstruction	✓	✓	✓
Dry Floodproofing of Historic Residential Structures	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓
Generators	✓	✓	
Localized Flood Risk Reduction Projects	✓	✓	✓
Non-Localized Flood Risk Reduction Projects	✓	✓	
Retrofitting of Existing Buildings	✓	✓	✓
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓	✓
Safe Room Construction	✓	✓	
Wind Retrofit for One- and Two-Family Residences	✓	✓	
Infrastructure Retrofit	✓	✓	✓

Table F.3-2. FEMA Hazard Mitigation Grant Program eligible activities (*cont'd*).

Eligible Activities	HMGP	BRIC	FMA
Soil Stabilization	✓	✓	✓
Wildland Fire Mitigation	✓	✓	
Post-Disaster Code Enforcement	✓		
Advance Assistance	✓		
5 Percent Initiative Projects*	✓		
Aquifer and Storage Recovery**	✓	✓	✓
Flood Diversion and Storage**	✓	✓	✓
Floodplain and Stream Restoration**	✓	✓	✓
Green Infrastructure**	✓	✓	✓
Miscellaneous/Other**	✓	✓	✓
Hazard Mitigation Planning	✓	✓	✓
Technical Assistance			✓
Management Costs	✓	✓	✓

*FEMA allows increasing the 5% Initiative amount up to 10% for a Presidential major disaster declaration under HMGP. The additional 5% Initiative funding can be used for activities that promote disaster-resistant codes for all hazards. As a condition of the award, either a disaster-resistant building code must be adopted, or an improved Building Code Effectiveness Grading Schedule is required.

**Indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.

Note: Eligible activities for the PDM Grant Program will be listed in future updates.

Reference

[FEMA] Federal Emergency Management Agency. (2023). *Hazard Mitigation Assistance Program and Policy Guide* (p. 619). Federal Emergency Management Agency. https://www.fema.gov/sites/default/files/documents/fema_hma_guide_062024.pdf

Commonwealth of the Northern Mariana Islands
State Hazard Mitigation Plan

Appendix G FEMA Review of the
2024 State Hazard Mitigation Plan Update

28 July 2024

Table of Contents

List of Tables

Appendix G FEMA Review of the 2024 SHMP Update

G.1 FEMA Review of the 2024 SHMP Update

G.1.1 FEMA Mitigation Plan Review Tool, July 2024 Comments

State Mitigation Plan Review Tool

The State Mitigation Plan Review Tool (Plan Review Tool) demonstrates and documents how the state mitigation plan meets the regulations set forth in 44 CFR Part 201 and offers FEMA mitigation planners an opportunity to provide feedback to the state.

The Regulation Checklist must be completed by FEMA. The FEMA Plan Approver must reference the State Mitigation Planning Policy Guide when completing the Plan Review Tool. The purpose of the checklist is to identify the location of relevant or applicable content in the plan by element/sub- element and to determine if each requirement has been “Met” or “Not Met.”

The Required Revisions summary at the bottom of each element must clearly explain the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is “Not Met.” Sub-elements should be referenced by the appropriate number, where applicable (e.g., S2-a, S2-b). Requirements for each element and sub-element are described in detail in Sections 3 and 4 of the State Mitigation Planning Policy Guide.

The HHPD section and FMAG sub-elements only need to be completed if the state is pursuing eligibility for those grant programs.

The Plan Assessment must be completed by FEMA. This assessment provides more comprehensive feedback to the state to acknowledge where the plan exceeds minimum requirements and provides suggestions for improvements. FEMA will describe the strengths that are demonstrated and highlight examples of best practices. FEMA’s suggestions for improvement are not required to be made for plan approval.

For greater clarification of the elements in the regulation checklist, please see Sections 3 and 4 in the State Mitigation Planning Policy Guide. This document defines terms and phrases used within this review tool.

1. Plan and Review Information

Plan Information	
State	Commonwealth of the Northern Mariana Islands
Title and Date of Plan	Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan April 30, 2024
Plan Update Version	2024/Version #5
State Point of Contact Name	Marion May M. Guerrero
Title	Program Manager
Agency	CNMI Office of the Governor
Address	Commonwealth of the Northern Mariana Islands, Office of the Governor Caller Box 10007, Saipan, MP 96950
Phone Number	670-664-2374
Email	marianmguerrero@omb.gov.mp
Meets mitigation planning requirements for HHPD?	No
Meets mitigation planning requirements for FMAG?	Yes

Review Information	
Date Received by FEMA region	July 8, 2024
FEMA Reviewer (Planning – Name / Title)	Emily Breen, FEMA Community Planner
FEMA Reviewer (HMA – Name / Title)	Jaime Symons, FEMA Community Planner
FEMA Reviewer (Name / Title)	Claire Fetters, CERC Planner
FEMA Reviewer (Name / Title)	Justin Traylor, FEMA Emergency Management Specialist
FEMA Approver (Name / Title)	JoAnn Scordino, FEMA Community Planner
Plan Status (Not Approved, Approvable Pending Adoption, Approved)	Approved

SUMMARY	YES	NO
STANDARD STATE MITIGATION PLAN		
Does the plan meet the standard state mitigation plan requirements?	☒	☐
ENHANCED STATE MITIGATION PLAN		
Does the plan meet the enhanced state mitigation plan requirements?	☐	☒

2. Standard State Mitigation Plan Regulation Checklist

PLANNING PROCESS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S1. Does the plan include a description of the process used to develop the plan? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S1-a. Does the plan describe the current process used to update the plan, including how the plan was prepared, the schedule or time frame, specific milestones and activities, the agencies and stakeholders who were involved in the process, and if the mitigation planning process was integrated to the maximum extent possible with other state planning efforts?	Ch. 1, pp. 4-8 Ch. 3, pp. 1-11 App. A	Met
S2. Does the plan describe how the state coordinated with other agencies and stakeholders? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S2-a. Does the plan describe how the state coordinated with other state agencies, appropriate federal agencies, and other stakeholders, and how they were involved in the process?	Ch. 1, pp. 5-8 Ch. 3, pp. 1-11 App. A	Met
Planning Process Required Revisions: Click or tap here to enter text.		

HAZARD IDENTIFICAION AND RISK ASSESSMENT

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state? [44 CFR § 201.4(c)(2)(i)]		
S3-a. Does the plan include a current overview of all natural hazards that can affect the state, including the type, location and previous occurrences?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. C	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S4. Does the risk assessment provide an overview of the probabilities of future hazard events? [44 CFR § 201.4(c)(2)(i)]		
S4-a. Does the risk assessment provide an overview of the probability of future hazard events that includes projected changes in the location, range of anticipated intensities, frequency, and/or duration of each natural hazard?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. C	Met
S4-b. Does the probability include considerations of changing future conditions, including climate change (e.g., long-term weather patterns, average temperature, and sea levels) on the type, location and range of anticipated intensities of identified hazards?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. C	Met

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S5-a. Does the risk assessment include an overview and analysis of the vulnerability to state assets from the identified hazards as well as a summary of the most vulnerable assets?	Sec. 2, pp. 37-63 Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. D	Met
S5-b. Does the risk assessment estimate potential dollar losses to state assets located in identified hazard areas?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. D	Met

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S6. Does the risk assessment include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S6-a. Does the risk assessment provide an overview and analysis of vulnerable jurisdictions based on the state and local government risk assessments?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B	Met
S6-b. Does the risk assessment include an overview and analysis of the potential losses to the identified vulnerable structures based on	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32	Met
estimates in the local risk assessments as well as the state risk assessment?	Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B	

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S7. Was the risk assessment revised to reflect changes in development? [44 CFR § 201.4(d)]		
S7-a. Does the plan provide a summary of recent development and potential or projected development in hazard-prone areas based on state and local government risk assessments?	Ch. 1, pp. 8-9 Ch. 2, 4-36 Ch. 4.1, pp. 31-34 Ch. 4.2, pp. 30-32 Ch. 4.3, pp. 22-23 Ch. 4.4, p. 13 Ch. 4.5, pp. 42-44, 54 Ch. 4.6, pp. 10-11 Ch. 4.7, p. 7 Ch. 4.8, pp. 22-23 Ch. 4.9, pp. 17-18 Ch. 4.10, pp. 12-13 Ch. 4.11, p. 13 App. B App. C App. D	Met
Hazard Identification and Risk Assessment Required Revisions: Click or tap here to enter text.		

STATE MITIGATION CAPABILITIES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S8. Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment? [44 CFR § 201.4(c)(3)(ii)]		
S8-a. Does the plan include an evaluation of state laws, regulations, policies and programs related to hazards that improve or impede resilience to future natural hazard events and other future conditions, including the effects of climate change?	Ch. 2, p. 4 Ch. 4.5, p. 23 Ch. 5, pp. 1-42 App. E	Met
S8-b. Does the plan include a general discussion of state funding capabilities for hazard mitigation actions and projects?	Ch. 4.1, pp. 8-11 Ch. 5, pp. 37-42 App. E App. F	Met
S8-c. Does the plan include a summary of obstacles, challenges and proposed solutions related to any state capabilities, including a brief discussion of potential strategies for overcoming any challenges related to implementing and enforcing hazard-resistant building codes statewide, as applicable, and changes since the previous plan approval?	Ch. 1, pp. 8-9 Ch. 5, pp. 1-44 Ch. 6, pp. 9-25 App. E	Met

Hazard Identification and Risk Assessment Required Revisions: Click or tap here to enter text.

MITIGATION STRATEGY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S9. Does the mitigation strategy include goals to reduce long-term vulnerabilities from the identified hazards? [44 CFR § 201.4(c)(3)(i)]		
S9-a. Does the plan identify hazard mitigation goals representing what the state seeks to accomplish through mitigation plan implementation using a wide range of funding, including non-FEMA funding?	Ch. 6, p. 4	Met
S9-b. Are the goals consistent with the hazards and vulnerabilities identified in the risk assessment?	Ch. 4.11, p. 12	Met
S10. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment? [44 CFR §§ 201.4(c)(3)(i), 201.4(c)(3)(ii) and 201.4(c)(3)(iii)]		
S10-a. Does the plan identify actions based on the current risk assessment to reduce the vulnerability of jurisdictions within the state, as well as the vulnerability of state assets as described in Elements S5 and S6?	Ch. 6, pp. 7-26	Met
S10-b. Does the plan describe the process used by the state to evaluate and prioritize actions that are cost-effective, environmentally sound, and technically feasible?	Ch. 6, pp. 26-29	Met
S10-c. Does the plan describe how each action contributes to the hazard mitigation goals?	Ch. 6, pp. 28-29	Met
S10-d. Does the plan describe how local government mitigation strategies link to the state mitigation strategy?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S11. Does the plan identify current and potential sources of funding to implement mitigation actions and activities? [44 CFR § 201.4(c)(3)(iv)]		
S11-a. Do mitigation activities include the identification of current and/or potential sources of federal, state, local or private funding for implementation?	Ch. 1, pp. 2-4 Ch. 5, pp. 37-42 Ch. 6, pp. 7-27 App. E App. F	Met
S11-b. Does the plan identify FEMA mitigation funding sources (if applicable), including, but not limited to: HMGP, BRIC, FMA and PA Mitigation, at a minimum?	Ch. 5, pp. 37-42 Ch. 6, pp. 9-26 App. E App. F	Met
S12. Was the plan updated to reflect progress in statewide mitigation efforts and changes in priorities? [44 CFR § 201.4(d)]		
S12-a. Does the plan provide a narrative of the status of each mitigation action in the previous plan?	Ch. 1, p. 9 Ch. 4.2, p. 32 Ch. 4.3, pp. 23-24 Ch. 4.4, p. 13 Ch. 4.5, p. 54 Ch. 4.6, p. 11 Ch. 4.7, p. 7 Ch. 4.8, p. 23 Ch. 4.9, p. 18 Ch. 4.10, p. 13 Ch. 6, pp. 5-6 App. F	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S12-b. Was the prioritization of mitigation actions and activities updated based on the updated analysis of risks, capabilities and progress?	Ch. 1, pp. 8-9 Ch. 4.1, p. 1 Ch. 4.2, p. 1 Ch. 4.3, p. 1 Ch. 4.4, p. 1 Ch. 4.5, p. 1 Ch. 4.6, p. 1 Ch. 4.7, p. 1 Ch. 4.8, p. 1 Ch. 4.9, p. 1 Ch. 4.10, p. 1 Ch. 4.11, p. 13 Ch. 6, pp. 5-6, 26-29 App. F	Met
Mitigation Strategy Required Revisions: Click or tap here to enter text.		

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S13. Does the plan generally describe and analyze the effectiveness of local government mitigation policies, programs, and capabilities? [44 CFR § 201.4(c)(3)(ii)]		
S13-a. Does the plan provide a summary of current local government policies, programs and capabilities of jurisdictions to accomplish hazard mitigation?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S13-b. Does the plan describe the effectiveness of local government mitigation policies, programs and capabilities?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S14. Does the plan describe the process to support the development of approvable local government mitigation plans? [44 CFR §§ 201.3(c)(5) and 201.4(c)(4)(i)]		
S14-a. Does the plan describe how the state supports developing or updating FEMA-approvable mitigation plans?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S14-b. Does the plan provide a brief summary of barriers to developing or updating, adopting, and implementing FEMA-approved local government mitigation plans based on an analysis of plan and jurisdiction coverage data and trends across the state and steps to remove barriers to help local governments advance mitigation planning, including how plan and jurisdiction coverage data and trends inform those steps?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S15. Does the plan describe the criteria for prioritizing funding? [44 CFR § 201.4(c)(4)(iii)]		
S15-a. Does the plan describe criteria for prioritizing jurisdictions to receive planning and project grants under available federal and non- federal programs?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S16. Does the plan describe the process and time frame to review, coordinate, and link local and tribal mitigation plans with the state mitigation plan? [44 CFR §§ 201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)]		
S16-a. Does the plan describe the state's process and time frame to review and submit approvable local and tribal mitigation plans to FEMA?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S16-b. Does the plan describe the state's process and time frame to share risk assessment data and mitigation priorities with local governments for their plan updates, as well as integrate local risk assessment and mitigation actions into the state mitigation plan updates?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
Review, Evaluation, and Implementation Required Revisions: Click or tap here to enter text.		

RREVIEW, EVALUATION AND IMPLEMENTATION

Requirements	Location in Plan (section and/or Met page number)	Met / Not
S17. Is there a description of the method and schedule for keeping the plan current? [44 CFR §§ 201.4(c)(5)(i) and 201.4(d)]		
S17-a. Does the plan describe the agency/office responsible for monitoring, evaluating and updating the plan?	Ch. 7, pp. 1-4	Met
S17-b. Does the plan describe the schedule for monitoring, evaluating, and updating the plan?	Ch. 7, pp. 1-8	Met
S18. Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§ 201.4(c)(5)(ii) and 201.4(c)(5)(iii)]		
S18-a. Does the plan describe the system for tracking the implementation of the mitigation activities and projects identified in the mitigation strategy, including all mitigation activities and not just those funded by FEMA?	Ch. 7, pp. 2-8	Met
S18-b. Does the system include the schedule, the agency/office responsible for coordination, and the role of the agencies/offices identified in the mitigation strategy as responsible for implementation of actions?	Ch. 7, pp. 2-8	Met
S18-c. Does the plan describe a system for reviewing progress on achieving the mitigation strategy's goals that includes the criteria and process for evaluating progress?	Ch. 7, pp. 2-8	Met
Review, Evaluation, and Implementation Required Revisions: Click or tap here to enter text.		

ADOPTION AND ASSURANCES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S19. Did the state provide documentation that the plan has been formally adopted? [44 CFR § 201.4(c)(6)]		
S19-a. Did the state provide documentation of formal adoption by the highest elected official or designee prior to FEMA approval?	Ch. 1, pp. vii, 9	Met
S20. Did the state provide assurances? [44 CFR § 201.4(c)(7)]		
S20-a. Does the plan include assurances that the state will manage and administer FEMA funding in accordance with applicable federal statutes and regulations?	Ch. 1, pp. 1-2, 4	Met
S20-b. Does the plan include assurances that the state will update its plan whenever necessary to reflect changes in state or federal laws and statutes?	Ch. 1, pp. 1-2, 4	Met
Adoption and Assurances Required Revisions: Click or tap here to enter text.		

HIGH HAZARD POTENTIAL DAMS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD1. Did Element S2 (planning process) describe how the state dam safety agency, other agencies, and stakeholders participated in the planning process and contributed expertise, data, studies, information, etc. relative to high hazard potential dams?		
HHPD1-a. Does the plan describe how the state dam safety agency, other agencies, and stakeholders were involved in the planning process?	Click or tap here to enter text.	Choose an item.
HHPD1-b. Does the plan describe the types of data contributed?	Click or tap here to enter text.	Choose an item.
HHPD2. Did Element S6 (risk assessment) address all dam risk for high hazard potential dams in the risk assessment?		

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD2-a. Does the plan provide a list of high hazard potential dams that have been identified by the state with their names, National Inventory of Dams identification numbers, locations by jurisdiction, and other relevant information, as well as maps?	Click or tap here to enter text.	Choose an item.
HHPD2-b. Does the plan summarize statewide vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	Click or tap here to enter text.	Choose an item.
HHPD2-c. Does the plan document limitations and describe the approach to address deficiencies?	Click or tap here to enter text.	Choose an item.
HHPD3. Did Element S9 (mitigation goals) include mitigation goals to reduce long-term vulnerabilities from high hazard potential dams?		
HHPD3-a. Does the plan address a reduction in vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents as part of their own goals or with other long-term strategies?	Click or tap here to enter text.	Choose an item.
HHPD3-b. Does the plan link the proposed actions to reduce long- term vulnerabilities consistent with the goals?	Click or tap here to enter text.	Choose an item.
HHPD4. Did Element S10 (mitigation actions) prioritize mitigation actions and activities to reduce vulnerabilities from high hazard potential dams?		
HHPD4-a. Does the plan include actions to reduce vulnerabilities to/from high hazard potential dams?	Click or tap here to enter text.	Choose an item.
HHPD4-b. Does the plan describe the process to evaluate and prioritize actions related to high hazard potential dams that are cost-effective, environmentally sound and technically feasible?	Click or tap here to enter text.	Choose an item.
HHPD4-c. Does the plan describe how each action to reduce risks related to high hazard potential dams contributes to the goals and describe how strategies are linked to the state mitigation strategy?	Click or tap here to enter text.	Choose an item.
HHPD5. Did Element S11 (funding sources) identify current and potential sources of funding to implement mitigation actions and activities for high hazard potential dams?		

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD5-a. Does the plan include various funding sources to mitigate vulnerabilities to and from high hazard potential dams from hazards and the potential consequences associated with dam incidents, as well as funding sources to rehabilitate or remove high hazard potential dams?	Click or tap here to enter text.	Choose an item.
HHPD6. Did Element S13 (local coordination) generally describe and analyze the effectiveness of local mitigation policies, programs, and capabilities that address high hazard potential dams?		
HHPD6-a. Does the plan provide a summary of the local policies, programs, and capabilities to implement mitigation actions and reduce vulnerabilities from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	Click or tap here to enter text.	Choose an item.
HHPD6-b. Does the plan describe challenges to implementing local mitigation policies, programs and capabilities to reduce vulnerabilities to and from high hazard potential dams and the approach to overcome these challenges?	Click or tap here to enter text.	Choose an item.
HHPD6-c. Does the plan describe opportunities for implementing mitigation actions to reduce risks to and from high hazard potential dams through local capabilities?	Click or tap here to enter text.	Choose an item.
HHPD7. Did Element S15 (prioritizing funding) describe the criteria for prioritizing funding for high hazard potential dams?		
HHPD7-a. Does the plan describe the method for funding actions to reduce vulnerabilities to and from high hazard potential dams if these actions were prioritized differently than mitigation actions for other hazards?	Click or tap here to enter text.	Choose an item.
HHPD7-b. Does the plan document limitations and describe the approach to addressing deficiencies?	Click or tap here to enter text.	Choose an item.
HHPD Required Revisions: Click or tap here to enter text.		

FIRE MANAGEMENT ASSISTANCE GRANTS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
FMAG1. Does the plan address wildfire risks? [44 CFR 201.4(c)(2); 44 CFR § 204.51(d)(2)]		
FMAG1-a. Does the risk assessment provide an overview of the location and previous occurrences of wildfire hazards in the state?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG1-b. Does the risk assessment provide an overview of the probability of future wildfire events that includes projected changes in the location, intensity, frequency and/or duration of wildfire hazards?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG1-c. Does the risk assessment address the vulnerability of state assets located in wildfire hazard areas and estimate the potential dollar losses to those assets?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG1-d. Does the risk assessment include an overview and analysis of local governments' vulnerability to wildfires and the potential losses to vulnerable structures?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG2. Does the plan's mitigation strategy contain wildfire-related mitigation initiatives? [44 CFR 201.4(c)(3); 44 CFR § 204.51(d)(2)]		
FMAG2-a. Does the mitigation strategy identify mitigation actions and activities to reduce the vulnerability of jurisdictions within the state as well as the vulnerability of state-owned assets as described in Elements S5 and S6?	Ch. 6, pp. 9-26	Met
FMAG Required Revisions: Click or tap here to enter text.		

3. Enhanced State Mitigation Plan Regulation Checklist

ENHANCED STATE PREREQUSITIES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E1. Does the enhanced plan include all elements of the standard state mitigation plan? [44 CFR § 201.5(b)]		
E1-a. Does the enhanced plan meet all the required elements of the standard state mitigation plan?	Click or tap here to enter text.	Choose an item.
E2. Regarding HMA, is the state maintaining the capability to meet application time frames and submitting complete project applications? [44 CFR § 201.5(b)(2)(iii)(A)]		
E2-a. Are all applications complete and submitted by the end of each program's respective application period?	Click or tap here to enter text.	Choose an item.
E2-b. Are all applications entered into FEMA's electronic data systems (i.e., NEMIS, eGrants, and/or FEMA GO)?	Click or tap here to enter text.	Choose an item.
E2-c. Is a complete Minimum Criteria Checklist for Project Subapplicants or equivalent documentation prepared for all subapplications?	Click or tap here to enter text.	Choose an item.
E2-d. Are all applications determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response?	Click or tap here to enter text.	Choose an item.
E3. Regarding HMA, is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses? [44 CFR § 201.5(b)(2)(iii)(B)]		
E3-a. Are all applications and amendments determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response, including all data requested by FEMA to support cost-effectiveness determinations and EHP compliance reviews?	Click or tap here to enter text.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E4. Regarding HMA, is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time? [44 CFR § 201.5(b)(2)(iii)(C)]		
E4-a. Are all progress reports complete and submitted on time?	Click or tap here to enter text.	Choose an item.
E4-b. Are all FFR SF-425s submitted on time?	Click or tap here to enter text.	Choose an item.
E4-c. Does the state consistently comply with the Financial Management Standard requirements described in 2 CFR §§ 200.300 to 200.309?	Click or tap here to enter text.	Choose an item.
E5. Regarding HMA, is the state maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation? [44 CFR § 201.5(b)(2)(iii)(D)]		
E5-a. Is all work as part of HMA subawards completed by the end of the period of performance, as described in the HMA Guidance?	Click or tap here to enter text.	Choose an item.
E5-b. Have there been no major findings on the last single audit obtained by the state related to HMA programs?	Click or tap here to enter text.	Choose an item.
E5-c. Are all grant closeout activities, including financial reconciliation, completed within 120 days from the end of the performance period as outlined in 2 CFR 200.344?	Click or tap here to enter text.	Choose an item.
E5-d. Have actual expenditures been documented and are they consistent with SF-424A or SF-424C?	Click or tap here to enter text.	Choose an item.
Enhanced State Prerequisites Required Revisions: Click or tap here to enter text.		

INTEGRATED PLANNING

Requirements	Location in Plan (section and/or Met page number)	Met / Not
E6. Does the plan demonstrate integration, to the extent practicable, with other state and/or regional planning initiatives and FEMA mitigation programs and initiatives? [44 CFR § 201.5(b)(1)]		
E6-a. Does the enhanced plan demonstrate integration with other state and/or regional planning initiatives?	Click or tap here to enter text.	Choose an item.
E6-b. Does the enhanced plan demonstrate integration of FEMA mitigation programs and initiatives?	Click or tap here to enter text.	Choose an item.
Integrated Planning Required Revisions: Click or tap here to enter text.		

DEMONSTRATING COMMITMENT TO A COMPREHENSIVE STATE MITIGATION PROGRAM

Requirements	Location in Plan (section and/or Met page number)	Met / Not
E7. Does the state demonstrate commitment to a comprehensive mitigation program? [44 CFR §§ 201.3(c), 201.5(b)(4) and 201.6(d)]		
E7-a. Does the state demonstrate commitment to statewide programs, initiatives and plans that advance mitigation and resilience?	Click or tap here to enter text.	Choose an item.
E7-b. Does the state demonstrate a commitment to mitigation training and capability building?	Click or tap here to enter text.	Choose an item.
E7-c. Does the state demonstrate a commitment to its mitigation planning responsibilities by helping local governments update and adopt their plans before they expire?	Click or tap here to enter text.	Choose an item.
Demonstrating a Commitment to a Comprehensive State Mitigation Program Required Revisions: Click or tap here to enter text.		

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E8. Is the state effectively using existing mitigation programs to achieve mitigation goals? [44 CFR §§ 201.5(a) and 201.5(b)(3)]		
E8-a. Does the state demonstrate and document the full and effective use of existing FEMA programs (if funding is available)?	Click or tap here to enter text.	Choose an item.
E8-b. Does the state demonstrate and document the full and effective use of non-FEMA programs?	Click or tap here to enter text.	Choose an item.
Effective Use of Existing Mitigation Programs to Achieve Mitigation Goals Required Revisions: Click or tap here to enter text.		

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E9. Does the enhanced plan document capability to implement mitigation actions? [44 CFR §§ 201.5(b)(2)(i), 201.5(b)(2)(ii), and 201.5(b)(2)(iv)]		
E9-a. Does the enhanced plan describe the system to rank the mitigation measures according to established eligibility criteria, including a process to prioritize between funding programs, jurisdictions, and proposals that address different or multiple hazards?	Click or tap here to enter text.	Choose an item.
E9-b. Does the enhanced plan describe how the state will assess the effectiveness of mitigation actions, mitigation the agencies that are involved as well as the timeline, and use the results to inform the mitigation strategy?	Click or tap here to enter text.	Choose an item.
Documentation of the State's Implementation Capability Required Revisions: Click or tap here to enter text.		

4. Plan Assessment

The Plan Assessment comments can be used to help guide the ongoing maintenance and update of your mitigation plan.

Standard State Mitigation Plan Requirements

PLANNING PROCESS

Strengths

- Chapter 3 does an excellent job in discussing the priorities and objectives of the planning process. It is clear how the planning team built on the previous plan's successes. The team also expanded the outreach to additional internal and external stakeholders.
- The planning process has already begun to list additional ways to make sure the public outreach in future plan updates can be more accessible and equitable to the residents of the territory. Finding ways to improve on the planning process in the future helps guide the CNMI officials who will be carrying out the next update.
- It is clear that the territory worked with organizations that have climate change expertise and data to contribute to the plan. Including them in this process makes sure that the plan has more accurate data on how climate change is affecting the CNMI.

Opportunities for Improvement

- There is an opportunity to clearly capture all other territorial planning efforts and processes that are ongoing currently in the plan. It is understood there was both passive and active integration of the current planning process with capital improvement programs, data integration and expertise given. In future planning, consider expounding on if there are other planning efforts in place and how the planning process informed them.
- In future planning, there is a chance to grow the external stakeholder outreach to other federal agencies that the CNMI has or could partner with in the future for mitigation activities. Engaging with other external stakeholders can foster strong partnerships for the territory.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

Strengths

- Each hazard profile includes many ways to explain an event's extent. Defining the scientific scale(s) related to each hazard is a universal way to explain how intense a hazard can be. The profiles also discuss other extent factors, such as warning time. Continue to use a variety of ways to identify the magnitude of a hazard event.

- Along with assessing the potential impacts of the hazards on the assets of the territory, each chapter of the risk assessment explores how future conditions will affect hazard impacts. Understanding how changes in the climate and population and development patterns will influence hazard events and related impacts is a key step in planning for future mitigation projects.
- It's clear the Team did extensive work to build and/or update GIS data for the CNMI's buildings and infrastructure, critical facilities GIS data, general build stock and infrastructure, and vulnerability. This could be very useful data to the Commonwealth, even beyond the HMP update.
- The summary of updates from the previous plan noted at the beginning of each hazard profile is a helpful summary for readers to clearly understand what new data or information has been incorporated.
- In discussing vulnerability of populations in particular extreme heat, the plan does a nice job of connecting general discussion of vulnerable population impacts to CNMI specific demographics. This extra step shows a commitment to understanding CNMI's vulnerabilities, wholistically.

Opportunities for Improvement

- In the next plan update, consider another way to analyze general trends for each hazard by calculating historical frequency by 5- to 10-year increments for the hazard. This will result in a currently accurate historical frequency probability for the action. It will also show how the number of events has increased, decreased or remained constant over time.
- In future planning, for the hazards that have fewer or no direct impacts on structural assets of the CNMI, it is recommended that the territory analyze potential impacts to the economy, its residents and other applicable assets. It may be harder to quantify potential losses associated with hazards such as drought and extreme heat. However, it is still important to understand the risk each hazard presents to the territory.
- In the next plan, consider taking the recent and potential development and population changes one step further to fully relate the shifts back to how they will impact vulnerability of the CNMI. Clearly linking the changes to the physical environment of the planning area as well as the makeup of its people will help territory officials understand how to best minimize increased vulnerability.

STATE MITIGATION CAPABILITIES

Strengths

- The summary of obstacles and challenges to the territory's capabilities is clear and thoughtful. Each capability discusses notable changes since the last plan and challenges related to the resource. The plan also includes meaningful steps for removing the identified challenges and obstacles in the future in the mitigation strategy.

- The evaluation of the territory's pre- and post-disaster capabilities is thorough. Each capability related to hazard mitigation has a detailed narrative and is further expanded on in Appendix E.
- The plan incorporates information from the THIRA, which is a great way to coordinate and ensure consistency across complimentary planning efforts occurring on island.

Opportunities for Improvement

- In future plans, consider including a brief narrative for each of the projects and activities that have received FEMA funding. Noting the titles of the grants gives an adequate sense of how the funding is intended to be used, but the plan could expand on how PA Mitigation, FMA and HMGP Post Fire grant dollars have been used to complete a number of efforts within the CNMI.

MITIGATION STRATEGY

Strengths

- The use of problem statements for each activity in Table 6-1 clearly links the key vulnerabilities identified in the risk assessment to the proposed solutions in the mitigation strategy.

Opportunities for Improvement

- In future planning, along with identifying the goal(s) related to each mitigation action in Table 6- 2, provide a narrative of how the action relates to and will further the goal(s) of the plan. Clearly explain how the completed activity or project will help the territory reach the stated goals. This shows the bridge between the goals and actions of the plan.
- It future planning, it is strongly encouraged that the mitigation strategy include unique actions for each hazard profiled in the plan. While it is acceptable to include multi- and all-hazard actions, including and implementing hazard-specific actions for the vulnerabilities identified in the risk assessment is the best way to minimize the impacts.
- In the next update, consider building on the discussion of how the prioritization of projects in the plan has changed to reflect the territory's current priorities. Describe the previous plan's prioritization of action method. Specifically, how the criteria identified in F.1.1.2 led to a priority rating or ranking. This will show how the prioritization method for the plan update reflects the updated analysis on risks, capabilities and progress on mitigation actions.

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Strengths

- Not applicable.

Opportunities for Improvement

- Not applicable.

REVIEW, EVALUATION, AND IMPLEMENTATION

Strengths

- The plan discusses the challenges to the previous plan's maintenance strategies due to the identified internal and external events. Learning from challenges of maintaining the previous plan and modifying the plan update's maintenance efforts to reflect the takeaways is a strength.
- The proposed maintenance processes in Chapter 7 will help streamline the 2029 update. Continuously reviewing and updating the plan to reflect the current conditions, priorities and capabilities of the CNMI will make sure it remains a living document relevant to the territory's needs.

Opportunities for Improvement

- To further prepare the State Hazard Mitigation Officer and HMGP for plan maintenance efforts, it is recommended that the Mitigation Action Tracker be fully developed and functional at the time of plan finalization. Having a tracker that is ready for use will help make sure the monitoring process is carried out as stated in Chapter 7.
- Although not required, there is opportunity for the territory to build on the public engagement that was done during the planning process. This could be done by including more active continued public outreach in the plan maintenance efforts. Think about carrying out the suggested improvements in Chapter 3.3.4 in public outreach efforts during the next five years to prepare for the full update.

ADOPTION AND ASSURANCES

Strengths

- None identified.

Opportunities for Improvement

- None identified.

HIGH HAZARD POTENTIAL DAMS

Strengths

- Not applicable.

Opportunities for Improvement

- Not applicable.

FIRE MANAGEMENT ASSISTANCE GRANTS

Strengths

- The wildfire hazard profile is well written. The chapter clearly communicates the territory's vulnerability by identifying assets located in high-risk areas. It also includes visual aids to support the narratives.

Opportunities for Improvement

- In the next plan update, consider expanding on the data in Table 4.8-2. The narrative prior to the table states that the territory has limited capability to respond to wildfires. However, it is not clear if this is related to technical equipment or staffing and/or if it is limited to a specific island. Identifying limitations and gaps in the CNMI can also lead to potential mitigation actions for the territory to implement.
- Consider including additional actions that are unique to reducing the vulnerabilities of the territory related to wildfire impacts. For example, pull in the forest restoration actions referenced Action 2024-6-15.

Enhanced State Mitigation Plan Requirements

ENHANCED STATE PREREQUISITES

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

INTEGRATED PLANNING

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

DEMONSTRATING A COMMITMENT TO A COMPREHENSIVE MITIGATION PROGRAM

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

G.1.2 FEMA Mitigation Plan Review Tool, May 2024 Comments

State Mitigation Plan Review Tool

The State Mitigation Plan Review Tool (**Plan Review Tool**) demonstrates and documents how the state mitigation plan meets the regulations set forth in 44 CFR Part 201 and offers FEMA mitigation planners an opportunity to provide feedback to the state.

The **Regulation Checklist** must be completed by FEMA. The FEMA Plan Approver must reference the State Mitigation Planning Policy Guide when completing the Plan Review Tool. The purpose of the checklist is to identify the location of relevant or applicable content in the plan by element/sub-element and to determine if each requirement has been "Met" or "Not Met."

The **Required Revisions** summary at the bottom of each element must clearly explain the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is "Not Met." Sub-elements should be referenced by the appropriate number, where applicable (e.g., S2-a, S2-b). Requirements for each element and sub-element are described in detail in Sections 3 and 4 of the State Mitigation Planning Policy Guide.

The **HHPD section and FMAG sub-elements** only need to be completed if the state is pursuing eligibility for those grant programs.

The **Plan Assessment** must be completed by FEMA. This assessment provides more comprehensive feedback to the state to acknowledge where the plan exceeds minimum requirements and provides suggestions for improvements. FEMA will describe the strengths that are demonstrated and highlight examples of best practices. FEMA's suggestions for improvement are not required to be made for plan approval.

For greater clarification of the elements in the regulation checklist, please see Sections 3 and 4 in the State Mitigation Planning Policy Guide. This document defines terms and phrases used within this review tool.

1. Plan and Review Information

Plan Information	
State	Commonwealth of the Northern Mariana Islands
Title and Date of Plan	Commonwealth of the Northern Mariana Islands State Hazard Mitigation Plan April 30, 2024
Plan Update Version	2024/Version #5
State Point of Contact Name	Marion May M. Guerrero
Title	Program Manager
Agency	CNMI Office of the Governor
Address	Commonwealth of the Northern Mariana Islands, Office of the Governor Caller Box 10007, Saipan, MP 96950
Phone Number	670-664-2374
Email	marianmguerrero@omb.gov.mp
Meets mitigation planning requirements for HHPD?	No
Meets mitigation planning requirements for FMAG?	Yes

Review Information	
Date Received by FEMA region	May 2, 2024
FEMA Reviewer (Planning – Name / Title)	Emily Breen, FEMA Community Planner
FEMA Reviewer (HMA – Name / Title)	Click or tap here to enter text.
FEMA Reviewer (Name / Title)	Claire Fetters, CERC Planner
FEMA Reviewer (Name / Title)	Justin Traylor, FEMA Emergency Management Specialist
FEMA Approver (Name / Title)	JoAnn Scordino, FEMA Community Planner
Plan Status (Not Approved, Approvable Pending Adoption, Approved)	Not Approved

SUMMARY	YES	NO
STANDARD STATE MITIGATION PLAN		
Does the plan meet the standard state mitigation plan requirements?	☐	☒
ENHANCED STATE MITIGATION PLAN		
Does the plan meet the enhanced state mitigation plan requirements?	☐	☒

2. Standard State Mitigation Plan Regulation Checklist

PLANNING PROCESS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S1. Does the plan include a description of the process used to develop the plan? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S1-a. Does the plan describe the current process used to update the plan, including how the plan was prepared, the schedule or time frame, specific milestones and activities, the agencies and stakeholders who were involved in the process, and if the mitigation planning process was integrated to the maximum extent possible with other state planning efforts?	Ch. 1, pp. 4-8 Ch. 3, pp. 1-11 App. A	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S2. Does the plan describe how the state coordinated with other agencies and stakeholders? [44 CFR §§ 201.4(b) and 201.4(c)(1)]		
S2-a. Does the plan describe how the state coordinated with other state agencies, appropriate federal agencies, and other stakeholders, and how they were involved in the process?	Ch. 1, pp. 5-8 Ch. 3, pp. 1-11 App. A	Met

Planning Process Required Revisions:
Click or tap here to enter text.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S3. Does the risk assessment include an overview of the type and location of all natural hazards that can affect the state? [44 CFR § 201.4(c)(2)(i)]		
S3-a. Does the plan include a current overview of all natural hazards that can affect the state, including the type, location and previous occurrences?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
	Ch. 4.11, pp. 1-13 App. B App. C	
S4. Does the risk assessment provide an overview of the probabilities of future hazard events? [44 CFR § 201.4(c)(2)(i)]		
S4-a. Does the risk assessment provide an overview of the probability of future hazard events that includes projected changes in the location, range of anticipated intensities, frequency, and/or duration of each natural hazard?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. C	Met
S4-b. Does the probability include considerations of changing future conditions, including climate change (e.g., long-term weather patterns, average temperature, and sea levels) on the type, location and range of anticipated intensities of identified hazards?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
	Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. C	
S5. Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S5-a. Does the risk assessment include an overview and analysis of the vulnerability to state assets from the identified hazards as well as a summary of the most vulnerable assets?	Sec. 2, pp. 37-63 Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
	Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B App. D	
S5-b. Does the risk assessment estimate potential dollar losses to state assets located in identified hazard areas?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. D	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S6. Does the risk assessment include an overview and analysis of jurisdictions' vulnerability to the identified hazards and the potential losses? [44 CFR §§ 201.4(c)(2)(ii) and 201.4(c)(2)(iii)]		
S6-a. Does the risk assessment provide an overview and analysis of vulnerable jurisdictions based on the state and local government risk assessments?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10 Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B	Met
S6-b. Does the risk assessment include an overview and analysis of the potential losses to the identified vulnerable structures based on estimates in the local risk assessments as well as the state risk assessment?	Ch. 4.1, pp. 1-42 Ch. 4.2, pp. 1-32 Ch. 4.3, pp. 1-22 Ch. 4.4, pp. 1-12 Ch. 4.5, pp. 1-53 Ch. 4.6, pp. 1-10	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
	Ch. 4.7, pp. 1-7 Ch. 4.8, pp. 1-21 Ch. 4.9, pp. 1-16 Ch. 4.10, pp. 1-11 Ch. 4.11, pp. 1-13 App. B	
S7. Was the risk assessment revised to reflect changes in development? [44 CFR § 201.4(d)]		
S7-a. Does the plan provide a summary of recent development and potential or projected development in hazard-prone areas based on state and local government risk assessments?	Ch. 1, pp. 8-9 Ch. 2, 4-36 Ch. 4.1, pp. 31-34 Ch. 4.2, pp. 30-32 Ch. 4.3, pp. 22-23 Ch. 4.4, p. 13 Ch. 4.5, pp. 42-44, 54 Ch. 4.6, pp. 10-11 Ch. 4.7, p. 7 Ch. 4.8, pp. 22-23 Ch. 4.9, pp. 17-18 Ch. 4.10, pp. 12-13 Ch. 4.11, p. 13 App. B App. C App. D	Met

Hazard Identification and Risk Assessment Required Revisions:

S6-b. With the exception of flood hazard, potential loss estimates are not provided for general building stock in the Northern Islands. For example, the volcanic activity hazard profile states that there are small residences on the Northern Islands that are vulnerable to lava flow. However, the profile does not include an estimated potential loss number for those vulnerable structures. It is understood that there is a small number of residences that are vulnerable to the hazard's impacts. Still, you must provide an estimate of the potential dollar losses to the structures vulnerable to a given hazard, unless the data is not available. If loss data is not available for the northern islands housing stock, please note this as a data limitation explicitly in the plan.

STATE MITIGATION CAPABILITIES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S8. Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment? [44 CFR § 201.4(c)(3)(ii)]		
S8-a. Does the plan include an evaluation of state laws, regulations, policies and programs related to hazards that improve or impede resilience to future natural hazard events and other future conditions, including the effects of climate change?	Ch. 2, p. 4 Ch. 4.5, p. 23 Ch. 5, pp. 1-42 App. E	Not Met
S8-b. Does the plan include a general discussion of state funding capabilities for hazard mitigation actions and projects?	Ch. 4.1, pp. 8-11 Ch. 5, pp. 37-42 App. E App. F	Met
S8-c. Does the plan include a summary of obstacles, challenges and proposed solutions related to any state capabilities, including a brief discussion of potential strategies for overcoming any challenges related to implementing and enforcing hazard-resistant building codes statewide, as applicable, and changes since the previous plan approval?	Ch. 1, pp. 8-9 Ch. 5, pp. 1-44 Ch. 6, pp. 9-25 App. E	Met

State Mitigation Capabilities Required Revisions:

S8-a. The National Flood Insurance Program section in the plan is robust. However, it does not explain how the territory's agencies work together to administer the substantial damage provision of the floodplain management regulations. Describe how these requirements are administered by the Department of Public Works Building Safety Code Division. Include other territory agencies that may aid in administration. Information on Substantial Improvement/Damage can be found here: [Substantial Improvement/Substantial Damage Desk Reference (fema.gov)]

MITIGATION STRATEGY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S9. Does the mitigation strategy include goals to reduce long-term vulnerabilities from the identified hazards? [44 CFR § 201.4(c)(3)(i)]		
S9-a. Does the plan identify hazard mitigation goals representing what the state seeks to accomplish through mitigation plan implementation using a wide range of funding, including non-FEMA funding?	Ch. 6, p. 4	Met
S9-b. Are the goals consistent with the hazards and vulnerabilities identified in the risk assessment?	Ch. 4.11, p. 12	Met
S10. Does the plan prioritize mitigation actions to reduce vulnerabilities identified in the risk assessment? [44 CFR §§ 201.4(c)(3)(i), 201.4(c)(3)(ii) and 201.4(c)(3)(iii)]		
S10-a. Does the plan identify actions based on the current risk assessment to reduce the vulnerability of jurisdictions within the state, as well as the vulnerability of state assets as described in Elements S5 and S6?	Ch. 6, pp. 7-26	Met
S10-b. Does the plan describe the process used by the state to evaluate and prioritize actions that are cost-effective, environmentally sound, and technically feasible?	Ch. 6, pp. 26-29	Met
S10-c. Does the plan describe how each action contributes to the hazard mitigation goals?	Ch. 6, pp. 28-29	Met
S10-d. Does the plan describe how local government mitigation strategies link to the state mitigation strategy?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S11. Does the plan identify current and potential sources of funding to implement mitigation actions and activities? [44 CFR § 201.4(c)(3)(iv)]		
S11-a. Do mitigation activities include the identification of current and/or potential sources of federal, state, local or private funding for implementation?	Ch. 1, pp. 2-4 Ch. 5, pp. 37-42 Ch. 6, pp. 9-26 App. E App. F	Not Met
S11-b. Does the plan identify FEMA mitigation funding sources (if applicable), including, but not limited to: HMGP, BRIC, FMA and PA Mitigation, at a minimum?	Ch. 5, pp. 37-42 Ch. 6, pp. 9-26 App. E App. F	Met
S12. Was the plan updated to reflect progress in statewide mitigation efforts and changes in priorities? [44 CFR § 201.4(d)]		
S12-a. Does the plan provide a narrative of the status of each mitigation action in the previous plan?	Ch. 1, p. 9 Ch. 4.2, p. 32 Ch. 4.3, pp. 23-24 Ch. 4.4, p. 13 Ch. 4.5, p. 54 Ch. 4.6, p. 11 Ch. 4.7, p. 7 Ch. 4.8, p. 23 Ch. 4.9, p. 18 Ch. 4.10, p. 13 Ch. 6, pp. 5-6 App. F	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S12-b. Was the prioritization of mitigation actions and activities updated based on the updated analysis of risks, capabilities and progress?	Ch. 1, pp. 8-9 Ch. 4.1, p. 1 Ch. 4.2, p. 1 Ch. 4.3, p. 1 Ch. 4.4, p. 1 Ch. 4.5, p. 1 Ch. 4.6, p. 1 Ch. 4.7, p. 1 Ch. 4.8, p. 1 Ch. 4.9, p. 1 Ch. 4.10, p. 1 Ch. 4.11, p. 13 Ch. 6, pp. 5-6, 26-29 App. F	Met

Mitigation Strategy Required Revisions:

S11-a. Most of the activities in the territory's action plan list a variety of potential funding sources. However, some actions 2018-4-01, 2018-4-03, 2018-4-04, 2018-4-05, 2018-4-06, 2018-5-02, 2018-6-04, 2024-6-13, and 2018-8-03 are missing a funding source that can support the implementation of the project. This includes actions 2018-4-01; 2018-4-03; 2018-4-04; 2018-4-05; 2018-4-06; 2018-5-02; 2018-6-04; 2024-6-13; and 2018-8-03. Similar to how the other actions in the plan list at least one potential funding source, identify the federal, territorial, private or other applicable funding source that can give financial support to complete these activities.

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S13. Does the plan generally describe and analyze the effectiveness of local government mitigation policies, programs, and capabilities? [44 CFR § 201.4(c)(3)(ii)]		
S13-a. Does the plan provide a summary of current local government policies, programs and capabilities of jurisdictions to accomplish hazard mitigation?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S13-b. Does the plan describe the effectiveness of local government mitigation policies, programs and capabilities?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S14. Does the plan describe the process to support the development of approvable local government mitigation plans? [44 CFR §§ 201.3(c)(5) and 201.4(c)(4)(i)]		
S14-a. Does the plan describe how the state supports developing or updating FEMA-approvable mitigation plans?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S14-b. Does the plan provide a brief summary of barriers to developing or updating, adopting, and implementing FEMA-approved local government mitigation plans based on an analysis of plan and jurisdiction coverage data and trends across the state and steps to remove barriers to help local governments advance mitigation planning, including how plan and jurisdiction coverage data and trends inform those steps?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S15. Does the plan describe the criteria for prioritizing funding? [44 CFR § 201.4(c)(4)(iii)]		
S15-a. Does the plan describe criteria for prioritizing jurisdictions to receive planning and project grants under available federal and non-federal programs?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S16. Does the plan describe the process and time frame to review, coordinate, and link local and tribal mitigation plans with the state mitigation plan? [44 CFR §§ 201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)]		
S16-a. Does the plan describe the state's process and time frame to review and submit approvable local and tribal mitigation plans to FEMA?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.
S16-b. Does the plan describe the state's process and time frame to share risk assessment data and mitigation priorities with local governments for their plan updates, as well as integrate local risk assessment and mitigation actions into the state mitigation plan updates?	Not applicable – there are no local HMPs in the CNMI.	Choose an item.

Local Planning Coordination and Capability Building Required Revisions: Click or tap here to enter text.

REVIEW, EVALUATION, AND IMPLEMENTATION

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S17. Is there a description of the method and schedule for keeping the plan current? [44 CFR §§ 201.4(c)(5)(i) and 201.4(d)]		
S17-a. Does the plan describe the agency/office responsible for monitoring, evaluating and updating the plan?	Ch. 7, pp. 1-4	Met
S17-b. Does the plan describe the schedule for monitoring, evaluating, and updating the plan?	Ch. 7, pp. 1-8	Met
S18. Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§ 201.4(c)(5)(ii) and 201.4(c)(5)(iii)]		
S18-a. Does the plan describe the system for tracking the implementation of the mitigation activities and projects identified in the mitigation strategy, including all mitigation activities and not just those funded by FEMA?	Ch. 7, pp. 2-8	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S18-b. Does the system include the schedule, the agency/office responsible for coordination, and the role of the agencies/offices identified in the mitigation strategy as responsible for implementation of actions?	Ch. 7, pp. 2-8	Met
S18-c. Does the plan describe a system for reviewing progress on achieving the mitigation strategy's goals that includes the criteria and process for evaluating progress?	Ch. 7, pp. 2-8	Met

Review, Evaluation, and Implementation Required Revisions:

Click or tap here to enter text.

ADOPTION AND ASSURANCES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
S19. Did the state provide documentation that the plan has been formally adopted? [44 CFR § 201.4(c)(6)]		
S19-a. Did the state provide documentation of formal adoption by the highest elected official or designee prior to FEMA approval?	Ch. 1, pp. vii, 9	Not Met
S20. Did the state provide assurances? [44 CFR § 201.4(c)(7)]		
S20-a. Does the plan include assurances that the state will manage and administer FEMA funding in accordance with applicable federal statutes and regulations?	Ch. 1, pp. 1-2, 4	Met
S20-b. Does the plan include assurances that the state will update its plan whenever necessary to reflect changes in state or federal laws and statutes?	Ch. 1, pp. 1-2, 4	Met

Adoption and Assurances Required Revisions:

S19-a. Once the Governor has signed an adoption letter, please email to fema-r9-mitigation-planning@fema.dhs.gov

HIGH HAZARD POTENTIAL DAMS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD1. Did Element S2 (planning process) describe how the state dam safety agency, other agencies, and stakeholders participated in the planning process and contributed expertise, data, studies, information, etc. relative to high hazard potential dams?		
HHPD1-a. Does the plan describe how the state dam safety agency, other agencies, and stakeholders were involved in the planning process?	Click or tap here to enter text.	Choose an item.
HHPD1-b. Does the plan describe the types of data contributed?	Click or tap here to enter text.	Choose an item.
HHPD2. Did Element S6 (risk assessment) address all dam risk for high hazard potential dams in the risk assessment?		
HHPD2-a. Does the plan provide a list of high hazard potential dams that have been identified by the state with their names, National Inventory of Dams identification numbers, locations by jurisdiction, and other relevant information, as well as maps?	Click or tap here to enter text.	Choose an item.
HHPD2-b. Does the plan summarize statewide vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	Click or tap here to enter text.	Choose an item.
HHPD2-c. Does the plan document limitations and describe the approach to address deficiencies?	Click or tap here to enter text.	Choose an item.
HHPD3. Did Element S9 (mitigation goals) include mitigation goals to reduce long-term vulnerabilities from high hazard potential dams?		
HHPD3-a. Does the plan address a reduction in vulnerabilities to/from high hazard potential dams from hazards and the potential consequences associated with dam incidents as part of their own goals or with other long-term strategies?	Click or tap here to enter text.	Choose an item.
HHPD3-b. Does the plan link the proposed actions to reduce long-term vulnerabilities consistent with the goals?	Click or tap here to enter text.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD4. Did Element S10 (mitigation actions) prioritize mitigation actions and activities to reduce vulnerabilities from high hazard potential dams?		
HHPD4-a. Does the plan include actions to reduce vulnerabilities to/from high hazard potential dams?	Click or tap here to enter text.	Choose an item.
HHPD4-b. Does the plan describe the process to evaluate and prioritize actions related to high hazard potential dams that are cost-effective, environmentally sound and technically feasible?	Click or tap here to enter text.	Choose an item.
HHPD4-c. Does the plan describe how each action to reduce risks related to high hazard potential dams contributes to the goals and describe how strategies are linked to the state mitigation strategy?	Click or tap here to enter text.	Choose an item.
HHPD5. Did Element S11 (funding sources) identify current and potential sources of funding to implement mitigation actions and activities for high hazard potential dams?		
HHPD5-a. Does the plan include various funding sources to mitigate vulnerabilities to and from high hazard potential dams from hazards and the potential consequences associated with dam incidents, as well as funding sources to rehabilitate or remove high hazard potential dams?	Click or tap here to enter text.	Choose an item.
HHPD6. Did Element S13 (local coordination) generally describe and analyze the effectiveness of local mitigation policies, programs, and capabilities that address high hazard potential dams?		
HHPD6-a. Does the plan provide a summary of the local policies, programs, and capabilities to implement mitigation actions and reduce vulnerabilities from high hazard potential dams from hazards and the potential consequences associated with dam incidents?	Click or tap here to enter text.	Choose an item.
HHPD6-b. Does the plan describe challenges to implementing local mitigation policies, programs and capabilities to reduce vulnerabilities to and from high hazard potential dams and the approach to overcome these challenges?	Click or tap here to enter text.	Choose an item.
HHPD6-c. Does the plan describe opportunities for implementing mitigation actions to reduce risks to and from high hazard potential dams through local capabilities?	Click or tap here to enter text.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
HHPD7. Did Element S15 (prioritizing funding) describe the criteria for prioritizing funding for high hazard potential dams?		
HHPD7-a. Does the plan describe the method for funding actions to reduce vulnerabilities to and from high hazard potential dams if these actions were prioritized differently than mitigation actions for other hazards?	Click or tap here to enter text.	Choose an item.
HHPD7-b. Does the plan document limitations and describe the approach to addressing deficiencies?	Click or tap here to enter text.	Choose an item.

HHPD Required Revisions:

Click or tap here to enter text.

FIRE MANAGEMENT ASSISTANCE GRANTS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
FMAG1. Does the plan address wildfire risks? [44 CFR 201.4(c)(2); 44 CFR § 204.51(d)(2)]		
FMAG1-a. Does the risk assessment provide an overview of the location and previous occurrences of wildfire hazards in the state?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG1-b. Does the risk assessment provide an overview of the probability of future wildfire events that includes projected changes in the location, intensity, frequency and/or duration of wildfire hazards?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met

Requirements	Location in Plan (section and/or page number)	Met / Not Met
FMAG1-c. Does the risk assessment address the vulnerability of state assets located in wildfire hazard areas and estimate the potential dollar losses to those assets?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG1-d. Does the risk assessment include an overview and analysis of local governments' vulnerability to wildfires and the potential losses to vulnerable structures?	Ch. 4.1, pp. 39-40 Ch. 4.8, pp. 1-21 Ch. 4.11, pp. 1-13	Met
FMAG2. Does the plan's mitigation strategy contain wildfire-related mitigation initiatives? [44 CFR 201.4(c)(3); 44 CFR § 204.51(d)(2)]		
FMAG2-a. Does the mitigation strategy identify mitigation actions and activities to reduce the vulnerability of jurisdictions within the state as well as the vulnerability of state-owned assets as described in Elements S5 and S6?	Ch. 6, pp. 9-26	Met

FMAG Required Revisions: Click or tap here to enter text.

3. Enhanced State Mitigation Plan Regulation Checklist

ENHANCED STATE PREREQUISITES

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E1. Does the enhanced plan include all elements of the standard state mitigation plan? [44 CFR § 201.5(b)]		
E1-a. Does the enhanced plan meet all the required elements of the standard state mitigation plan?	Click or tap here to enter text.	Choose an item.
E2. Regarding HMA, is the state maintaining the capability to meet application time frames and submitting complete project applications? [44 CFR § 201.5(b)(2)(iii)(A)]		
E2-a. Are all applications complete and submitted by the end of each program's respective application period?	Click or tap here to enter text.	Choose an item.
E2-b. Are all applications entered into FEMA's electronic data systems (i.e., NEMIS, eGrants, and/or FEMA GO)?	Click or tap here to enter text.	Choose an item.
E2-c. Is a complete Minimum Criteria Checklist for Project Subapplicants or equivalent documentation prepared for all subapplications?	Click or tap here to enter text.	Choose an item.
E2-d. Are all applications determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response?	Click or tap here to enter text.	Choose an item.
E3. Regarding HMA, is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses? [44 CFR § 201.5(b)(2)(iii)(B)]		
E3-a. Are all applications and amendments determined to be complete by FEMA within 90 days of submittal or selection for further review, or after the first request for information response, including all data requested by FEMA to support cost-effectiveness determinations and EHP compliance reviews?	Click or tap here to enter text.	Choose an item.

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E4. Regarding HMA, is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time? [44 CFR § 201.5(b)(2)(iii)(C)]		
E4-a. Are all progress reports complete and submitted on time?	Click or tap here to enter text.	Choose an item.
E4-b. Are all FFR SF-425s submitted on time?	Click or tap here to enter text.	Choose an item.
E4-c. Does the state consistently comply with the Financial Management Standard requirements described in 2 CFR §§ 200.300 to 200.309?	Click or tap here to enter text.	Choose an item.
E5. Regarding HMA, is the state maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation? [44 CFR § 201.5(b)(2)(iii)(D)]		
E5-a. Is all work as part of HMA subawards completed by the end of the period of performance, as described in the HMA Guidance?	Click or tap here to enter text.	Choose an item.
E5-b. Have there been no major findings on the last single audit obtained by the state related to HMA programs?	Click or tap here to enter text.	Choose an item.
E5-c. Are all grant closeout activities, including financial reconciliation, completed within 120 days from the end of the performance period as outlined in 2 CFR 200.344?	Click or tap here to enter text.	Choose an item.
E5-d. Have actual expenditures been documented and are they consistent with SF-424A or SF-424C?	Click or tap here to enter text.	Choose an item.

Enhanced State Prerequisites Required Revisions:
Click or tap here to enter text.

INTEGRATED PLANNING

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E6. Does the plan demonstrate integration, to the extent practicable, with other state and/or regional planning initiatives and FEMA mitigation programs and initiatives? [44 CFR § 201.5(b)(1)]		
E6-a. Does the enhanced plan demonstrate integration with other state and/or regional planning initiatives?	Click or tap here to enter text.	Choose an item.
E6-b. Does the enhanced plan demonstrate integration of FEMA mitigation programs and initiatives?	Click or tap here to enter text.	Choose an item.

Integrated Planning Required Revisions:
Click or tap here to enter text.

DEMONSTRATING COMMITMENT TO A COMPREHENSIVE STATE MITIGATION PROGRAM

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E7. Does the state demonstrate commitment to a comprehensive mitigation program? [44 CFR §§ 201.3(c), 201.5(b)(4) and 201.6(d)]		
E7-a. Does the state demonstrate commitment to statewide programs, initiatives and plans that advance mitigation and resilience?	Click or tap here to enter text.	Choose an item.
E7-b. Does the state demonstrate a commitment to mitigation training and capability building?	Click or tap here to enter text.	Choose an item.
E7-c. Does the state demonstrate a commitment to its mitigation planning responsibilities by helping local governments update and adopt their plans before they expire?	Click or tap here to enter text.	Choose an item.

Demonstrating a Commitment to a Comprehensive State Mitigation Program Required Revisions:
Click or tap here to enter text.

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E8. Is the state effectively using existing mitigation programs to achieve mitigation goals? [44 CFR §§ 201.5(a) and 201.5(b)(3)]		
E8-a. Does the state demonstrate and document the full and effective use of existing FEMA programs (if funding is available)?	Click or tap here to enter text.	Choose an item.
E8-b. Does the state demonstrate and document the full and effective use of non-FEMA programs?	Click or tap here to enter text.	Choose an item.

Effective Use of Existing Mitigation Programs to Achieve Mitigation Goals Required Revisions:
Click or tap here to enter text.

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Requirements	Location in Plan (section and/or page number)	Met / Not Met
E9. Does the enhanced plan document capability to implement mitigation actions? [44 CFR §§ 201.5(b)(2)(i), 201.5(b)(2)(ii), and 201.5(b)(2)(iv)]		
E9-a. Does the enhanced plan describe the system to rank the mitigation measures according to established eligibility criteria, including a process to prioritize between funding programs, jurisdictions, and proposals that address different or multiple hazards?	Click or tap here to enter text.	Choose an item.
E9-b. Does the enhanced plan describe how the state will assess the effectiveness of mitigation actions, mitigation the agencies that are involved as well as the timeline, and use the results to inform the mitigation strategy?	Click or tap here to enter text.	Choose an item.

Documentation of the State's Implementation Capability Required Revisions:
Click or tap here to enter text.

4. Plan Assessment

The Plan Assessment comments can be used to help guide the ongoing maintenance and update of your mitigation plan.

Standard State Mitigation Plan Requirements

PLANNING PROCESS

Strengths

- Chapter 3 does an excellent job in discussing the priorities and objectives of the planning process. It is clear how the planning team built on the previous plan's successes. The team also expanded the outreach to additional internal and external stakeholders.
- The planning process has already begun to list additional ways to make sure the public outreach in future plan updates can be more accessible and equitable to the residents of the territory. Finding ways to improve on the planning process in the future helps guide the CNMI officials who will be carrying out the next update.
- It is clear that the territory worked with organizations that have climate change expertise and data to contribute to the plan. Including them in this process makes sure that the plan has more accurate data on how climate change is affecting the CNMI.

Opportunities for Improvement

- There is an opportunity to clearly capture all other territorial planning efforts and processes that are ongoing currently in the plan. It is understood there was both passive and active integration of the current planning process with capital improvement programs, data integration and expertise given. In future planning, consider expounding on if there are other planning efforts in place and how the planning process informed them.
- In the next plan update, consider expanding the planning process stakeholder list in Table 3-1 to identify the community lifeline group(s) they support or are related to, if applicable. The risk assessment and mitigation strategy chapters of the plan include the relation to community lifelines; there is a chance to also include the link to the eight lifeline groups in the planning process.
- In future planning, there is a chance to grow the external stakeholder outreach to other federal agencies that the CNMI has or could partner with in the future for mitigation activities. Engaging with other external stakeholders can foster strong partnerships for the territory.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

Strengths

- Each hazard profile includes many ways to explain an event's extent. Defining the scientific scale(s) related to each hazard is a universal way to explain how intense a hazard can be. The profiles also discuss other extent factors, such as warning time. Continue to use a variety of ways to identify the magnitude of a hazard event.
- Along with assessing the potential impacts of the hazards on the assets of the territory, each chapter of the risk assessment explores how future conditions will affect hazard impacts. Understanding how changes in the climate and population and development patterns will influence hazard events and related impacts is a key step in planning for future mitigation projects.
- It's clear the Team did extensive work to build and/or update GIS data for the CNMI's buildings and infrastructure, critical facilities GIS data, general build stock and infrastructure, and vulnerability. This could be very useful data to the Commonwealth, even beyond the HMP update.
- The summary of updates from the previous plan noted at the beginning of each hazard profile is a helpful summary for readers to clearly understand what new data or information has been incorporated.
- In discussing vulnerability of populations in particular extreme heat, the plan does a nice job of connecting general discussion of vulnerable population impacts to CNMI specific demographics. This extra step shows a commitment to understanding CNMI's vulnerabilities, wholistically.

Opportunities for Improvement

- During the plan maintenance process, we encourage you to complete Mitigation Success section of each hazard profile. Taking time to highlight and celebrate successful projects and activities implemented in the CNMI is an important step in the hazard mitigation process.
- In the next plan update, consider another way to analyze general trends for each hazard by calculating historical frequency by 5- to 10-year increments for the hazard. This will result in a currently accurate historical frequency probability for the action. It will also show how the number of events has increased, decreased or remained constant over time.
- In future planning, for the hazards that have fewer or no direct impacts on structural assets of the CNMI, it is recommended that the territory analyze potential impacts to the economy, its residents and other applicable assets. It may be harder to quantify potential losses associated with hazards such as drought and extreme heat. However, it is still important to understand the risk each hazard presents to the territory.
- In the next plan, consider taking the recent and potential development and population changes one step further to fully relate the shifts back to how they will impact vulnerability of the CNMI. Clearly linking the changes to the physical environment of the planning area as

well as the makeup of its people will help territory officials understand how to best minimize increased vulnerability.

STATE MITIGATION CAPABILITIES

Strengths

- The summary of obstacles and challenges to the territory's capabilities is clear and thoughtful. Each capability discusses notable changes since the last plan and challenges related to the resource. The plan also includes meaningful steps for removing the identified challenges and obstacles in the future in the mitigation strategy.
- The evaluation of the territory's pre- and post-disaster capabilities is thorough. Each capability related to hazard mitigation has a detailed narrative and is further expanded on in Appendix E.
- The plan incorporates information from the THIRA, which is a great way to coordinate and ensure consistency across complimentary planning efforts occurring on island.

Opportunities for Improvement

- In future plans, consider including a brief narrative for each of the projects and activities that have received FEMA funding. Noting the titles of the grants gives an adequate sense of how the funding is intended to be used, but the plan could expand on how PA Mitigation, FMA and HMGP Post Fire grant dollars have been used to complete a number of efforts within the CNMI.

MITIGATION STRATEGY

Strengths

- The use of problem statements for each activity in Table 6-1 clearly links the key vulnerabilities identified in the risk assessment to the proposed solutions in the mitigation strategy.

Opportunities for Improvement

- Prior to finalizing the plan, be sure to include the results of the action prioritization process for the projects and activities in the mitigation strategy.
- In future planning, along with identifying the goal(s) related to each mitigation action in Table 6-2, provide a narrative of how the action relates to and will further the goal(s) of the plan. Clearly explain how the completed activity or project will help the territory reach the stated goals. This shows the bridge between the goals and actions of the plan.
- It future planning, it is strongly encouraged that the mitigation strategy include unique actions for each hazard profiled in the plan. While it is acceptable to include multi- and all-hazard actions, including and implementing hazard-specific actions for the vulnerabilities identified in the risk assessment is the best way to minimize the impacts.

- In the next update, consider building on the discussion of how the prioritization of projects in the plan has changed to reflect the territory's current priorities. Describe the previous plan's prioritization of action method. Specifically, how the criteria identified in F.1.1.2 led to a priority rating or ranking. This will show how the prioritization method for the plan update reflects the updated analysis on risks, capabilities and progress on mitigation actions.

LOCAL PLANNING COORDINATION AND CAPABILITY BUILDING

Strengths

- Not applicable.

Opportunities for Improvement

- Not applicable.

REVIEW, EVALUATION, AND IMPLEMENTATION

Strengths

- The plan discusses the challenges to the previous plan's maintenance strategies due to the identified internal and external events. Learning from challenges of maintaining the previous plan and modifying the plan update's maintenance efforts to reflect the takeaways is a strength.
- The proposed maintenance processes in Chapter 7 will help streamline the 2029 update. Continuously reviewing and updating the plan to reflect the current conditions, priorities and capabilities of the CNMI will make sure it remains a living document relevant to the territory's needs.

Opportunities for Improvement

- To further prepare the State Hazard Mitigation Officer and HMGP for plan maintenance efforts, it is recommended that the Mitigation Action Tracker be fully developed and functional at the time of plan finalization. Having a tracker that is ready for use will help make sure the monitoring process is carried out as stated in Chapter 7.
- Although not required, there is opportunity for the territory to build on the public engagement that was done during the planning process. This could be done by including more active continued public outreach in the plan maintenance efforts. Think about carrying out the suggested improvements in Chapter 3.3.4 in public outreach efforts during the next five years to prepare for the full update.

ADOPTION AND ASSURANCES

Strengths

- None identified.

Opportunities for Improvement

- None identified.

HIGH HAZARD POTENTIAL DAMS

Strengths
- Not applicable.

Opportunities for Improvement
- Not applicable.

FIRE MANAGEMENT ASSISTANCE GRANTS

Strengths
- The wildfire hazard profile is well written. The chapter clearly communicates the territory's vulnerability by identifying assets located in high-risk areas. It also includes visual aids to support the narratives.

Opportunities for Improvement
- In the next plan update, consider expanding on the data in Table 4.8-2. The narrative prior to the table states that the territory has limited capability to respond to wildfires. However, it is not clear if this is related to technical equipment or staffing and/or if it is limited to a specific island. Identifying limitations and gaps in the CNMI can also lead to potential mitigation actions for the territory to implement.
- Consider including additional actions that are unique to reducing the vulnerabilities of the territory related to wildfire impacts. For example, pull in the forest restoration actions referenced Action 2024-6-15.

Enhanced State Mitigation Plan Requirements

ENHANCED STATE PREREQUISITES

Strengths
- [Insert plan assessment comments]

Opportunities for Improvement
- [Insert plan assessment comments]

INTEGRATED PLANNING

Strengths
- [Insert plan assessment comments]

Opportunities for Improvement
- [Insert plan assessment comments]

DEMONSTRATING A COMMITMENT TO A COMPREHENSIVE MITIGATION PROGRAM

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

EFFECTIVE USE OF EXISTING MITIGATION PROGRAMS TO ACHIEVE MITIGATION GOALS

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

DOCUMENTATION OF THE STATE'S IMPLEMENTATION CAPABILITY

Strengths

- [Insert plan assessment comments]

Opportunities for Improvement

- [Insert plan assessment comments]

G.1.3 Hazard Mitigation Grant Program Responses to Comments on the May 2024 Mitigation Plan Review Tool

Table G.1-1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update.

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
1. Plan and Review Information	N/A	N/A	All information provided was reviewed and is correct	N/A
2. Standard State Mitigation Plan Regulation Checklist	Planning Process	S1 and S2	All elements met. No revisions required for the Planning Process sub-section	N/A

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
	Hazard Identification and Risk Assessment	S3, S4, S5, S6, S7	Element S6-b: With the exception of flood hazard, potential loss estimates are not provided for general building stock in the Northern Islands. For example, the volcanic activity hazard profile states that there are small residences on the Northern Islands that are vulnerable to lava flow. However, the profile does not include an estimated potential loss number for those vulnerable structures. It is understood that there is a small number of residences that are vulnerable to the hazard's impacts. Still, you must provide an estimate of the potential dollar losses to the structures vulnerable to a given hazard, unless the data is not available. If loss data is not available for the northern islands housing stock, please note this as a data limitation explicitly in the plan.	Information about general building stock in the Northern Islands was not available for the 2024 SHMP Update and this remains a data gap. Over the next 5 years, HMGP will work with the Northern Islands Mayor's Office to address this data gap. In the SHMP the data gap for general building stock was address on the following pages: 1. Section 4.2 Typhoon - page 4.2-26. 2. Section 4.3 Tsunami - page 4.3-17 3. Section 4.4 Drought - page 4.4-10. We edited the text to "Drought is expected to impact all regions of the Commonwealth similarly, including the Northern Islands." 4. Section 4.5 Flood - page 4.5-34 (event-based flood), 4.5-38 (Chronic coastal flood), page 4.5-40 (coastal erosion) 5. Section 4.6 Health Risk - N/A 6. Section 4.7 Extreme Heat and Heatwave. We edited the text to "As with the Commonwealth buildings, no direct impacts from extreme heat or heatwaves are expected for the general building stock, including any existing stock in the Northern Islands." - page 4.7-5 7. Section 4.8 - page 4.8-17 8. Section 4.9 - page 4.9-15 9. Section 4.10 - page 4.10-10

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
	State Mitigation Capabilities	S8	Element S8-a: The National Flood Insurance Program section in the plan is robust. However, it does not explain how the territory's agencies work together to administer the substantial damage provision of the floodplain management regulations. Describe how these requirements are administered by the Department of Public Works Building Safety Code Division. Include other territory agencies that may aid in administration. Information on Substantial Improvement/Damage can be found here: Substantial Improvement/Substantial Damage Desk Reference (fema.gov)	Pages 5-19 through 5-21 were updated to address comments by FEMA. Responses include: 1) DPW administers the National Flood Insurance Program and employs a single Flood Plain Manager within the Building Safety Code Division; 2) The Flood Plain Manager works with other CNMI agencies to administer flood plain regulations and the NFIP via building permit and environmental review processes; 3) Changes in NFIP participation and insurance coverage were addressed; 4) The process to administer substantial damage was included; and 5) A discussion of Commonwealth owned/operated structures that are at high risk of flooding and repetitive loss structures was included.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
	Mitigation Strategy	S9, S10, S11, S12	Element S11-a: Most of the activities in the territory's action plan list a variety of potential funding sources. However, some actions 2018-4-01, 2018-4-03, 2018-4-04, 2018-4-05, 2018-4-06, 2018-5-02, 2018-6-04, 2024-6-13, and 2018-8-03 are missing a funding source that can support the implementation of the project. This includes actions 2018-4-01; 2018-4-03; 2018-4-04; 2018-4-05; 2018-4-06; 2018-5-02; 2018-6-04; 2024-6-13; and 2018-8-03. Similar to how the other actions in the plan list at least one potential funding source, identify the federal, territorial, private or other applicable funding source that can give financial support to complete these activities.	Funding sources HMGP and BRIC were added to actions 2018-4-01 (page 6-16), 2018-4-03 (page 6.-17), 2018-4-04 (page 6-17), 2018-4-05 (page 6-18), 2018-4-06 (page 6-18), 2018-6-04 (page 6-21), 2024-6-13 (6-24), and 2018-8-03 (page 6-27) and BRIC was added to 2018-5-02 (page 6-19).
	Local Planning Coordination and Capability Building	S13, S14, S15, S16	N/A	N/A
	Review, Evaluation, and Implementation	S17, S18	All elements met. No revisions required for the Review, Evaluation, and Implementation sub-section.	N/A

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
	Adoption and Assurances	S19, S20	Element S19-a: S19-a. Once the Governor has signed an adoption letter, please email to fema-r9-mitigation-planning@fema.dhs.gov	The adoption letter signed by the Governor was inserted into the 2024 SHMP Update (pages 1-10 to 1-13) and submitted to FEMA.
	High Hazard Potential Dams	HHPD1-7,	N/A	N/A
	Fire Mitigation Assistance Grants	FMAG1, FMAG2	All elements met. No revisions required for the Fire Mitigation Assistance Grants sub-section	N/A
3. Enhanced State Mitigation Planning Regulation Checklist	N/A		N/A	N/A
4. Plan Assessment - Standard State Mitigation Plan Requirements	Planning Process - Opportunities for Improvement		There is an opportunity to clearly capture all other territorial planning efforts and processes that are ongoing currently in the plan. It is understood there was both passive and active integration of the current planning process with capital improvement programs, data integration and expertise given. In future planning, consider expounding on if there are other planning efforts in place and how the planning process informed them.	This opportunity for improvement is acknowledged. A task was added to the Maintenance Schedule in Chapter 7.0 (Table 7-1) to track planning efforts with stakeholders at the annual SHMP update meeting and to maintain a list of territory planning efforts.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			In the next plan update, consider expanding the planning process stakeholder list in Table 3-1 to identify the community lifeline group(s) they support or are related to, if applicable. The risk assessment and mitigation strategy chapters of the plan include the relation to community lifelines; there is a chance to also include the link to the eight lifeline groups in the planning process.	Table 3-1 was updated to associate stakeholders with the community lifeline they support, where applicable.
			In future planning, there is a chance to grow the external stakeholder outreach to other federal agencies that the CNMI has or could partner with in the future for mitigation activities. Engaging with other external stakeholders can foster strong partnerships for the territory.	This opportunity for improvement is acknowledged. A section was added to Chapter 3.0 (page 3-12) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
	Hazard Identification and Risk Assessment - Opportunities for Improvement		During the plan maintenance process, we encourage you to complete Mitigation Success section of each hazard profile. Taking time to highlight and celebrate successful projects and activities implemented in the CNMI is an important step in the hazard mitigation process.	The Mitigation Success sections were completed for each hazard profile.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			In the next plan update, consider another way to analyze general trends for each hazard by calculating historical frequency by 5- to 10-year increments for the hazard. This will result in a currently accurate historical frequency probability for the action. It will also show how the number of events has increased, decreased or remained constant over time.	This opportunity for improvement is acknowledged. A section was added to Chapter 4.11 (pages 4.11-12 to 4.11-13) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
			In future planning, for the hazards that have fewer or no direct impacts on structural assets of the CNMI, it is recommended that the territory analyze potential impacts to the economy, its residents and other applicable assets. It may be harder to quantify potential losses associated with hazards such as drought and extreme heat. However, it is still important to understand the risk each hazard presents to the territory.	This opportunity for improvement is acknowledged. A section was added to Chapter 4.11 (page 4.11-13) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			In the next plan, consider taking the recent and potential development and population changes one step further to fully relate the shifts back to how they will impact vulnerability of the CNMI. Clearly linking the changes to the physical environment of the planning area as well as the makeup of its people will help territory officials understand how to best minimize increased vulnerability.	This opportunity for improvement is acknowledged. A section was added to Chapter 4.11 (page 4.11-13) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
	State Mitigation Capabilities - Opportunities for Improvement		In future plans, consider including a brief narrative for each of the projects and activities that have received FEMA funding. Noting the titles of the grants gives an adequate sense of how the funding is intended to be used, but the plan could expand on how PA Mitigation, FMA and HMGP Post Fire grant dollars have been used to complete a number of efforts within the CNMI.	This opportunity for improvement is acknowledged. A section was added to Chapter 5.0 (page 5-45) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
	Mitigation Strategy - Opportunities for Improvement		Prior to finalizing the plan, be sure to include the results of the action prioritization process for the projects and activities in the mitigation strategy.	The results of the mitigation action prioritization process were incorporated to Chapter 6.0, Table 6-2, page 6-30. The average score for each criterial is presented in Appendix F, Table F.2-1, pages F-20 to F-25.
			In future planning, along with identifying the goal(s) related to each mitigation action in Table 6-2, provide a narrative of how the action relates to and will further the goal(s) of the plan. Clearly explain how the completed activity or project will help the territory reach the stated goals. This shows the bridge between the goals and actions of the plan.	This opportunity for improvement is acknowledged. A section was added to Chapter 6.0 (page 6-30) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
			It future planning, it is strongly encouraged that the mitigation strategy include unique actions for each hazard profiled in the plan. While it is acceptable to include multi- and all-hazard actions, including and implementing hazard-specific actions for the vulnerabilities identified in the risk assessment is the best way to minimize the impacts.	This opportunity for improvement is acknowledged. A section was added to Chapter 6.0 (page 6-30) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			In the next update, consider building on the discussion of how the prioritization of projects in the plan has changed to reflect the territory's current priorities. Describe the previous plan's prioritization of action method. Specifically, how the criteria identified in F.1.1.2 led to a priority rating or ranking. This will show how the prioritization method for the plan update reflects the updated analysis on risks, capabilities and progress on mitigation actions.	This opportunity for improvement is acknowledged. A section was added to Chapter 6.0 (page 6-30) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
	Local Planning Coordination and Capability Building - Opportunities for Improvement		None	N/A
	Review, Evaluation, and Implementation - Opportunities for Improvement		To further prepare the State Hazard Mitigation Officer and HMGP for plan maintenance efforts, it is recommended that the Mitigation Action Tracker be fully developed and functional at the time of plan finalization. Having a tracker that is ready for use will help make sure the monitoring process is carried out as stated in Chapter 7.	This opportunity for improvement is acknowledged. A section was added to Chapter 7.0 (page 7-9) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			Although not required, there is opportunity for the territory to build on the public engagement that was done during the planning process. This could be done by including more active continued public outreach in the plan maintenance efforts. Think about carrying out the suggested improvements in Chapter 3.3.4 in public outreach efforts during the next five years to prepare for the full update.	This opportunity for improvement is acknowledged. A section was added to Chapter 7.0 (page 7-9) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
	Adoption and Assurances - Opportunities for Improvement		None	N/A
	Hazard High Profile Dams - Opportunities for Improvement		N/A	N/A
	Fire Management Assistance Grants - Opportunities for Improvement		In the next plan update, consider expanding on the data in Table 4.8-2. The narrative prior to the table states that the territory has limited capability to respond to wildfires. However, it is not clear if this is related to technical equipment or staffing and/or if it is limited to a specific island. Identifying limitations and gaps in the CNMI can also lead to potential mitigation actions for the territory to implement.	This opportunity for improvement is acknowledged. A section was added to Chapter 4.8 Wildfire (page 4-8.24) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.

Table G.1 -1. Commonwealth Hazard Mitigation Grant Program Responses to comments from FEMA of the May draft of the 2024 SHMP Update (*cont'd*).

State Mitigation Plan Review Tool Section	SMP Review Tool Sub-Section	Element(s)	FEMA Comment	CNMI HMGP Response
			Consider including additional actions that are unique to reducing the vulnerabilities of the territory related to wildfire impacts. For example, pull in the forest restoration actions referenced Action 2024-6-15.	This opportunity for improvement is acknowledged. A section was added to Chapter 4.8 Wildfire (page 4-8.24) to capture FEMA's suggestions within the SHMP and to encourage effort toward these recommendations over the next 5-year planning cycle.
4. Plan Assessment - Enhances State Mitigation Plan Requirements	N/A		N/A	N/A

G.2 FEMA Consultation Notes, Fiscal Years 2019–2023

G.2.1 Fiscal Year 2019

CNMI's FY19 Mitigation Program Consultation Notes

Date and Time: Friday, August 9, 2019 from 8:00am to 9:45am (Hawaii Time)
Location: FEMA Pacific Area Office (PAO), Fort Shafter, Oahu, Hawaii

Name	Title	Email
CNMI Staff		
Vicky Villagomez	State Hazard Mitigation Officer	Vcvillagomez@omb.gov.mp
Leona Sablan	State Floodplain Manager	leona.cip@gmail.com
Nerissa Benavente	Capital Improvements Planning	Nerissa.cip@gmail.com
Erin Derrington	Office of Planning and Development	Erin.derrington@gmail.com
FEMA Staff		
Juliette Hayes	Mitigation Division Director	juliette.hayes@fema.dhs.gov
Colby Stanton	Director of Readiness, Pacific Area Office	colby.stanton@fema.dhs.gov
Lori Willess	FEMA Integration Team Lead, Guam	lorena.willess@fema.dhs.gov
Chuck Ada	FEMA Integration Team, Guam	charles.ada@fema.dhs.gov
Matthew Jepsen	FEMA Intern	matthew.jepsen@fema.dhs.gov
Jeanne Johnston	Hazard Mitigation Assistance Grants Specialist	jeanne.johnston@fema.dhs.gov
Alison Kearns	Risk Analysis Branch Chief	alison.kearns@fema.dhs.gov
JoAnn Scordino	Community Planner	joann.scordino@fema.dhs.gov
Michael Hornick	Floodplain Management Specialist	michael.hornick@fema.dhs.gov
Eric Simmons	Engineer	eric.simmons@fema.dhs.gov
Asia King	Risk Analyst	Asia.king@fema.dhs.gov
Joseph Johnson	Risk Analyst	Joseph.johnson@fema.dhs.gov

Tasks from the 2019 Consultation		
Action	**POC**	**Completed**
Bring training on new BCA tool.	Jeanne, Vicky	
Request for an update of floodplain maps.	Eric	
Share FEMA's Building Science Division's evaluation of micro-wind systems with Vicky and HM Planning group, once it is available.	Juliette	
Update the Hazard Mitigation Plan's Risk Assessment using FEMA's Building Science Division's evaluation of micro wind systems.	Vicky	
Share 3cm resolution satellite data with SHMO and Hazard Mitigation Planning team.	Eric, Vicky	
Update the Hazard Mitigation Risk Assessment with the 3cm resolution satellite data fly over that is being acquired by the Office of Planning and Development.	Vicky	
Make sure FEMA, USACE and other stakeholders are all working from the same hazard assessments (outcome from Risk MAP).	Asia	
Bring floodplain management training to CNMI for Department of Public Works.	Michael	

1

G.2.2 Fiscal Year 2020

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

MITIGATION PROGRAM CONSULTATION

MEETING SUMMARY | NOVEMBER 24, 2020

3–5 p.m. PST/ 9–11 a.m. ChST
Virtual Meeting, Zoom Platform

Mitigation Program Consultations are annual meetings between FEMA and state partners to collaborate on advancing the mitigation program. The intent of the consultations is to:

- Establish a formal process that strengthens active and ongoing communication between states and FEMA to meet shared hazard mitigation goals.
- Create or improve partnerships within FEMA and with state stakeholders.
- Provide FEMA with a tool for proactively supporting each state's mitigation program and advancing the implementation of the state mitigation plan.

TOP TAKEAWAYS:

1. Successes have continued for the CNMI, despite the challenges COVID-19 has presented.
   - The CNMI received a number of grant applications by the deadline, totaling $80M.
   - Cross-agency coordination on the Smart Safe Growth initiative has continued, bringing successes to the program.
   - Acquisition of ArcGIS program for the Department of Public works has the potential to improve systems and agency organization.
2. Challenges for CNMI include:
   - Reduced staff.
   - Finding match for grants and the broken BCA tool.
   - Capacity of on-island consulting support is limited in terms of firms that have the training to develop proposals and the expertise to execute project work on island.
3. Changes are expected at the FEMA level for HMA Guidance, local and state planning policies, and the G-318 Training. Updates on the Community Rating System and other NFIP programs will be highlighted during an upcoming training hosted by FEMA.
4. Updated flood maps remain a priority for the CNMI; FEMA will continue to coordinate with the islands on progress.
5. Building codes have been adopted, and next step is to provide training on how they can be strengthened and implemented.

1

G.2.3 Fiscal Year 2022

Commonwealth of the Northern Mariana Islands (CNMI)

MITIGATION PROGRAM CONSULTATION

MEETING NOTES | July 18, 2022

TIME: 9 a.m.–4:30 p.m. ChST
LOCATION: Aqua Hotel, Saipan, CNMI; Virtual Meeting, Zoom Platform

Objectives for FY22

- Allow territory partners, FEMA, and other territory agencies to discuss using resources to efficiently collaborate on programs and project delivery to support the territory's mitigation priorities.
- Review the territory's identified priorities for the coming year, evaluate each priority throughout the year, and identify how best to use existing resources for implementation.

TOP TAKEAWAYS:

1. CNMI's priorities for their mitigation program in the coming year include:
   a. Work with FEMA to advance nature-based solutions for mitigation projects across CNMI.
   b. Identify barriers to accessing mitigation grants and develop tailored training and outreach to address the gaps.
   c. Work to advance building code education in the private sector and increase the resilience of the local building stock by using energy efficiency and smart growth principals.
2. CNMI is making progress in mitigation, but there are still challenges to overcome
   a. CNMI has a list of projects to submit as funding comes available but has to work through finding sources for the match requirements.
   b. So far, CNMI has not been exceptionally successful with the BRIC program under the competitive opportunity.
   c. HMGP projects often face challenges with costs and timelines.
3. Over the course of the consultation, a number of action items were identified (noted on page 2 and 3) that FEMA Region 9, CNMI Hazard Mitigation Grant Program, CNMI Office of Planning & Development, and other CNMI partners can coordinate on to advance the territory's mitigation priorities. Examples of actions include:
   a. Organizing trainings to improve NFIP compliance and building code capabilities.
   b. Develop a master list of projects and a prioritization system to be able to act quickly when funding comes available.
   c. Support the development of capacity around Nature-Based solutions projects.

G.2.4 Fiscal Year 2023

CNMI MITIGATION PROGRAM CONSULTATION

MEETING NOTES | August 11, 2023

TIME: 8:30 a.m. – 3:30 p.m.
LOCATION: Crown Plaza / Grandvrio Resort, Saipan

OBJECTIVES FOR FY23

- Allow territory partners, FEMA, and other territory agencies to discuss using resources to efficiently collaborate on programs and project delivery to support the territory's mitigation priorities.
- Review the Commonwealth of the Northern Mariana Islands' (CNMI) identified priorities for the coming year, evaluate each priority throughout the year, and identify how to best use existing resources for implementation.

PRIORITY AREAS FOR FY23

- Develop a uniform approach for developing and scoping projects to assist internal and external partners to ensure consistency and help streamline project completion.
- Discuss opportunities to increase building code education and identify additional resources and training for capacity building.
- Identify barriers to achieving a positive benefit cost ratio and opportunities to ensure better outcomes for the future.