

# Garapan Watershed Conservation Action Plan



Photo: the West Takpochao watershed viewed from Mt. Takpochao (courtesy of Jose Quan)



The Nature  
Conservancy



Commonwealth of the Northern Mariana Islands  
Office of the Governor  
Division of Environmental Quality  
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THIS CONSERVATION ACTION PLAN HAS BEEN APPROVED BY:



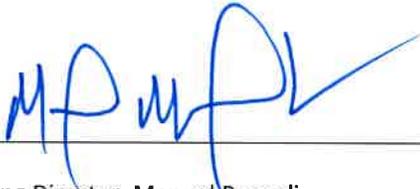
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## EXECUTIVE SUMMARY

The Garapan area is part of a subwatershed called West Takpochao Central that drains the area from Mount Takpochao out into the lagoon, between Fishing Base and Smiling Cove (figures 1 and 2, pages 10-11). This area is significant because of its terrestrial forest resources, easily accessed lagoon waters, high population densities, key commercial districts, and important social and community role. Beginning in September 2012, a diverse group of stakeholders including local and federal government agencies, private businesses and contractors, non-profits and college faculty and students formed an advisory group and drafted a Conservation Action Plan (CAP) for the West Takpochao Central subwatershed to preserve and enhance the natural resources within this area. The CAP will be reviewed and updated by the advisory group every five years to track improvements and initiate new conservation projects and programs. Associated with the CAP is a workplan that will be updated by the advisory group every two years to provide guidance when implementing actions to improve our natural resources.

The advisory group brainstormed and compiled a list of nine focal conservation targets for the watershed area: (marine) benthic habitat, invertebrates, food fish, turtles, water quality, beaches, urban greenspace, upland forests and wetlands/mangroves. According to researchers, natural resource managers and specialists in the CNMI, these targets are being heavily affected by land-based sources of pollution, such as bacteria from human and animal waste, nutrients from agricultural land use, nutrients and chemicals from urban land use, and sediments from unpaved roads or improper land clearing. Marine threats include poor water quality, turtle poaching and recreational or subsistence use of the marine resources. Stakeholders engaged in the Conservation Action Planning process also voiced concerns about trash, invasive species and climate change effects, which will have impacts on both marine and land habitats. The advisory group prioritized these threats by evaluating the health of the targets and the potential impact of each threat on each target. These priorities will help inform management decisions in the future.

In order to respond to these threats, Garapan CAP partners will be collaborating and leveraging their resources to implement a workplan of strategic actions. These actions can be grouped into six general strategies: implementing best management practices, improving engineering and infrastructure, improving regulations and enforcement, conducting education and awareness programs, continuing research and monitoring, and improving community stewardship and incentive programs. Details involving these strategies and objectives that are expected to be achieved as a result of the implementation are outlined in the strategic workplan (page 22).

The goal of the Garapan Conservation Action Plan is to maintain and improve the valuable natural resources that exist in the West Takpochao Central subwatershed and to coordinate efforts between stakeholders to provide the most benefits to the natural resources and the community that uses them. The implementation of the Garapan CAP workplan will assist in realizing the vision statement for the Garapan watershed developed by the advisory group:

*The Garapan watershed is the CNMI's "Hafa Adai" and "Tirow" to the world. Garapan is the convergence of our economic, natural and cultural resources. It provides our community with safe and healthy resources to engage in and share with our visitors. It is thriving and resilient from ridge to reef.*

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## INTRODUCTION

The Garapan Conservation Action Plan (CAP) is a cooperative effort between regional, federal and local partners with mandates or missions to improve, protect, enhance and conserve the many natural, cultural, social and economic resources within the Garapan area of Saipan. In the Commonwealth of the Northern Mariana Islands (CNMI), increased development in coastal and inland areas and increased use of our terrestrial and marine natural resources has exacerbated threats facing our environment. Trends observed by long-time residents include an increase in impermeable surfaces, the localized depletion of fish stocks, increased contamination of beaches and near shore waters, and destruction of coral reefs. These effects are magnified within the Garapan area, which serves as Saipan's center of population, commerce, economic development and tourism, as well as a gathering place for the community.

Garapan and its surrounding villages form a large part of the West Takpochao watershed, and although the majority of the environmental threats are land-based, strong rains during parts of the year and the natural flow of water causes land-based threats to have dramatic effects on the Saipan lagoon. From a long-term perspective, the decline in marine health threatens the CNMI's cultural heritage, traditional ways of life and physical protection from storms. However, this decline also immediately impacts CNMI's tourism and fisheries industries, and thus its economy. As such, the CNMI government places coral reef ecosystem conservation and management as a priority concern (CNMI and NOAA Coral Reef Conservation Program, 2010).

In 2008, the CNMI was approached by The Nature Conservancy (TNC) Micronesia program and offered assistance in developing site-specific management plans through the Conservation Action Planning process. The CAP process was designed by TNC to bring multiple stakeholders to the table and incorporate both scientific and anecdotal information into an overarching set of conservation priorities. The shift of emphasis to site-specific management of threats facing the CNMI's marine environment was further supported by the National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP) as a way of focusing conservation efforts.

Through the CRCP priority-setting process and the CNMI Coral Reef Management Priorities document developed from it, the CNMI resource management agencies and their federal partners designated three priority watersheds for conservation action: the Laolao Bay and Garapan watersheds on the island of Saipan and the Talakhaya/Sabana watershed on the island of Rota. CAPs for Laolao Bay and Talakhaya/Sabana were completed in January 2009 and January 2012 respectively, laying out the conservation priorities and a strategic workplan for those areas.

## SUMMARY OF THE CONSERVATION ACTION PLAN PROCESS

The Garapan CAP process followed the model established by TNC, using the Miradi adaptive management software tool developed by the Conservation Measures Partnership and Beneficent Technology, Inc. The CAP process is represented by four major steps which work together to form a cyclical analysis of conservation planning. The cycle starts with defining the project, which includes defining the people (stakeholders) involved, as well as the project scope and focal targets. During



this initial step, partners examine target viability, rate critical threats to the focal targets, and perform a situation analysis. Then, the project team develops objectives, strategies and actions to be performed and implemented in order to mitigate threats and improve the health of the focal conservation targets. These steps are followed by the gradual implementation of the strategies and measures, then the use of the results to adapt and improve before beginning the process again. The process helps groups to focus on certain conservation aims, threats and strategies by engaging key stakeholders and team members to achieve desired outcomes, measure their achievements and reevaluate and continue their progress (The Nature Conservancy, 2007).

## PROCESS AND MANAGEMENT APPROACH

The majority of the information and planning for the Garapan Conservation Action Plan originated from a four-day workshop held at the Hafa Adai Beach Hotel in Garapan, Saipan from September 10-13<sup>th</sup>, 2012, and subsequent follow-up meetings with participants and other stakeholders. The workshop experienced excellent attendance from many key stakeholders and produced a first draft of the Conservation Action Plan, with facilitation from Kaitlin Mattos, Watershed Coordinator at the CNMI Division of Environmental Quality (DEQ), and Steven Victor from The Nature Conservancy. The four-day workshop brought natural resource groups, private and public organizations and other stakeholders together to define focal conservation targets, discuss threats to the natural resources in the watershed area around Garapan, and develop a strategic plan to address threats and improve the health of the resources. Interagency and stakeholder cooperation is necessary for this process because the nature of watershed issues requires the integration of knowledge and efforts from people in a variety of different fields. Outputs from the four-day workshop were a vision statement, list of focal conservation targets, preliminary assessment of target health, a prioritized list of critical threats, recommended strategies for decreasing threats, a preliminary action plan, capacity analyses and defined follow-up steps.

Following the workshop, the Watershed Coordinator, who will be organizing the CAP efforts, conducted subsequent meetings with participants and other stakeholders to solidify brainstorming ideas developed during the workshop. The Coordinator collected additional detailed information about resources and strategies (i.e. leadership, timelines and possible funding sources). This Conservation Action Plan represents the best available information and analyses of the programs and projects that were discussed during the meetings. The CAP will be updated every two to five years and includes a strategic workplan that will be reviewed and updated every one to two years. Updates will be done by the advisory group which was initially involved in the CAP workshop, which will be convened in association with the Watershed Working Group. Actions discussed in the workplan are being implemented on individual schedules. Partners did not necessarily wait until the CAP was finalized before beginning implementation of the workplan.

## EXISTING MANAGEMENT PLANS AND RESOURCES

The Garapan CAP is intended to be a comprehensive natural resource management plan for the entire watershed area. Therefore, current and former projects, studies and plans were included as part of the strategic workplan, and their sponsoring organizations were listed as partners in this process. The advisory group assisted with identifying new and existing projects and plans within their agencies/organizations to be incorporated into the CAP. The plans described on the following page will be accessible to Garapan stakeholders, and project updates will be included in periodic and annual meetings. There is no reason to duplicate efforts or exclude from the plan projects that are already underway. Rather, the Garapan CAP serves to bring all of these projects together and fill in missing pieces with new strategies as outlined in the workplan.

<b>Plan/Project</b>	<b>Agency</b>	<b>Year Published</b>	<b>Summary</b>
<b>Saipan Lagoon Use Management Plan</b>	CRM	1997	CRM guiding document; provides guidance for parks management, multiple use zoning, stormwater pollution control, resource concerns.
<b>NPS 5-15 Year Plan</b>	CRM DEQ	1999	Outlines NPS objectives through 2014, including restoring designated uses of all water bodies. Mentions Garapan drainage improvements as top priority
<b>Garapan Revitalization Project</b>	CIP	2003	Describes projects to improve infrastructure around Coral Tree Ave and other areas that are at least partially funded
<b>Garapan Watershed Study Status Report</b>	USDA – NRCS	2003	Reports preliminary findings and recommendations to address trash, sewage and upland watershed improvements as part of the Garapan Watershed Project, which was discontinued in 2004
<b>Garapan Water Quality Restoration Project</b>	DEQ	2004	Conceptual design for building a stormwater treatment area on the old Samoan housing lot in Garapan to improve water quality in the Fiesta Drainage – project has since been discontinued
<b>Conceptual Stormwater Management Plan for the Garapan II Drainage</b>	DEQ	2005	Recommends watershed (surface water) sampling, major changes and BMPs for areas of stormwater concern; recommends soil stabilization (erosion control) as best cost effective management method.
<b>Aquatic Ecosystem Restoration Study – Drainage designs</b>	CRM, Army Corps	2006	Describes preliminary designs for possible sediment basins near China House, Gualo Rai and Quartermaster to contain stormwater before it reaches the lagoon
<b>Garapan and Beach Road Revitalization Plan</b>	Zoning	2007	Describes tourism vision for Garapan area and recommends short-, medium-, and long-term improvements (mostly aesthetic/tourism-related) to various pieces of infrastructure and natural resources
<b>Garapan Tourism District Stormwater Conceptual Study</b>	CIP	2010	Develops a list of prioritized stormwater improvements for three main Garapan drainages and alternatives -- this is the guidance document for stormwater-related engineering works and BMPs in the Garapan area
<b>CNMI Statewide Assessment and Resource Strategy</b>	DLNR Forestry	2010	Analysis of statewide forest resources and conditions with goals to protect and conserve forests and enhance public benefit from forest resources. Prioritizes upper Garapan watershed for vegetation work to decrease erosion

## DESCRIPTION OF THE GARAPAN WATERSHED

### LOCATION AND GOVERNANCE

The 466-mile long Mariana Island archipelago includes fourteen islands within the US Commonwealth of the Northern Mariana Islands in the western Pacific. The Mariana Islands are the closest Pacific Island chain to Japan,

approximately 1,500 miles from Tokyo or approximately 3 ½ hours by air. The northernmost of the populated islands, Saipan, is located at 15° 10'51 N and 145° 45'21 E. The island is 5.6 miles by 12 miles at its widest parts and covers 44.55 square miles. The highest point is Mount Takpochao which climbs to 1,560 ft in the approximate center of the island. Nearly 90% of the CNMI's population is based on Saipan, with 2010 census figures recording 48,000 people (US Census Bureau, 2010).

The Division of Environmental Quality, the Coastal Resource Management Office (CRM) and the Department of Lands and Natural Resources (DLNR), which houses the Division of Fish and Wildlife (DFW) and Forestry (under the Division of Agriculture), are situated within the office of the Governor. These agencies are partners in managing the natural resources of the CNMI. DEQ was created through Public Law 3-23 to protect the right of each person to a clean and healthful environment. The Commonwealth Environmental Protection Act defines DEQ's purpose, jurisdiction and authorization to issue regulations and implement programs to protect the air, land and water of the Commonwealth. CRM was established with the implementation of Public Law 3-47 within the Office of the Governor to promote the conservation and wise development of coastal resources. Under CNMI law, CRM has regulatory jurisdiction over all lands of the Commonwealth. DLNR was established by Public Law 1-8 "to be responsible for the protection and enhancement of the natural resources of the islands." DFW was created by Public Law 2-51 which was later revised by Public Law 10-57 with the purpose to conserve fish, game and wildlife and to protect endangered and threatened species. CNMI Forestry was created by Public Law 1-8 and repealed and reenacted by Public Law 10-57 with the duty to promote and develop an agricultural program related to plants. Through research, monitoring, regulation, enforcement, planning and management, these agencies seek to ensure the long-term survival and sustainability of the CNMI's natural resources.

The Mayor of Saipan has various duties that are complimentary to the duties of the Office of the Governor. Duties such as providing road clearing or improvement services, assisting with land clearing or earth-moving activities for village cultural events, licensing domestic animals and providing public recreation programs are enabled by Public Law 1-4, amended by PL4-11, PL 4-23, PL 6-5, PL7-33 and PL11-44. The Office of the Mayor of Saipan has jurisdiction for these and other duties related to environmental conservation and natural resources.

In order to own land in the CNMI, individuals must prove they are of Northern Marianas descent. Land leases are available to other corporations or individuals. All lands in the CNMI fall into one of two categories: private lands or public lands. Private lands are all lands that are alienable by the titleholder. Public lands are those that were transferred into the public domain upon the creation of the Commonwealth. Public lands are freely alienable by the Commonwealth and managed by the Department of Public Lands (DPL). Public lands include government acquired lands that have been purchased by the government for public purposes, the use of which is controlled by deed restriction. DPL has the authority to dispose public lands, including the issuing of village homestead and agricultural homestead permits on lots and the subsequent transfer of these lands to private ownership.

The CNMI is the only US territory that does not have title to its submerged lands from the coastline out to three miles. The submerged lands bill, HR-670, was unanimously passed by the U.S. House of Representatives in 2011, but it has yet to be voted on within the Senate. As such, the CNMI Attorney General's Opinion NO: 07-01 written by Matthew T. Gregory on May 8<sup>th</sup>, 2007 is still the guiding document regarding submerged lands authority within the CNMI. In his letter Gregory concludes that "For all of the foregoing reasons, it is the opinion of the Attorney General that the Commonwealth of the Northern Mariana Islands has exclusive authority over its internal waters, as described herein. The Commonwealth retains the authority to exercise its police powers within the three-mile wide territorial sea extending seaward from its internal waters. And, present, the Commonwealth retains no

authority over the exclusive economic zone surrounding the archipelago.” In terms of the Garapan watershed this means that the management of the lagoon and other internal waters within the area is retained by the CNMI.

## PROJECT SCOPE

The West Takpochao watershed is situated in the western central area of Saipan, from the north-south spine of Mt. Takpochao out to the west coast of the island (figures 1 and 2, pages 10-11). The northern boundary is Lower Base east to Capitol Hill and the southern boundary is near Quartermaster Road east to Gualo Rai according to USGS survey lines that were established several decades ago (USDA NRCS, 2003). The West Takpochao watershed, which covers 6.62 square miles (17.14 km<sup>2</sup>), contains the villages of Chalan Laulau, I Liyang, Gualo Rai, As Falipe, Takpochao, Garapan, China Town, Fananganam, Maturana Hill, Chalan Galaide, American Memorial Park, As Palacios, Navy Hill, As Rabagau, Puerto Rico, Lower Base, Sadog Tasi and Capitol Hill. The Garapan CAP primarily addresses natural resource concerns for the West Takpochao Central subwatershed, which is 2.2 square miles (5.71 km<sup>2</sup>) and covers the Falipe, As Falipe and Fanaganam Lichan drainage areas from Fishing Base north to Smiling Cove, and from the Mt. Takpochao ridgeline west to the coastline.

The central subwatershed was chosen as the focus of this plan because it contains the village of Garapan, the most populous village in the CNMI, with nearly 4,000 residents during the 2010 census, and it is the center of economic and community activities on Saipan (US Census Bureau, 2010).



Figure 1: Map of Saipan watersheds (created by DEQ). The intersection of the boundaries in the center of the island is Mt. Takpochao, the highest point on Saipan.

## PHYSICAL FEATURES

US Geological Survey (USGS) maps indicate that the western coastal portion of the watershed has 0-5% slopes and consists of urban lands, loamy sand or gravelly soils and muck in the remaining wetland and mangrove areas. Moving inland, slopes increase to 5-15% and soils are gravelly, clay, clay-loam or rock outcrops. Proceeding east and further uphill, slopes increase to 15-30% and become dominated by rock and clay-loam (figure 3).

As can be observed from casual examinations of the watershed, development within the area is heaviest in the lowland coastal areas and sparser continuing uphill towards the divide. Upland areas are scattered with family compounds, apartment buildings and small farms with piggeries, livestock or crops. The lowland area consists of many businesses, houses and apartments, roads and parking infrastructure and public institutions such as Garapan Elementary School, the Northern Marianas Housing Corporation, and the Commonwealth Healthcare Center. As such, approximately 25% of the West Takpochao watershed is covered with impervious surfaces (DEQ, unpublished data). A variety of ephemeral and intermittent streams flow from the top of the watershed during the rainy season and can cause flash floods and dramatic fluctuations in water level. In the lowland areas, most of the surface water is aggregated into drainage ditches and channeled above- and underground out to the ocean.

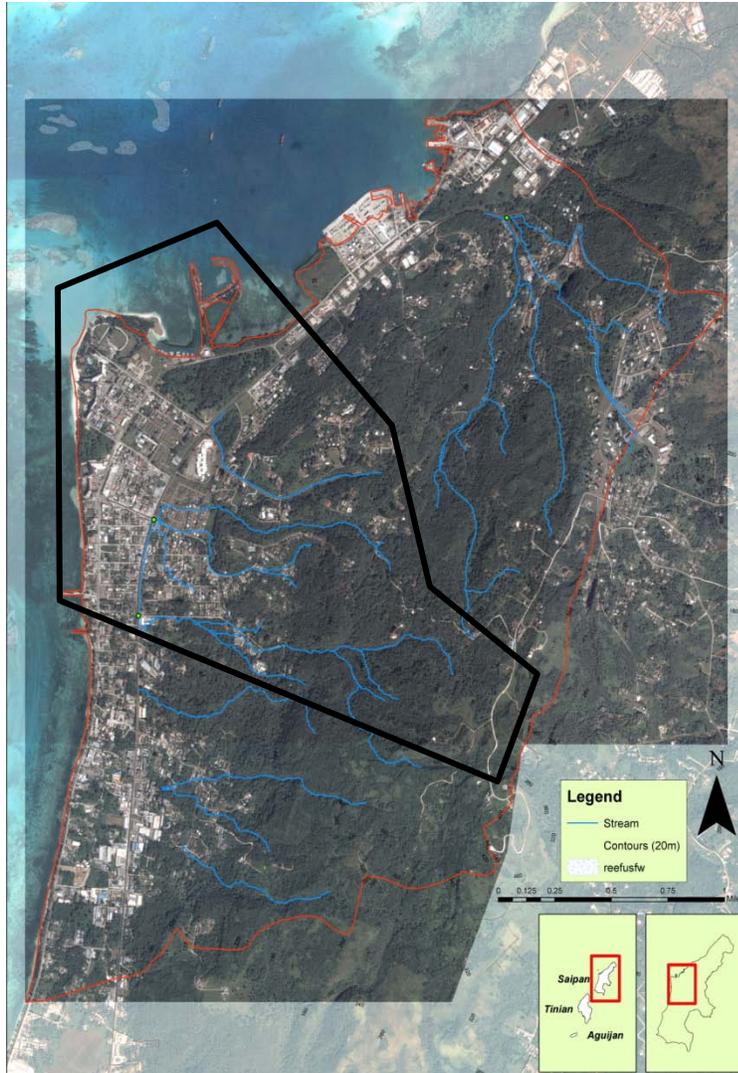


Figure 2: The West Takpochao watershed (outlined in red) can be divided into three segments. Garapan lies within the West Takpochao Central subwatershed (outlined in black), which is approximately 2.2 square miles (5.71 km<sup>2</sup>) and covers the Falipe, As Falipe and Fanaganam Lichan drainage areas from Fishing Base at the south to Smiling Cove at the north, and from the Mt. Takpochao ridgeline west to the coastline. (Map created by DEQ.)

The CNMI has three groundwater management zones, all of which are represented in the Garapan watershed area. There are currently five Commonwealth Utilities Corporation (CUC) water tanks and approximately thirty-eight drinking water wells that have access to the groundwater at any given time. Several hotels and other businesses operate eight reverse osmosis (R/O) injection wells in the watershed, used for discharging high salinity brine underground after desalination to produce improved drinking water. A groundwater spring discharges within American Memorial Park on the northwestern corner of the watershed.

Middle Road (Chalan Pale Arnold) and Beach Road (Sunset Drive) are the primary roads within the West Takpochao watershed, while major secondary roads cut through Navy Hill and Chinatown into Lower Base. A variety of small paved and unpaved streets connect to individual neighborhoods. Other important infrastructure includes five CUC sewage lift stations in the subwatershed, where the entire lowland area is connected to the Sadog Tasi sewage treatment plant by underground pipes. The Sadog Tasi Wastewater Treatment Plant outfall pipe discharges treated wastewater into the lagoon in the West Takpochao North subwatershed. The Puerto Rico dump located in Lower Base closed in 2003, but was not properly sealed or cleaned-up. Both groundwater and the lagoon are still contaminated from chemicals leaching out of the dump (Denton et al., 2009).

The Division of Environmental Quality is responsible for regulating and mitigating a variety of point and nonpoint sources of pollution. The West Takpochao watershed has several diesel air stacks permitted by DEQ's Clean Air Program, as well as approximately twenty-six permitted above and underground diesel and fuel storage tanks. The water quality surveillance laboratory at DEQ monitors beaches (weekly), reef flats and sea grass sites (annually) in the lagoon.

The beaches of Garapan constitute one of Saipan's most valuable resources. Most of the West Takpochao Central subwatershed is characterized by sandy, gently sloping beaches that serve as a transition zone between terrestrial and marine ecosystems and a focal point of recreation and economic viability. These beaches enjoy protection from the Saipan lagoon and fringing reefs which prevent significant wave damage and buffer storm surges and tsunami action from the Philippine Sea. According to shoreline erosion mapping and assessments done in the Garapan area, the shoreline extending from the southern boundary of the West Takpochao Central subwatershed area (Fishing Base) to the drainage outlet just south of Fiesta Hotel and Resort have experienced relative stability over the past two decades (US Army Corps of Engineers, 2004). In contrast, the north and northeast extent of Garapan's shoreline is very dynamic. The section that presently includes the beachfronts of Fiesta and Hyatt Resorts and American Memorial Park has been subject to significant change on decadal, annual and semi-annual timescales (US Army Corps of Engineers, 2004; Yuknavage and Palmer, 2010; Krüger et al., 2010). A 2013 study by CRM assessed shoreline data from 2003 through 2011 and confirmed previously identified trends of beach loss along the western shore of American Memorial Park along with significant accretion to the northeast of the park (figure 4). Although coastlines should be expected to shift over time, significant erosion or accretion could greatly affect natural and cultural resources within the watershed area.

## BIOLOGICAL FEATURES

The terrestrial watershed area is dominated by mixed introduced forests, and urban vegetated and urban built-up lands (figure 5). Native limestone forests segments, named for their unique ancient karst/coral substrate with little soil and little water retention, exist within mixed introduced forested areas. Although these areas are geographically small, they are significant because they contribute to native plant and animal diversity and habitat. These segments have historical and cultural significance for local communities and traditional medicine as well. Plants that make up this forest type include *Premna obtusifolia*, *Aglaia mariannensis* (mapunyo), *Elaeocarpus joga* (yoga), *Barringtonia* sp. (fishkill), *Pandanus* spp. (kafu), *Pisonia grandis*, *Trema orientalis*, and *Hibiscus tiliaceus*. DFW bird surveys have identified 21 bird species within the West Takpochao Central subwatershed forest and fringe habitats, which is on par with diversity within other subwatersheds and within Saipan as a whole.

There is a small but important secondary forest, wetland and mangrove area consisting of thirty-five acres (14.14 ha) in the American Memorial Park, the National Park Service's only unit on Saipan. The mangrove tree species *Bruguiera gymnorhiza* persists in this area. This is the largest and most intact section of mangroves on Saipan (Williams et al., 2007) and was well-studied by National Park Service contractors in the 2000s. The mangrove forests and wetlands are home to fourteen bird species: the Bridled White-eye (*Zosterops conspicillatus*), Collared Kingfisher (*Halcyon chloris*), Eurasian Tree Sparrow (*Passer montanus*), Golden White-eye (*Cleptonia marchei*), Mariana Fruit-Dove (*Ptilinopus roseicapilla*), Micronesian Honeyeater (*Myzomela rubra*), , Micronesian Starling (*Aplonis opaca*), Nightingale Reed Warbler (*Acrocephalus luscini*), Pacific Reef Heron (*Egretta sacra*), Philippine Turtle Dove (*Streptopelia bitorquata*), Rufous Fantail (*Rhipidura rufifrons*), White Tern (*Gygis alba*), White Throated Ground Dove (*Gallicolumba xanthonura*), and Yellow Bittern (*Ixobrychus sinensis*, Williams et al., 2007), Many of these species also populate the native limestone and Tangantangan (*Leucaena leucocephala*) forest types. The Nightingale Reed warbler was listed as federally endangered in 1970.

The native humped tree snail (*Partula gibba*), listed as a candidate species under the Endangered Species Act, has been identified in the wetlands and mangroves (Williams et al., 2007). Hive snails of the genus *Liardetia* have been observed in these areas as well (Meneses et al. 2013). Other notable species observed include the curious skink (*Carlia fusca*), the Pacific blue tailed skink (*Emoia caeruleocauda*), hermit crabs (*Coenobita brevimanus*), land crabs

(*Cardisoma carnifex*), and the Guardian butterfly (*Hypolimnas anomala*, Williams et al. 2007). These species are also common in the limestone forest and can inhabit other forest and habitat types as well.

According to habitat surveys done by the DEQ/CRM Marine Monitoring Team, the marine watershed area is dominated by seagrass beds, fringing reefs and patch reefs. The seagrass beds in the watershed area can be divided into three sub-habitats: the Thick *Enhalus* zone; the Pleistocene rock – *Gelidiella*/*Halodule* mix; and the *Halodule*/macroalgae mix (Houk and van Woessik, 2008; figure 6). Three seagrass species are found throughout the habitats: *Enhalus acoroides*, *Halodule uninervis* and *Halophila minor*. Macroalgae can also be found in abundance throughout these habitats. Dominant species include *Caulerpa racemosa*, *Acanthophora spicifera*, *Laurencia papillosa*, *Halimeda opuntia* and *Halimeda macroloba*. The seagrass beds provide habitat for a number of fish and invertebrate species. Commonly found fish in the seagrass are *Lethrinus harak* (mafuti), Scaridae species (palakse), juvenile *Mulloidichthys flavoliniatus* (tiao), juvenile *Caranx* spp. (l'e') and *Siganus* spp. (sesyon/hiteng/manahak). Macroinvertebrates include sea cucumbers or balate (*Holothuria atra*, *H. hilla*, *Bohadschia argus*, *Stichopus horrens*, *Synapta maculate*), pillow urchins (*Triploneustes gratilla*), and sea stars (*Linckia laevigata*). Green sea turtles (*Chelonia mydas*), listed as a federally threatened species, also use seagrass beds as foraging habitat.

Fringing and patch are the dominant coral reef frameworks in the watershed area. These patch reefs are dominated by massive/encrusting Faviids (*Goniastrea* spp., *Favites* spp., *Favia* spp., etc.) A special exception is made for the mid-lagoon staghorn *Acropora* reefs. These reefs are almost exclusively made up of *Acropora aspera* and *A. muricata*. The federally endangered Hawksbill sea turtle (*Eretmochelys imbricata*) uses lagoon reefs as foraging and resting habitat. Commonly seen fish around these reefs include *Acanthurus lineatus* (hiyok), *Naso lituratus* (hangan), *Chlorurus sordidus* (palakse), *Halichoeres hortulanus* (wrasse) and an assortment of damselfishes and butterflyfishes. Important invertebrates on the reefs include the Topshell *Trochus niloticus* (aliling), giant clam *Tridacna* sp. (hima), spider conchs (*Lambis lambis*) and grazing sea urchins (*Echinothrix* sp., *Diadema* sp. and *Echinometra* sp.)

In 2010, NOAA's National Marine Fisheries Service (NMFS) proposed the listing of 66 species of corals as threatened or endangered. Twenty-four of those species were identified around Saipan during the 2012 Saipan Reef Resiliency Study, with eleven occurring specifically at sites within or adjacent to the Garapan watershed: *Acanthastrea brevis*, *Acropora aculeus*, *Acropora aspera*, *Acropora paniculata*, *Acropora vauhani*, *Acropora verweyi*, *Millepora tuberosa*, *Montipora lobulata*, *Montipora calculata*, *Pocillopora danae*, and *Pocillopora elegans* (Maynard et al., 2012). It is important to note that these eleven species are proposed as "threatened" by NMFS, not as "endangered". This proposed listing allows for more flexibility related to interactions and take of the species, especially within the context of cultural use.

## CULTURAL AND SOCIOECONOMIC FEATURES

Garapan and the other coastal areas on the west half of the West Takpochao watershed have historically been important village and community centers for the local indigenous cultures (Chamorro and Carolinian). The villages of the Garapan subwatershed area currently have the highest population density on island and the highest housing unit densities (US Census Bureau, 2010). When the economy and tourism of the Mariana Islands began to build after World War II, Garapan became an important center of commercial development. Today, it is the commercial and population center of the island of Saipan, containing many of the island's large businesses, hotels and tourism industries. The majority of the lowland areas are zoned as commercial (including restaurants, hotels,

entertainment, recreational businesses), residential (single-family and apartments) or public (including churches, government services, hospitals, schools, and assembly halls; figure 7).

The National Park Service owns and operates the American Memorial Park just north of Garapan, which serves educational, historical, recreational and natural resource preservation purposes. Local parks and museums including Sugar King Park, Garapan Central Park, and the CNMI Museum also operate in this area. These and other public land and venues (such as the Carolinian Utt or the Fishing Base) provide vibrant community gathering places for events. Annual festivals and events take place in downtown Garapan attracting local families and tourists such as the Taste of the Marianas (May), the Liberation Day Parade (July 4<sup>th</sup>), and the weekly Farmer's Market (Tuesdays) and Night Market (Thursdays). The easily accessible beaches provide opportunities for fishing, swimming, barbeques and other recreational activities for locals and tourists alike. The lagoon also allows fishing access year-round from the shore, or from boat launches at Fishing Base or Smiling Cove. Furthermore, the presence of fish, seagrass, corals and calm currents make the lagoon an excellent dive or snorkeling spot for tourism businesses (figure 8).

The upland areas are zoned as rural areas which include residential housing, agricultural activities, and some types of businesses. Population becomes sparser moving up in elevation in the watershed. The very top of the watershed contains the coral/gravel road to the top of Mt. Takpochao, which experiences frequent vehicle traffic from tourists seeking sight-seeing or recreational opportunities. The majority of the upper watershed contains only unpaved roads.

Unfortunately, the high population density and high use of resources throughout the watershed causes various sources of environmental degradation. Land-based sources of pollution that mix into stormwater runoff have damaging effects on lowland areas and the lagoon. Recent shipwrecks and derelict World War II barges, as well as metal and plastic debris from the former Puerto Rico dump, impact marine and terrestrial areas (Starmer, 2007). The year-round access by people to west-side beaches has caused local depletion of food fish and concerns about targeted hunting of some species (such as sea turtles). Additionally, feral species (such as "boonie" or feral dogs and cats) and invasive species (such as vines, rats, mice, non-native fish and the Brown Treesnake) that have or will become established pose a threat to native ecosystems and to human use of natural resources. Freshwater invasive species (e.g. sailfin mollies [*Poecilia latipinna*], tilapia) that have been identified in stormwater drainages in Garapan could pose a threat to fisheries or native ecosystems and species, such as the juvenile milkfish [*Chanos chanos*] and Indo-Pacific tarpon [*Megalops cyprinoides*] that also dwell in these drainages (McKagan et al., 2008).

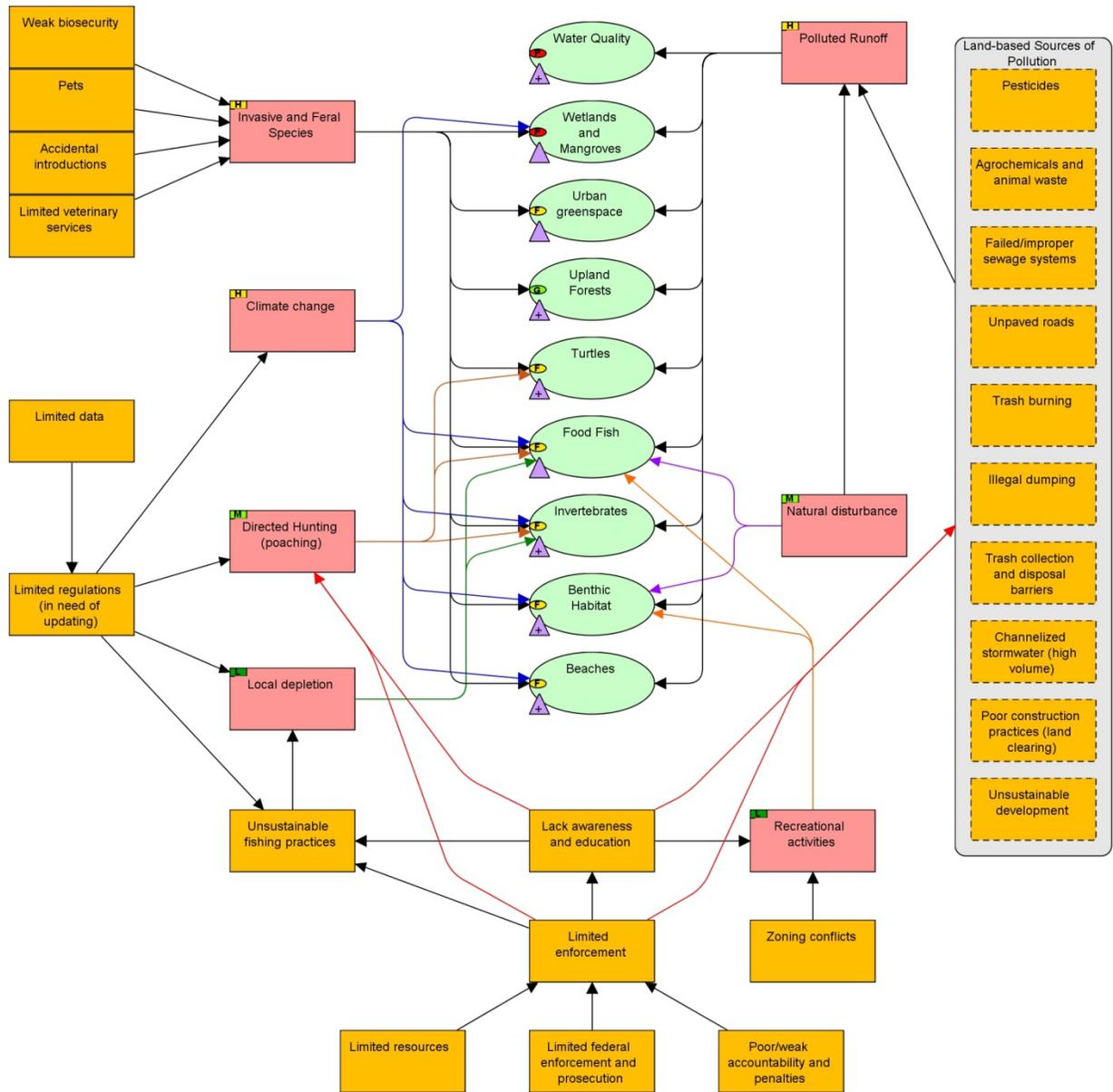
Climate change may cause additional threats to marine life, beaches and nearshore infrastructure (figure 9). Because so much of Saipan's infrastructure and population is located close to the water's edge, it may be affected by rising sea and groundwater levels. Ocean acidification due to climate change may affect marine life, while changes in sea and air temperature and weather patterns can impact agriculture and existing livelihoods on Saipan. Although many international scientists and climate specialists consider it to be too late to curb carbon emissions, there are opportunities to adapt to climate change vulnerabilities by decreasing other threats and stresses (e.g. eliminating sources of pollution, decreasing habitat destruction and modification; IPCC, 2007).

## GARAPAN CAP OVERVIEW

### VISION STATEMENT

*The Garapan watershed is the CNMI's "Hafa Adai" and "Tirow" to the world. Garapan is the convergence of our economic, natural and cultural resources. It provides our community with safe and healthy resources to engage in and share with our visitors. It is thriving and resilient from ridge to reef.*

### CONCEPTUAL MODEL



## CONSERVATION TARGETS

### TARGETS AND DEFINITION

“Focal conservation targets” are defined as the limited set of species, communities and ecological systems that are chosen to represent the biodiversity in a project area. They are the center of the project, around which goals are set, actions are carried out, and conservation effectiveness is measured (TNC, 2007).

Nine focal conservation targets have been identified for the Garapan watershed area:

1. Water (quality)
2. Wetlands and mangroves
3. Urban greenspace
4. Upland forests
5. Turtles
6. Food fish
7. Invertebrates
8. (Marine) benthic habitat
9. Beaches

Several secondary targets were identified by the advisory group that will likely be indirectly affected by the implementation of this conservation action plan, including ecosystems (in general), tourism, human health, healthy communities and historical sites.

### TARGET VIABILITY RATINGS

Viability of the targets was assessed to assist in developing relevant objectives and focused strategies, to guide monitoring protocols and measures of success, and to identify knowledge gaps. The viability assessment consisted of three steps: defining key ecological attributes (KEAs), determining indicators for the attributes, and assigning values for the indicators and for the target status as a whole.

Key Ecological Attributes are aspects of the conservation target that clearly define or characterize the target and determine its distribution and variation over space and time. They are characteristics of the target that, if eliminated or altered, would result in the demise of the target or would shift it into something quite different. KEAs are factors that are critical for long-term viability and are likely to be affected by human activities. Indicators are measurable aspects of the KEAs that inform the health or status of the target. Indicators strongly relate to the status of the KEA, are efficient and affordable to measure and provide an early warning to serious stress. Indicator measurements were divided into categories of POOR, FAIR, GOOD or VERY GOOD, whose criteria were defined by specialists within the advisory group (scientists from government agencies and non-governmental organizations). Specialists also helped define the current status and the desired future status of each indicator for each KEA for each target. Wherever possible, indicators that were already being measured were chosen so that each indicator would have baseline data and an existing method of data collection to provide the best information for the management plan. Where data was not available, specialists were asked to give a best guess based on a rapid assessment of the target or KEA, and plans were made to initiate measurements for that indicator in the future.

Targets and KEAs	Indicators	STATUS
<b>Upland forests – FAIR</b>		
➤ <b>Vegetation cover</b>	▪ % canopy cover of limestone forest (figure 5)	Fair
➤ <b>Presence of key species</b>	▪ Abundance of native birds	Good
<b>Urban greenspace – FAIR</b>		
➤ <b>Vegetation cover</b>	▪ % of urban area covered by vegetation (figure 5)	Fair
<b>Wetlands and mangroves – POOR</b>		
➤ <b>Vegetation cover</b>	▪ Acreage of wetland/mangrove vegetation	Poor
<b>Water (quality) – POOR</b>		
➤ <b>Lagoon water quality</b>	▪ % Beaches with microbiological violations (figure 10)	Poor
	▪ Concentration of nutrients	Data not yet available
	▪ Total suspended solids	Data not yet available
➤ <b>Surface water (stormwater) quality</b>	▪ Presence of <i>E. coli</i>	Data not yet available
	▪ Concentration of nutrients	Data not yet available
	▪ Total suspended solids	Data not yet available
	▪ Volume	Data not yet available
<b>Beaches – FAIR</b>		
➤ <b>Shoreline profile</b>	▪ Rate of change at critical points	Fair
➤ <b>Aesthetic beauty</b>	▪ Visual survey of trash	Fair
	▪ Visual survey of algae	Poor
<b>Turtles – FAIR</b>		
➤ <b>Turtle population size</b>	▪ # of in-water captures (figure 11)	Fair
➤ <b>Anthropogenic impacts</b>	▪ # of stranded, injured or diseased turtles	Poor
<b>Food fish -- FAIR</b>		
➤ <b>Abundance of food resources</b>	▪ Catch per unit effort (figure 12)	Fair
<b>Invertebrates – FAIR</b>		
➤ <b>Presence of key species</b>	▪ Edible shell density (figure13)	Poor
	▪ Sea cucumber density (figure 13)	Fair
	▪ Grazing urchin density (figure 13)	Poor
➤ <b>Biodiversity</b>	▪ Species richness	Good
<b>Benthic habitat – FAIR</b>		
➤ <b>Size class distribution</b>	▪ Coral colony size class distribution (figure 14)	Fair
➤ <b>Substrate quality</b>	▪ % cover of reef-accreting substrate (figure 15)	Poor
	▪ % cover of seagrass	Good

## THREATS

### THREATS AND DEFINITIONS

A “direct threat” to one of the focal conservation targets is an activity or process that is a source of stress to the target. In order to better understand priorities for mitigation, the direct threats were rated by advisory group members who specialize in different fields of natural resource management. Ratings are based on objective rankings of scope, severity and irreversibility on a scale of low, medium, high and very high.

*Scope* is defined spatially as the proportion of the target that can reasonably be expected to be affected by the threat within ten years given the continuation of current circumstances and trends. For ecosystems and ecological communities, it is measured as the proportion of the target's occurrence. For species, it is measured as the proportion of the target's population. “Low” means that the threat is very localized, whereas “very high” means the threat is likely to be widespread and pervasive.

*Severity* describes the level of damage to the target from the threat that can reasonably be expected within the scope given the continuation of current circumstances and trends. For ecosystems and ecological communities, it is typically measured as the degree of destruction or degradation of the target within the scope. For species, it is usually measured as the degree of reduction of the target population within the scope. “Low” means that the threat will only slightly impair the target, while “very high” means that the threat is likely to destroy or eliminate the target.

*Irreversibility (permanence)* is the degree to which the effects of a threat can be reversed and the target affected by the threat restored. Low means the stress is easily reversible at a relatively low cost, while “very high” means the threat is impossible to reverse.

The Garapan watershed area CAP was given an overall priority rating of “high”, indicating that the threats are severe and the targets are significant enough to warrant extensive action and resources to be allocated to the region. Summary threat ratings are listed on the following page and will be updated when the CAP is reviewed every two to five years to illustrate changes in priorities and relative impact of threats over time as the sources of stress are addressed and mitigated.

THREAT RATINGS

TARGETS and THREATS	Food fish	Wetlands and Mangroves	Beaches	Urban greenspace	Invertebrates	Benthic habitat	Upland forests	Water quality	Turtles	SUMMARY THREAT RATING
Natural disturbance	Low	Low	Low	Low	Low	Med	Low	Low	Med	MEDIUM
Climate change	Low	High	High		Med	Med				HIGH
Recreational activities	Med					Low				LOW
Polluted runoff	High	Med	Med	Med	High	High	Med	High	Med	HIGH
Local depletion	Med				Low					LOW
Directed hunting (poaching)	Low				Med				High	MEDIUM
Invasive and feral species	Med	High	Med	High	Med	Med	Med		Low	HIGH
<b>SUMMARY TARGET RATINGS</b>	MED	HIGH	MED	MED	MED	MED	MED	MED	MED	<b>OVERALL PROJECT RATING: HIGH</b>

## CAPACITY ANALYSIS

At the initial CAP workshop in September 2012, a capacity analysis was led by Steven Victor, the Micronesia Conservation Planner at TNC, to evaluate people, internal resources and external resources available for implementing the CAP. On a scale of low to high capacity, human resources scored “medium” because regular assistance from the multidisciplinary team was assessed to be available for program design and decision-making in some, but not all, important programmatic areas. Internal resources also received a score of “medium” because some funding has been secured or pledged for at least one year, but planning for long-term support has not been secured. External resources scored “high” because the project area was assessed to have both the social/legal framework for conservation and the community and constituency support. All participants identified that support was available, but that the difficulty was to get the community to engage and participate in making positive changes happen within the watershed. Overall, the project resources received a rank of “medium” in terms of capacity to implement the work plan.

## REFERENCES

- Commonwealth of the Northern Mariana Islands and NOAA Coral Reef Conservation Program. 2010. Commonwealth of the Northern Mariana Islands’ Coral Reef Management Priorities. National Oceanic and Atmospheric Administration: Silver Spring, MD.
- Denton, G. R. W., Morrison, R. J., Bearden, B. G., Houk, P., Starmer, J. A., Wood, H. R. 2009. Impact of a coastal dump in a tropical lagoon on trace metal concentrations in surrounding marine biota: A case study from Saipan, Commonwealth of the Northern Mariana Islands (CNMI). *Marine Pollution Bulletin*, 58: 424-431.
- Houk, P. and van Woesik, R. 2008. Dynamics of shallow-water assemblages in the Saipan Lagoon. *Marine Ecological Progress Series*, 356: 39-50.
- Intergovernmental Panel on Climate Change. 2007. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyers (eds). Cambridge University Press: Cambridge, New York, NY.
- Krüger, J., Kumar, S., Damlamian, H. and Sharma, A. 2010. Oceanographic Survey, Shoreline Mapping and Preliminary Hydrodynamic Modeling Report, Saipan, Commonwealth of the Northern Mariana Islands. SOPAC Data Release Report 26. Pacific Islands Applied Geoscience Commission: Suva, Fiji.
- Maynard, J., McKagan, S., Johnson, S., Houk, P., Ahmadi, G., van Hooi donk, R., Harriman, L., Mcleod, E. 2012. Coral reef resilience to climate change in Saipan, CNMI: field-based assessments and implications for vulnerability and future management. CNMI Division of Environmental Quality: Saipan, MP.
- McKagan, S., Herod, J., Johnson, P., Tenorio, M., Trianni, M. 2008. Freshwater Invasive Species Project. CNMI Division of Fish and Wildlife: Saipan, MP.
- Meneses, N., Shuster, S., Bulger, B., Greene, R., Benford, R. 2013. Investigator’s Annual Report (Final) 2013 Terrestrial Crab & Snail Survey. CNMI Division of Fish and Wildlife: Saipan, MP.
- The Nature Conservancy. 2007. Conservation Action Planning Handbook: Developing Strategies, Taking Action and Measuring Success at Any Scale. The Nature Conservancy: Arlington, VA.

Starmer, John. 2007. Assessment of Mangrove Associated Marine Habitats in the American Memorial Park, Saipan, CNMI. National Park Service.

US Census Bureau. 2010. Census for the Commonwealth of the Northern Mariana Islands. [www.census.gov](http://www.census.gov).

USDA Natural Resources Conservation Service. 2003. Status Report: Garapan Watershed Study. CNMI Saipan Watershed Council and Garapan Stakeholder's Group: Saipan, CNMI.

U.S. Army Corps of Engineers. 2004. Saipan Lagoon Erosion Study, Saipan Island, Commonwealth of the Northern Mariana Islands. CNMI Coastal Resources Management Office: Saipan, CNMI.

Williams, L., Starmer, J., Jarzen, D., and Dilcher, D. 2007. Ecological Assessment of the Mangrove Habitat in the American Memorial Park, Saipan, Northern Mariana Islands. Ed. J. Starmer. National Park Service: Saipan, CNMI.

Winzler & Kelly Consulting Engineers. 2005. Conceptual Stormwater Management Plan for the Garapan II Drainage. CNMI Division of Environmental Quality: Saipan, CNMI.

Yuknavage, K. and Palmer, A. 2010. Monitoring and Preparing for Shoreline Change at American Memorial Park (2004-2009). CNMI Coastal Resources Management Office: Saipan, CNMI.

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## GARAPAN CAP WORKPLAN

The table below outlines the objectives and strategic actions identified by the advisory group and partner agencies and organizations. They are divided into six strategies: best management practices, engineering, regulations and enforcement, education and outreach, stewardship incentive programs, and research and monitoring.

<b>STRATEGY A: BEST MANAGEMENT PRACTICES</b>		
<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE A1: By the end of FY2018, water turbidity has been reduced below 2013 ambient levels by 10% on average at all Garapan water quality lagoon monitoring sites</b>		
Enroll eligible landowners into the USDA-NRCS cost-share programs to encourage proper farming and agriculture techniques	NRCS	Medium
Explore options and techniques for agricultural areas to decrease reliance on agro-chemicals	NRCS, DEQ, NMC-Crees	Medium
Conduct campaign to teach residents about proper disposal of waste and contaminants (e.g. FOG, sanitary waste)	CUC, DEQ	Medium
Host landowner workshops to encourage proper land-clearing and land stewardship	DEQ, Forestry	Medium
Increase permeable surfaces in the lower watershed using ponding basins, permeable parking lots and permeable pavement	Zoning, DEQ, CIP	High
Encourage public and private use of swales and rain gardens to collect and filter stormwater runoff	NOAA, CRM, DEQ, Zoning	High
Create an interagency working group for unpaved roads	Mayor's Office, DPW, MVA, Zoning	High
Design and construct the planned stormwater management improvements (retention ponds, wetlands) for drainages leading into the lagoon to help filter water and moderate runoff during storm events (as described in the Garapan Revitalization plan)	Zoning, CIP, DPW	Medium
Implement stormwater retrofits in the Garapan area to decrease and control stormwater and pollutant loading (as described in the 2010 Winzler & Kelly Garapan Tourist District Storm Water Conceptual Study)	CIP, DPW, CRM, DEQ	High
Clean and maintain all stormwater drainages including improving, cleaning drainages, clearing open ditch areas, ponds and drainages and cut overgrown vegetation	DPW, Zoning, DEQ, CRM	High
Construct permeable sidewalks and beautify high-use areas with native vegetation as needed	DPW, Zoning	Low
<b>OBJECTIVE A2: By the end of FY2018, annual "red flag" occurrences at Garapan-area beach monitoring sites have been reduced by 50% from 2013 levels</b>		
Initiate illicit discharge detection and elimination program to identify wastewater violations within the Garapan area	DEQ, CUC, DPW	High

<b>OBJECTIVE A3: By the end of FY2020, all trash piles and junk cars have been removed or properly managed as required by zoning and environmental laws</b>		
Issue citations and assist residents in removing junk cars and trash piles to reduce feral animal habitat	Mayor's Office, Zoning, DPL	Medium
Reduce rat habitat and populations in village areas	DLNR, BEH, NMC-Crees	Low
<b>OBJECTIVE A4: By the end of FY2023, feral cat and dog populations in the Garapan watershed area are effectively controlled (as indicated by no increase in numbers of annual captures or wild population counts)</b>		
Enhance kennel facilities to allow dog capture program to expand	Mayor's Office	Medium
Provide incentives to the public for capturing and turning in strays	DFW, Parks & Rec	Low
Control and monitor stray cats to prevent depredation and attacks on native birds and other wildlife	DFW, Mayor's Office	Medium
Design and implement a spay/neuter program	DLNR, Mayor's Office	Low
<b>OBJECTIVE A5: By the end of FY2015, the quantity of public trash bins in tourist areas has doubled and all public trash bins are secured and maintained (never overfull)</b>		
Maintain existing bins during high volume periods (weekends) and make sure all bins are lidded and secured to protect from feral animals	Mayor's Office, CRM, MINA, DLNR Parks and Grounds	High
Support and continue MVA and Chamber of Commerce "Cash for Trash" programs	Chamber, MVA	Medium
Encourage businesses and organizations to sponsor public trash bins for high-use areas	Chamber, MVA, DEQ, MINA	Medium
Initiate "Think Blue" business stewardship campaign to identify BMPs for businesses and help with implementation	DEQ, CRM	Medium
<b>OBJECTIVE A6: By the end of FY2018, there is a 40% decrease in weight of trash picked-up at DEQ clean-up brigade sites in Garapan compared to 2010-2013 records</b>		
Maintain existing bins during high volume periods (weekends) and make sure all bins are lidded and secured to protect from feral animals	Mayor's Office, CRM, MINA, DLNR Parks and Grounds	High
Support and continue MVA and Chamber of Commerce "Cash for Trash" programs	Chamber, MVA	Medium
Encourage businesses and organizations to sponsor public trash bins for high-use areas	Chamber, MVA, DEQ, MINA	Medium
Initiate "Think Blue" business stewardship campaign to identify BMPs for businesses and help with implementation	DEQ, CRM	Medium

<b>OBJECTIVE A7: By the end of FY2018, all critical habitat areas affected by invasive vines and aquatic plants have been identified and control plans are being implemented</b>		
Identify critical areas where vines are damaging habitat and define higher and lower priorities	Forestry, DFW, NMC-Crees	Medium
Actively remove/reduce presence of invasive plants (scarlet gourd, chain-of-love, devil's gut vine) in critical habitat areas	Forestry, CUC, NMC-Crees	Medium
Remove invasive vines from forest edges and gaps in American Memorial Park mangroves and wetland areas	Nat'l Park Service	High
Replant trees (targeting natives) to increase bird habitat in American Memorial Park where invasive vines have killed trees	Nat'l Park Service	Medium
Create and implement a plan for water hyacinth control and removal in American Memorial Park wetlands	Nat'l Park Service	High

<b>STRATEGY B: ENGINEERING</b>		
<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE B1: By FY2028, construction of the Saipan Lagoon Aquatic Ecosystem Restoration Project (SLAERP) ponding basins are complete according to Army Corps of Engineers recommendations and specifications</b>		
Secure funding from partnering agencies and complete planning and construction of basins (as defined in the SLAERP)	DOT, CIP, CRM, DPW, EPA, DEQ	High
<b>OBJECTIVE B2: By the end of FY2018, water turbidity has been reduced below 2013 ambient levels by 10% on average at all Garapan water quality lagoon monitoring sites</b>		
Install sediment traps, check dams and infiltration basins at the Sugar King Industrial Park and other key locations (as described in the 2005 Winzler & Kelly Conceptual Stormwater Management Plan for the Garapan II Drainage)	CRM, DEQ, DPW, EPA	Medium
Expand the grassy swale by Sugar King Road, Garapan Street, and other key locations for use in stormwater treatment and infiltration (as described in the 2005 Winzler & Kelly Conceptual Stormwater Management Plan for the Garapan II Drainage)	CRM, DEQ, DPW	Medium
Continue to evaluate sewer line repair needs and replace leaking or damaged lines at the earliest possible opportunity	CUC	High
Implement stormwater retrofits in the Garapan area to decrease and control stormwater and pollutant loading (as described in the 2010 Winzler & Kelly Garapan Tourist District Storm Water Conceptual Study)	CIP, DPW, CRM, DEQ	High
<b>OBJECTIVE B3: By the end of FY2018, engineering alternatives or maintenance options have been examined for all unpaved roads within the Garapan watershed</b>		
Create an interagency working group for unpaved roads to address proper maintenance, upgrading and construction of water drainages for unpaved new road projects	DPW, Mayor's Office, Legislature, MVA, Zoning, DPL	High
Discuss collaboration opportunities with Navy pre-positioned ships	DPW, CUC	Low

## STRATEGY C: REGULATIONS AND ENFORCEMENT

<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE C1: By the end of FY2018, annual “red flag” occurrences at Garapan-area beach monitoring sites have been reduced by 50% from 2013 levels</b>		
Expend CUC sewer connection funds by identifying and reaching out to eligible property-owners	CUC, DEQ, DPH-BEH	High
Initiate illicit discharge detection and elimination program to identify wastewater violations within the Garapan area	DEQ, CUC	High
Issue notices of violation (NOVs) and citations where appropriate. Ensure proper prosecution and follow-up on all cases	DEQ, CUC, AG’s office	High
<b>OBJECTIVE C2: By the end of FY2020, all trash piles and junk cars have been removed or properly managed as required by zoning and environmental laws</b>		
Issue citations and assist residents in removing junk cars and trash piles to reduce feral animal habitat	Mayor’s Office, Zoning	Medium
Reduce rat habitat and populations in village areas	DLNR, BEH, NMC-Crees	Low
Increase enforcement actions in cases of trash burning	CRM, DEQ, DPS	Medium
<b>OBJECTIVE C3: Environmental infraction cases heard in the local courts has increased by 20% each year starting in 2018</b>		
Identify funding and fill post of AAG for environmental resource agencies	NOAA, AG’s office	High
Review hearing process for natural resource agencies, identify and fill gaps, monitor change	DEQ, CRM, DLNR, NOAA, AG’s office	Medium
Participate in NOAA CRCP external capacity assessment (which includes enforcement review) in 2013	NOAA, DEQ, CRM, DLNR	High
Review natural resource enforcement work-plans to identify improvements, updates and needs (training, funding, personnel), specifically regarding turtle poaching, illegal fishing, directed hunting, littering/dumping, trash burning, land clearing, and wastewater elimination	PIMPAC, DEQ, DFW, DLNR, NOAA, CRM, DPL, Zoning, DPS	High
Focus agency resources on improving enforcement training, funding and personnel related to turtle poaching, illegal fishing, directed hunting, littering/dumping, trash-burning, land clearing, and wastewater elimination	DEQ, DFW, DLNR, NOAA, CRM, DPS	High
<b>OBJECTIVE C4: By the end of FY2018, effectiveness of current management strategies for herbivorous fish have been maintained and improved</b>		
Assess recruitment of juvenile herbivorous and other fish species (e.g. habitat preference) and consider management options for preferred habitat	DEQ, DFW	Medium

<b>OBJECTIVE C5: By the end of FY2015, Forestry inspection and approvals are included with DLNR/DFW in the one-start permitting process</b>		
Discuss permit requirements and evaluate personnel and capacity to include Forestry approval in the one-start process with DLNR-DFW	DFW, Forestry	Medium
Determine special permitting options for Areas of Particular Concern (APC) related to highly erodible soils	CRM, Forestry, DEQ, DFW	Medium
Fill-in capacity and personnel gaps at Forestry to assure smooth integration into the one-start process	Forestry	Medium
<b>OBJECTIVE C6: By the end of FY2018, there is a 40% decrease in weight of trash picked-up at DEQ clean-up brigade sites in Garapan compared to 2010-2013 records</b>		
Update and introduce new legislation regarding littering fines	DEQ, CRM,	High
Continue litter control officer trainings to increase number of officers patrolling and issuing citations in the watershed area	DEQ	High
Create a hotline or enforcement number for the public to report littering	DEQ	High
<b>OBJECTIVE C7: By the end of FY2018, there is mandatory framework for a tour guide certification program that includes rigorous environmental and conservation training for all tour operators involved in outdoor recreational activities with visitors</b>		
Create curriculum and develop program logistics	MVA, CRM, NMC	Medium
Pass law or regulations to require tour guide certification program for all operators in the CNMI	MVA, CRM	Medium
<b>OBJECTIVE C8: By the end of FY2020, significantly reduce the threat of terrestrial and marine invasive species introductions</b>		
Increase enforcement capacity to prevent and stop spread of invasive species	Quarantine, DLNR Forestry, NMC-Crees, Ports Authority	Low
Finish drafting and implement CNMI Marine Biosecurity plan in coordination with the Micronesia Biosecurity Plan	NOAA, DLNR-DFW, CPA	Low

<b>STRATEGY D: EDUCATION AND OUTREACH</b>		
<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE D1: By 2015 a survey of educational gaps has been completed and the results analyzed</b>		
Identify environmental literacy topics with natural resource agencies	MINA, PMRI, Rare Micronesia	Low
Conduct surveys and analyze data	MINA, PMRI, DEQ, NMC	Low

<b>OBJECTIVE D2: By 2018, three targeted environmental awareness campaigns will be developed and implemented within the Garapan watershed</b>		
Identify needs and gaps and target education programs to information gaps	Rare Micronesia, PMRI, DEQ, MINA, CRM	Medium
Develop targeted campaigns. Recommended topics: <ul style="list-style-type: none"> <li>▪ Local depletion of fish</li> <li>▪ Poaching/targeted hunting (fish, turtles, inverts)</li> <li>▪ Benthic habitat – ridge to reef concept</li> <li>▪ Reducing erosion (land-clearing practices)</li> <li>▪ Invasive/feral species</li> <li>▪ Trash disposal, reduce, reuse, recycle</li> <li>▪ Integration of land uses</li> </ul>	Rare Micronesia, PMRI, DEQ, MINA, DFW, Micronesian Environmental Services	High
Implement education and outreach through the permitting process to teach property owners about BMPs	DFW, DEQ, HPO, CRM, Forestry	Medium
Continue and expand BMPs in private businesses through the Think Blue campaign	DEQ	Medium
Launch “No Need Bag” campaign to decrease plastic bag use	DEQ, MINA	High
Create nature trail and interpretive signs at American Memorial Park through wetland and mangrove areas	Nat’l Park Service	Low
Repeat 2003 “Know Your Watershed Campaign” and related activities (tentatively 2014)	DEQ	Medium
<b>OBJECTIVE D3: By the end of FY2015, the quantity of public trash bins in tourist areas has doubled and all public trash bins are secured and maintained (never overfull)</b>		
Design and conduct a watershed- or island-wide anti-litter education and outreach campaign	Governor’s Tourism Taskforce, MINA, CRM, DEQ	High
<b>OBJECTIVE D4: By the end of FY2018, there is a 40% decrease in weight of trash picked-up at DEQ clean-up brigade sites in Garapan compared to 2010-2013 records</b>		
Design and conduct a watershed- or island-wide anti-litter education and outreach campaign	Governor’s Tourism Taskforce, MINA, CRM, DEQ	High
<b>OBJECTIVE D5: By the end of FY2018, there are active recycling programs in all public and private schools</b>		
Work with schools, administrators and clubs to initiate programs in all schools using existing models	CRM, DEQ	Low
<b>OBJECTIVE D6: By the end of FY2018, there is mandatory framework for a tour guide certification program that includes rigorous environmental and conservation training for all tour operators involved in outdoor recreational activities with visitors</b>		
Create curriculum and develop program logistics	NMC, MVA, CRM	Medium

## STRATEGY E: STEWARDSHIP INCENTIVE PROGRAMS

<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE E1: Beginning in FY 2015, there will be no net loss of urban greenspace each year due to protection of green areas and conversion of urban built-up land into vegetated area</b>		
Target community groups to get involved in land integration and native area stewardship: <i>Neighborhood Watch, Village Revitalization, Saipan Municipal Council, Mayor's Office, Homeowner's Associations</i>	Forestry, DEQ, Mayor's Office	Medium
Conduct tree plantings and offer free trees to private, public, commercial groups	Forestry, Mayor's Office	Medium
Encourage businesses to sponsor large-scale greenscaping projects	Forestry, DEQ, MVA, Chamber of Commerce	Low
<b>OBJECTIVE E2: From FY2014-2018, the number of groups participating in stewardship programs will increase 10% each year</b>		
Enroll eligible landowners into the USDA-NRCS cost-share programs to encourage proper farming and agriculture techniques	USDA-NRCS	Medium
Advertise trash pick-up programs: Cash for Trash, Adopt-a-Beach, trash bag giveaways, Adopt-a-Highway, <i>PDM Promoters</i> , monthly clean-ups	MVA, Chamber of Commerce, CRM, DPW, DEQ, PDM Promoters	Medium
Promote commercial recognition programs: Think Blue, green properties, subsidized recycling bins, recycling competitions	DEQ, Forestry, MINA, CRM	Medium
Promote private property recognition: Green areas, adopted clean-up areas, recycling bin hand-out	Mayor's Office, DPW Energy	Medium

## STRATEGY F: RESEARCH AND MONITORING

<i>Objectives and Strategic Actions</i>	<i>Partners</i>	<i>Priority</i>
<b>OBJECTIVE F1: By the end of FY2016, all high priority water quality problem areas within the watershed have been identified</b>		
Implement the Surface Water Quality Assurance Monitoring Plan created for DEQ in 2013 by collecting water and sediment samples at designated stream sites to evaluate possible land-based sources of pollution and to isolate affected watershed segments	DEQ	High
Explore relative contributions of agrochemicals, trash burning and other land-based pollution to water quality impairments	DEQ, NRCS, EPA	Medium
<b>OBJECTIVE F2: By 2016, the Climate Change Adaptation Plan will be finished and data used for informing regulations</b>		
Continue to support and participate in the Climate Change Working Group	CRM, NOAA	High

<b>OBJECTIVE F3: By FY2018, funding is secured and capacity identified to support long-term ecological monitoring within the watershed</b>		
Identify and eliminate gaps in scientific data for fisheries management	DFW, NOAA	Medium
Identify and eliminate gaps in scientific data for marine monitoring	DEQ, CRM	Medium
Understand algae preference by herbivorous fish	DFW, CRM, DEQ	High
Quantify impacts of various recreational activities on marine resources, including direct contact from boats, snorkelers, divers and swimmers and indirect impacts from beach recreational activities)	DEQ, CRM, DFW	Medium
Understand types and coverage of forest areas	Forestry, USFS, Nat'l Park Service	Medium
Evaluate health of wetlands and mangroves periodically and implement management plans	NPS, CRM, DEQ, Forestry	High
Establish a new weather station within the watershed	Nat'l Park Service	High
Create plans for groundwater monitoring wells related to wetland areas	Nat'l Park Service	Low

SUPPLEMENTAL FIGURES

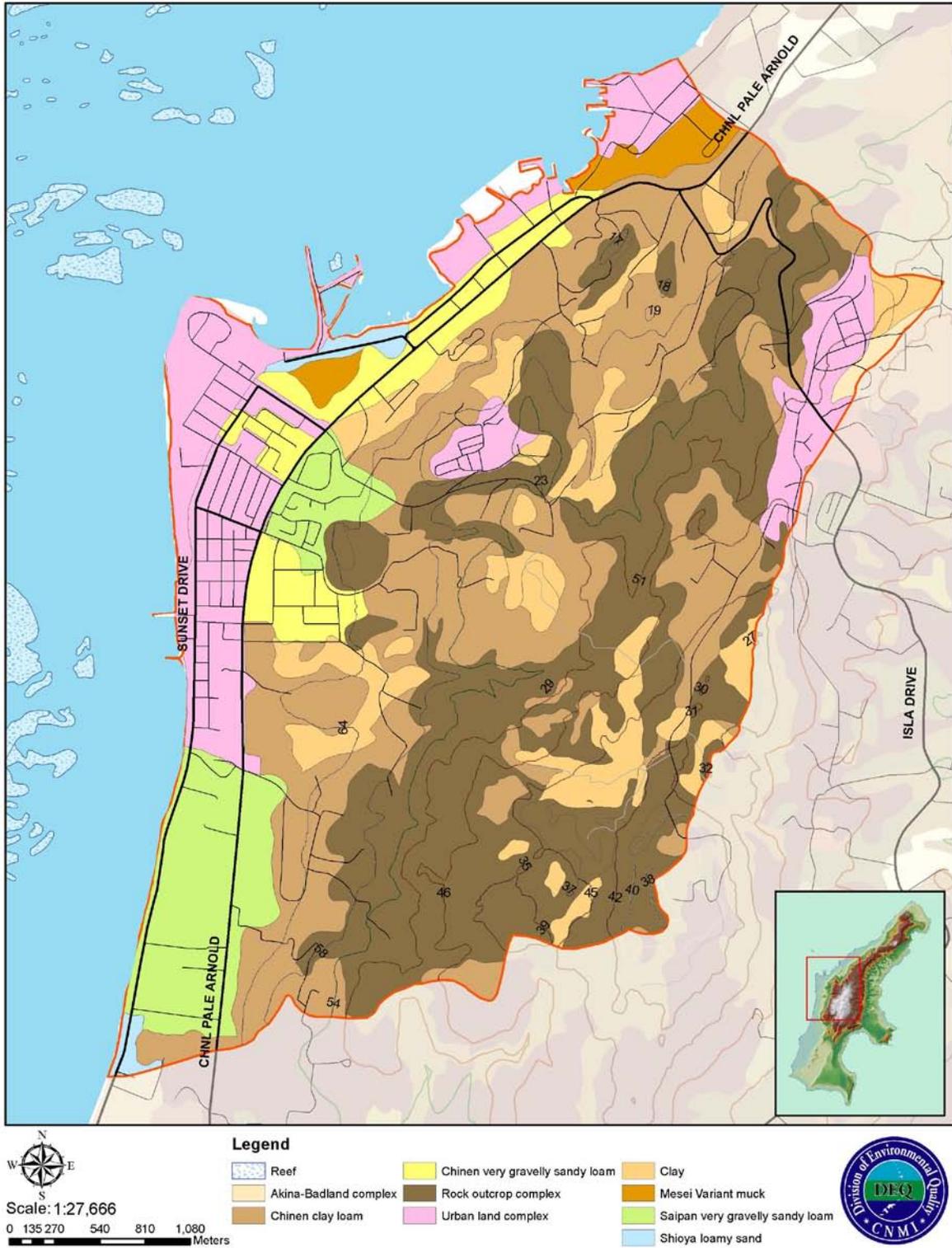


Figure 3: Soil and substrate types in the West Takpochao watershed. Data provided by USGS, map created by the DEQ.

## Shoreline Change and Rating: North Garapan and American Memorial Park

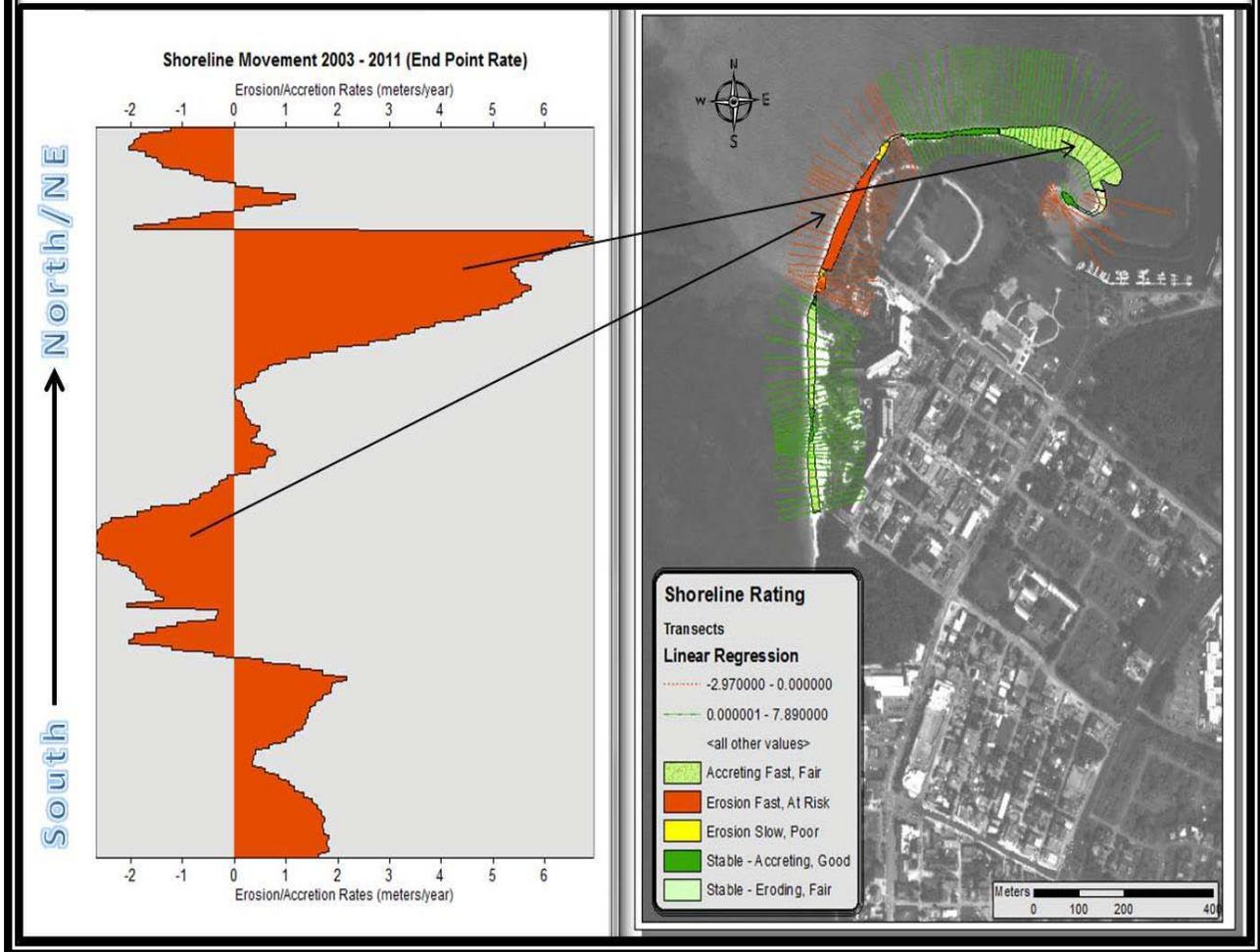


Figure 4: Shoreline erosion and accretion at critical points as assessed by the USGS Digital Shoreline Analysis System and CRM from 2003 to 2011. Data and map provided by CRM.

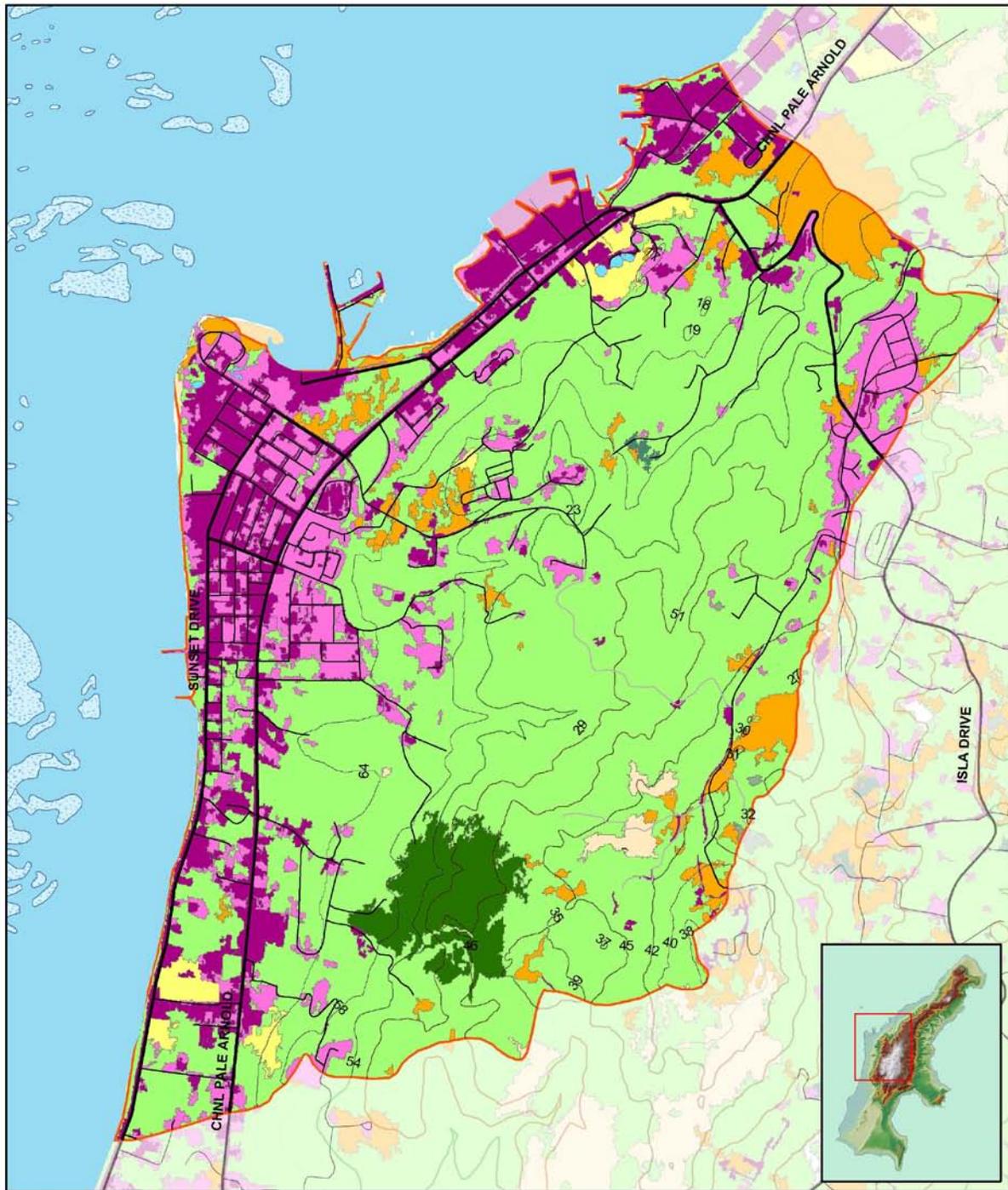


Figure 5: 2006 land use and vegetation map for the West Takpochao watershed. The upland forests (native limestone) and urban greenspace (urban vegetation) targets are rated as “fair” due to their low coverage areas. Data provided by the US Forest Service, map created by DEQ.

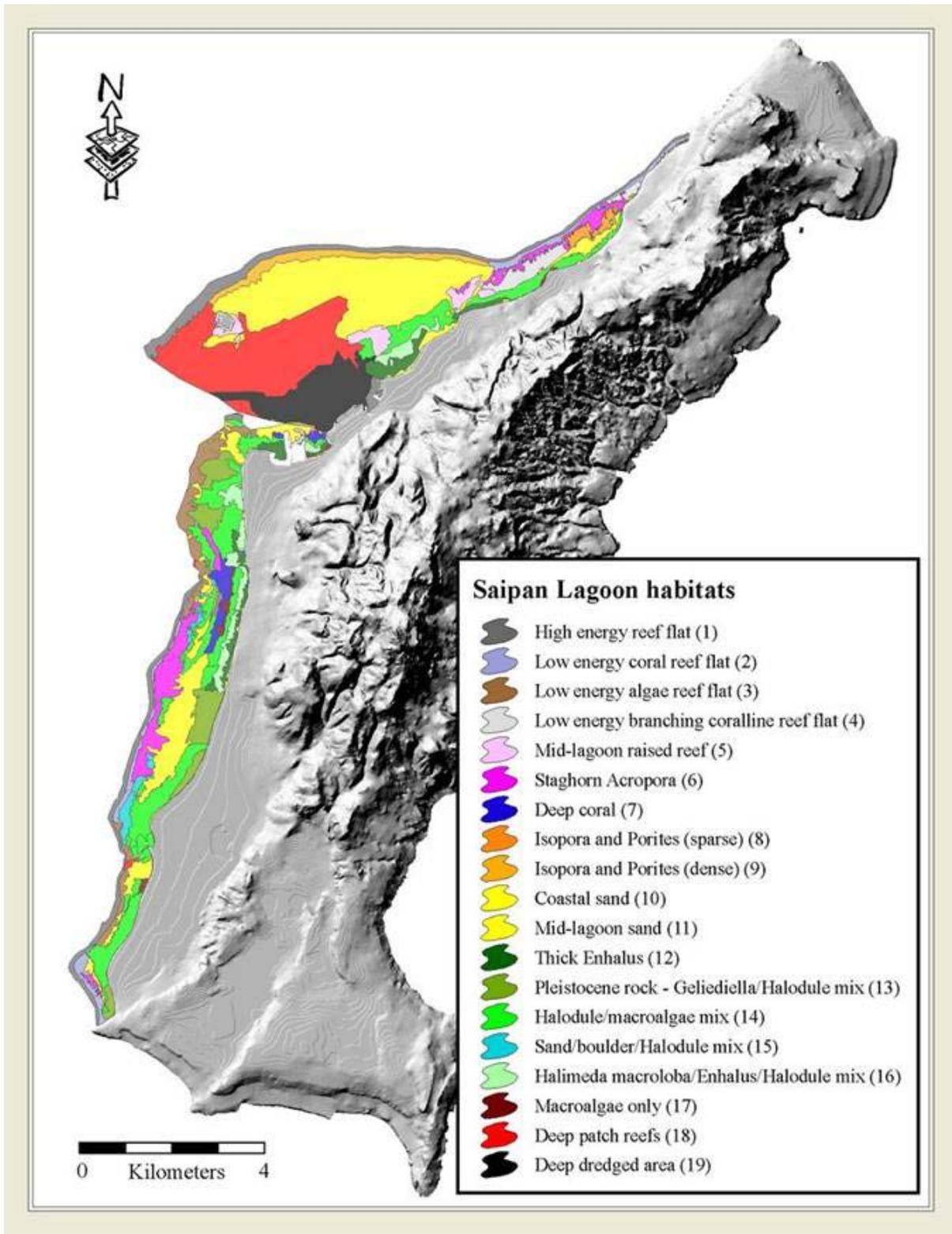


Figure 6: Marine habitat types in Saipan’s western Lagoon. Map from Houk and van Woesik (2008).

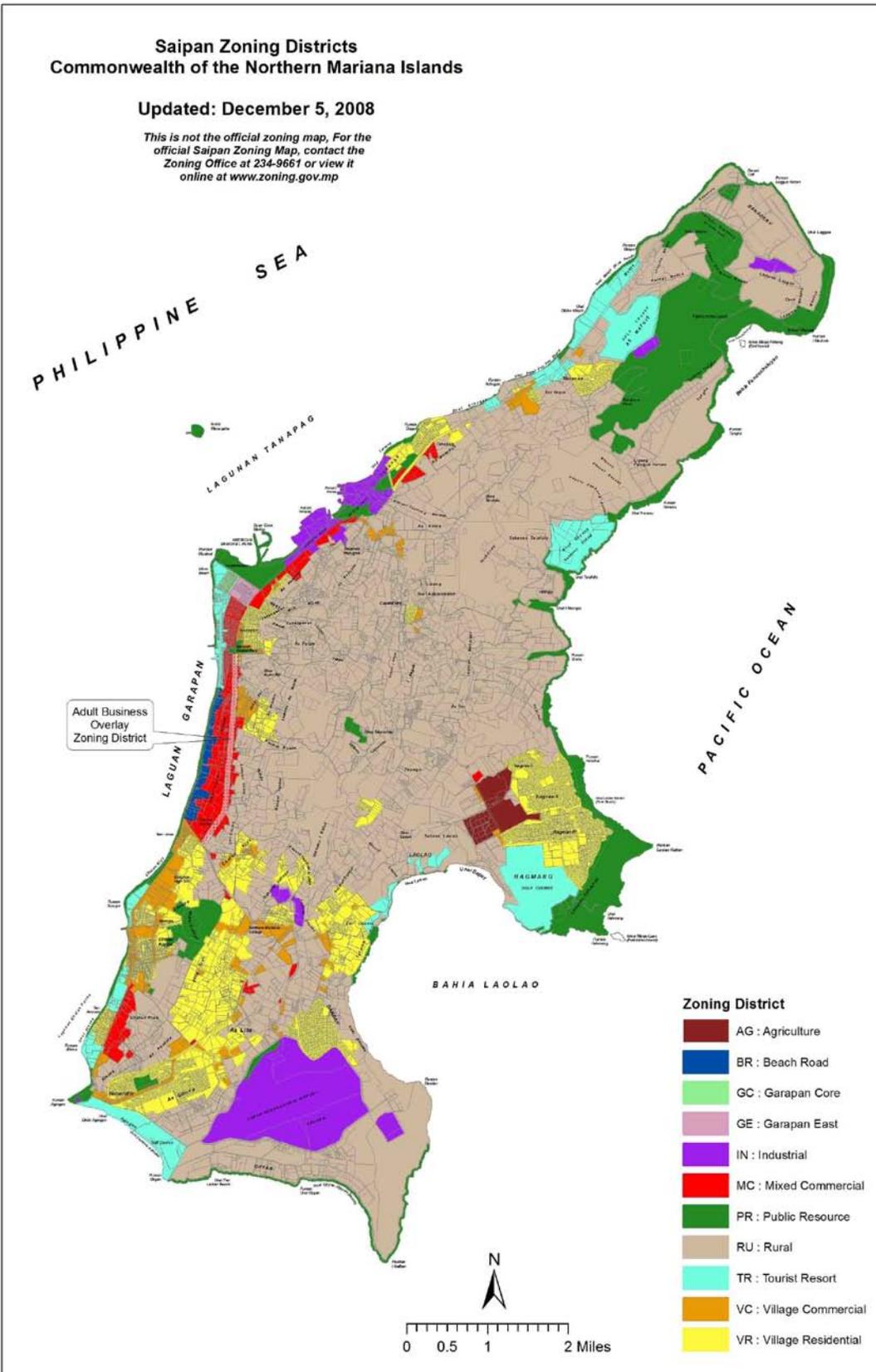


Figure 7: Zoning districts as specified in the CNMI Zoning Code. Map provided by the Zoning office.

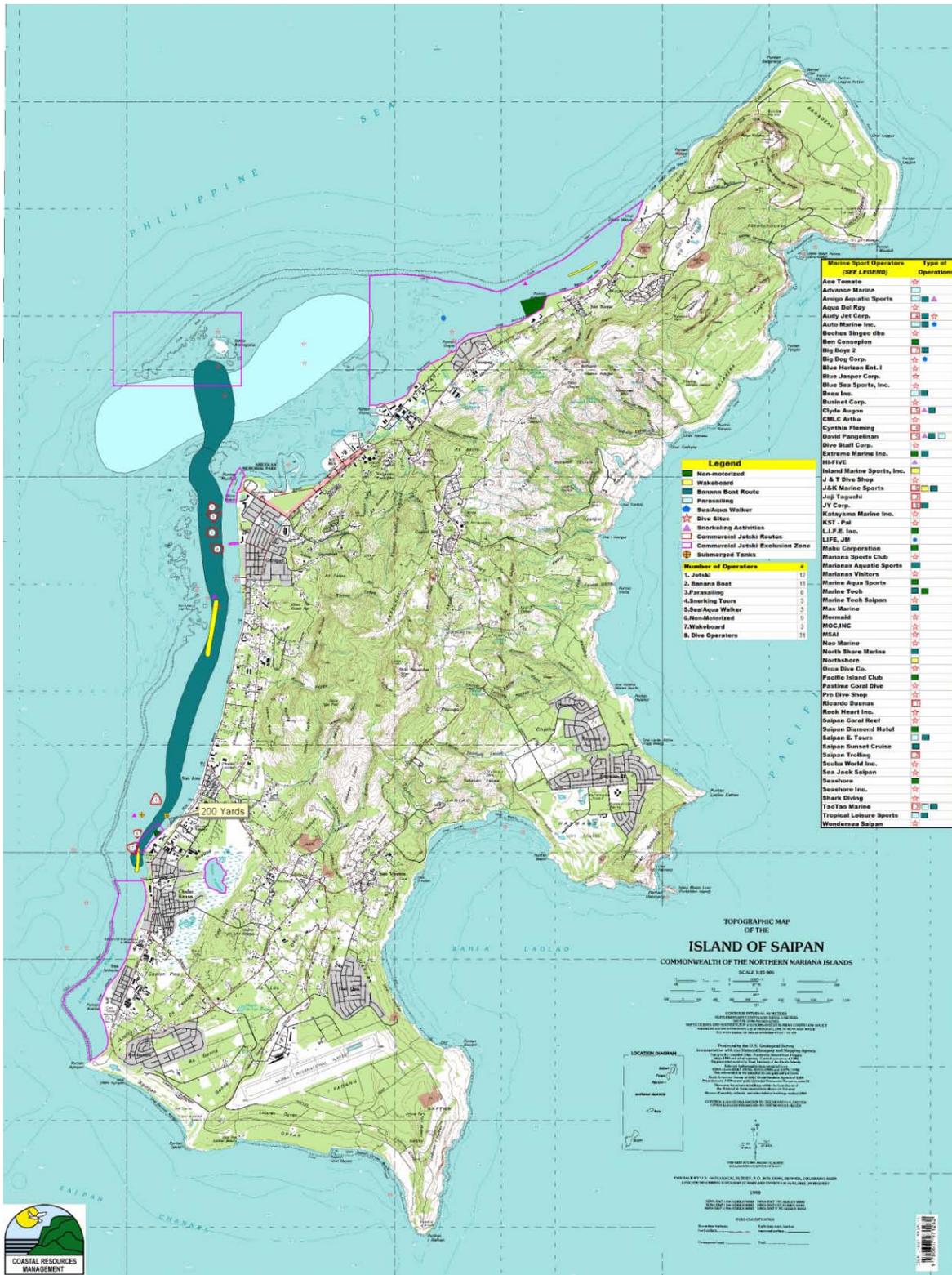


Figure 8: A map of permitted marine sports operators in the Saipan lagoon. Parasailing, banana boats, and diving are important activities along the Garapan coast. Map created by CRM and USGS.

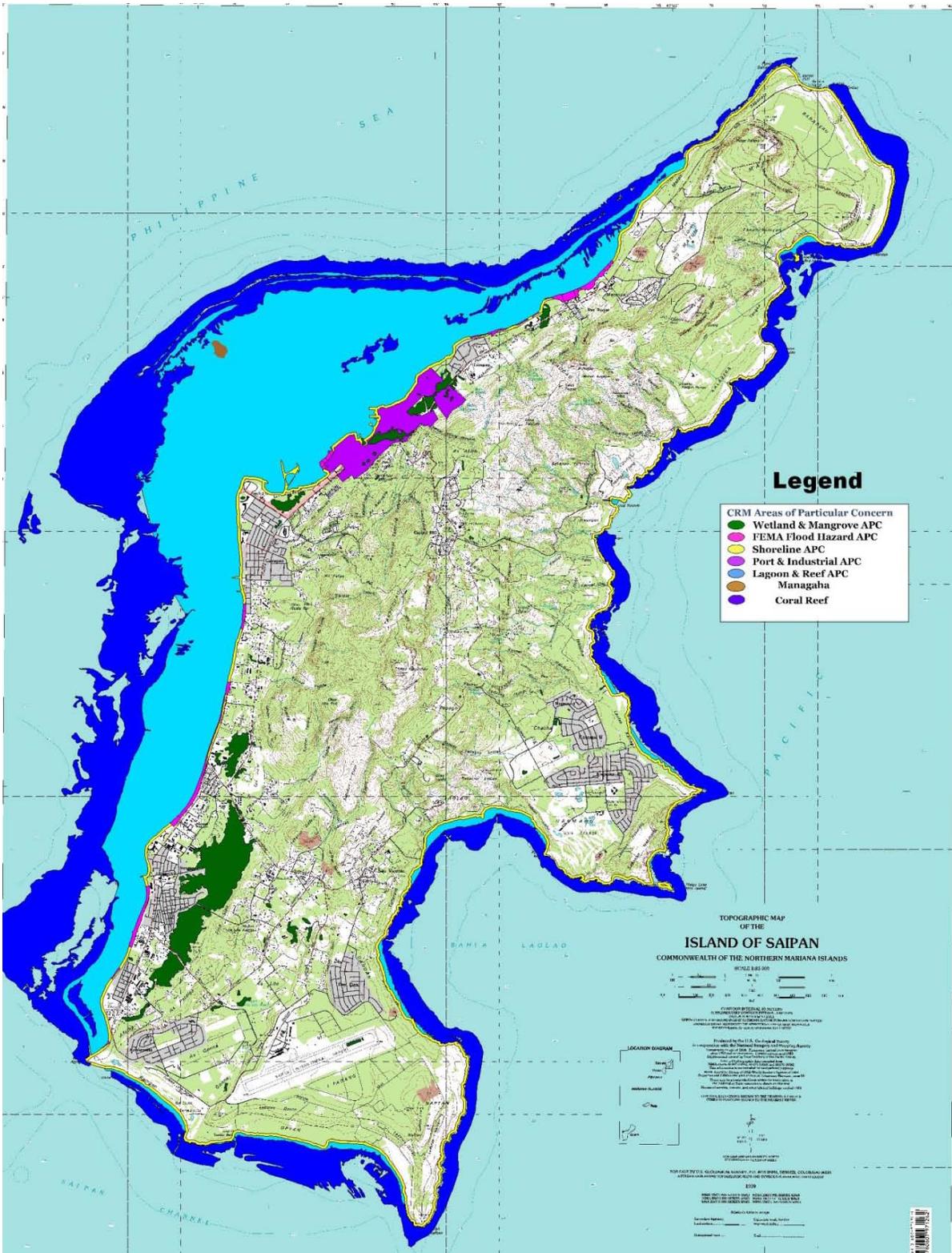


Figure 9: Areas of Particular Concern for the Coastal Resources Management Office. Map created by CRM and USGS.

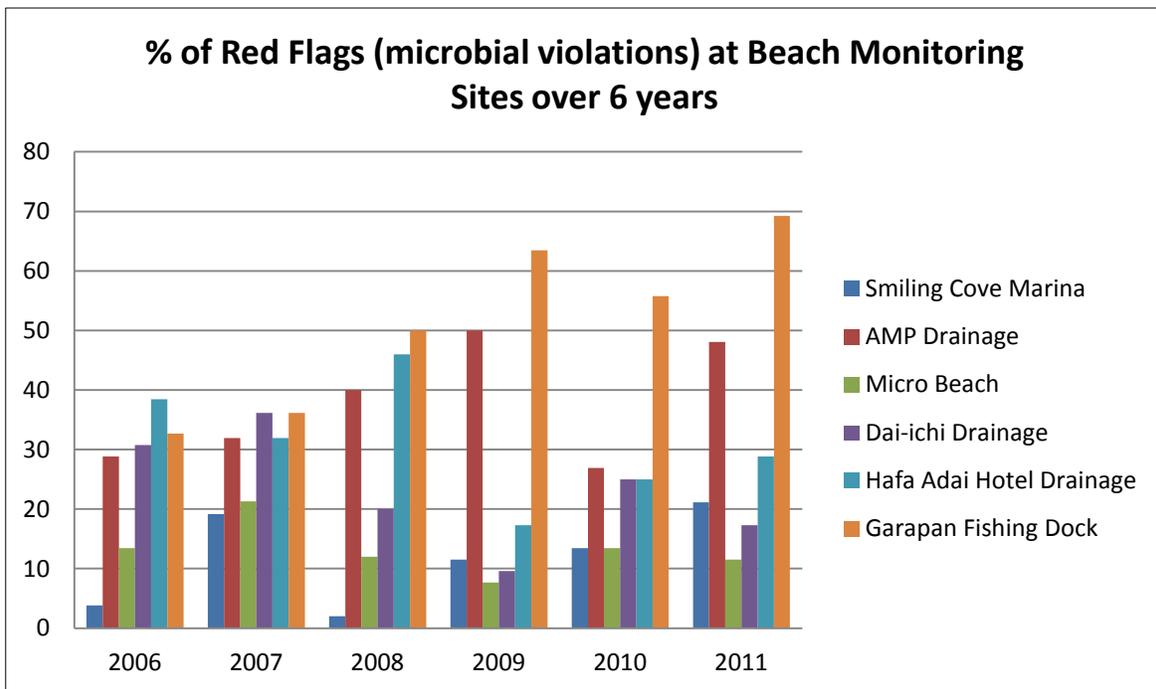


Figure 10: Graph of % of weeks each year that Garapan beaches are “red-flagged” indicating that the concentration of microbes in the sample exceeds CNMI Water Quality Standards. Data and graph provided by the DEQ Water Quality Surveillance Laboratory.

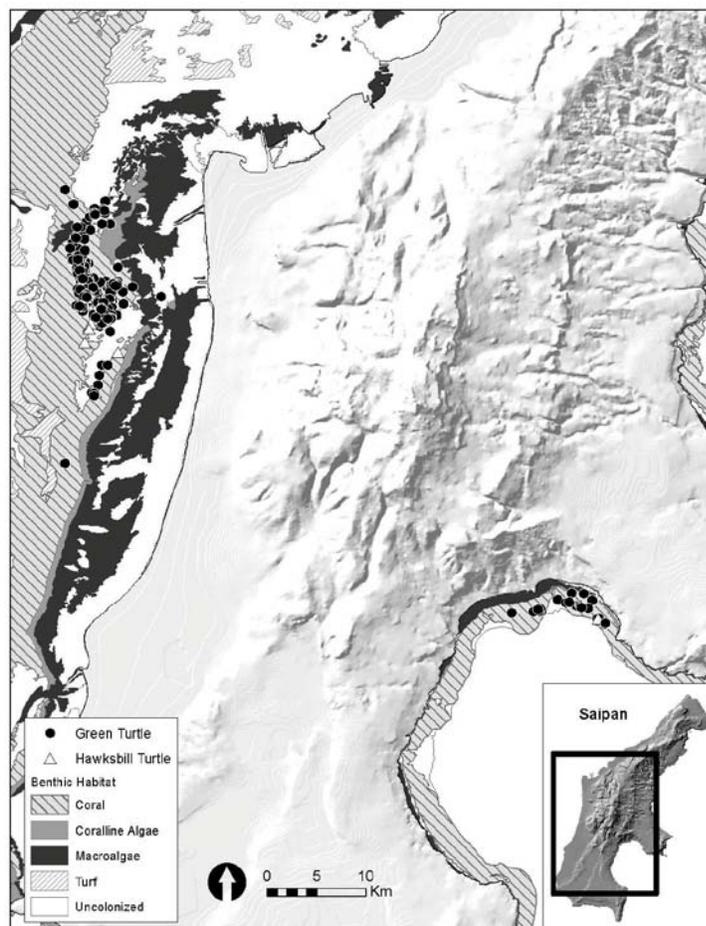


Figure 11: In-water turtle captures in the Garapan lagoon and Laolao Bay. Garapan is one of the main foraging sites on Saipan. The in-water capture indicator is rated as “fair”. Data and map provided by the CNMI DLNR Sea Turtle Program.

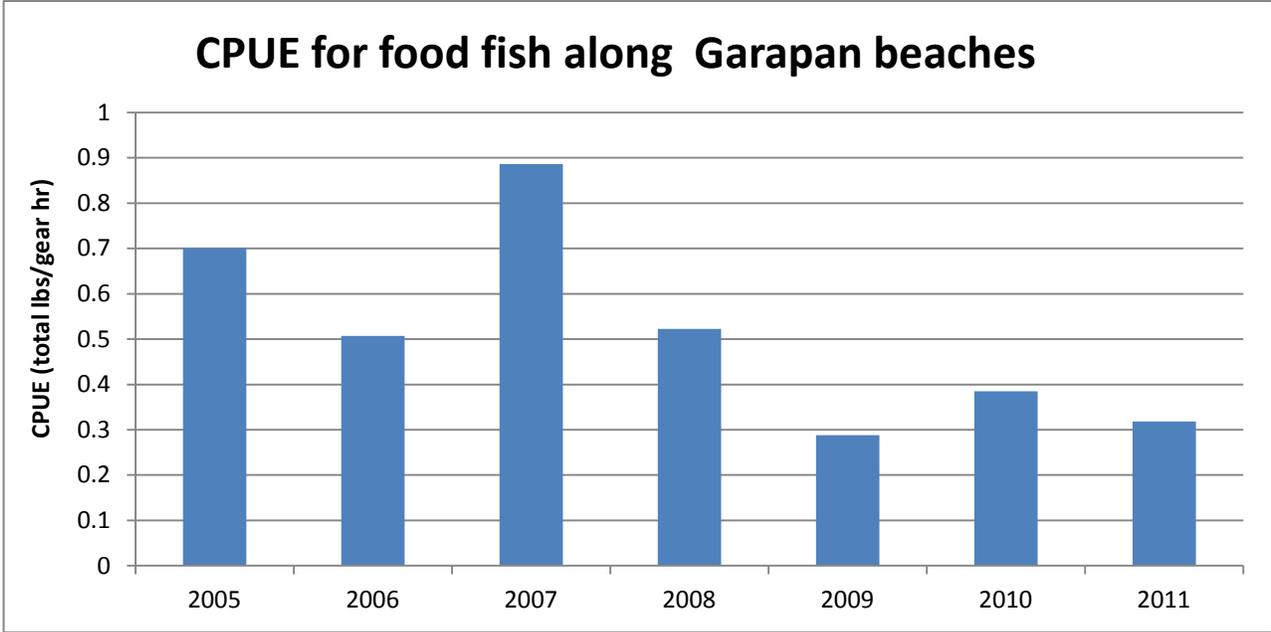


Figure 12: Combined average catch per unit effort (CPUE) of food fish caught during daytime and nighttime from hook & line, cast-net fishing or spearfishing in Garapan area survey zones. The food fish target is rated as “fair” based on a lack of a near-term significant increase or decrease in CPUE. Data provided by DFW creel surveys.

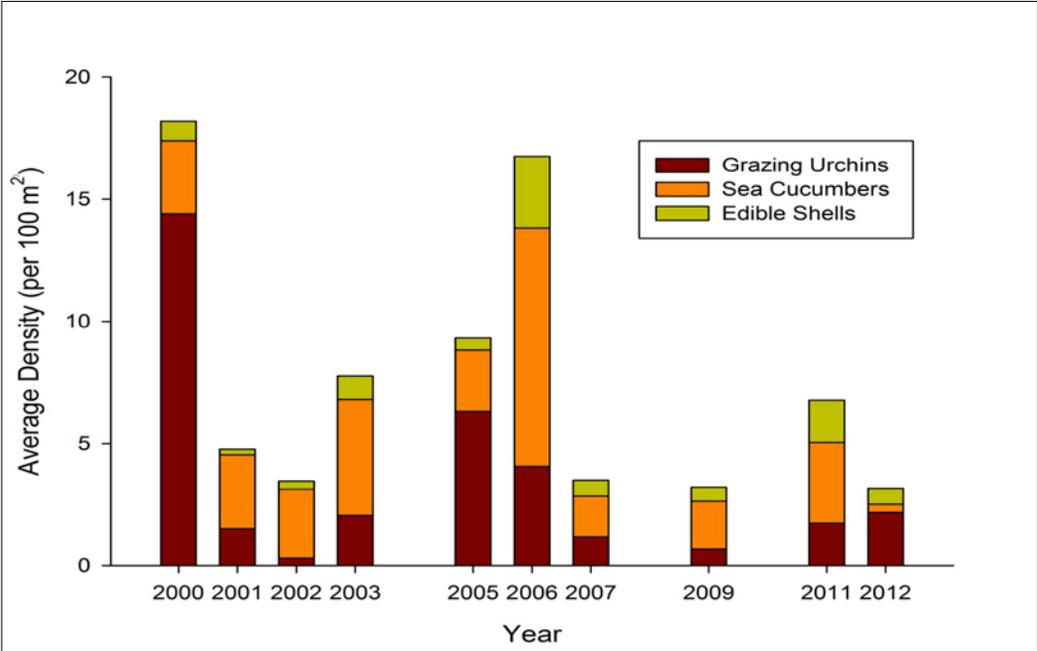


Figure 13: Average density of three different classes of marine invertebrates during sampling years. Relative and overall densities change significantly over time. Density of edible shells and grazing urchins are rated as “poor” while sea cucumbers are rated as “fair”, contributing to an overall rating of “fair for the invertebrate target. Data and graph provided by the DEQ Marine Monitoring Team.

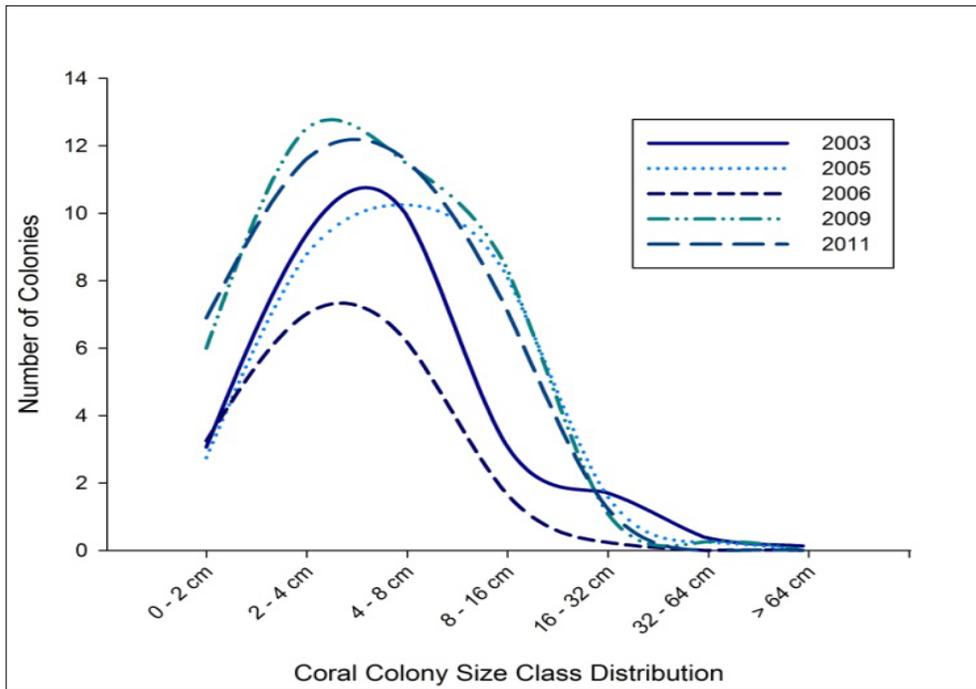


Figure 14: Coral colony size class distribution is rated as “fair” contributing to the overall benthic health status of “fair”. Data and graph provided by the DEQ Marine Monitoring Team.

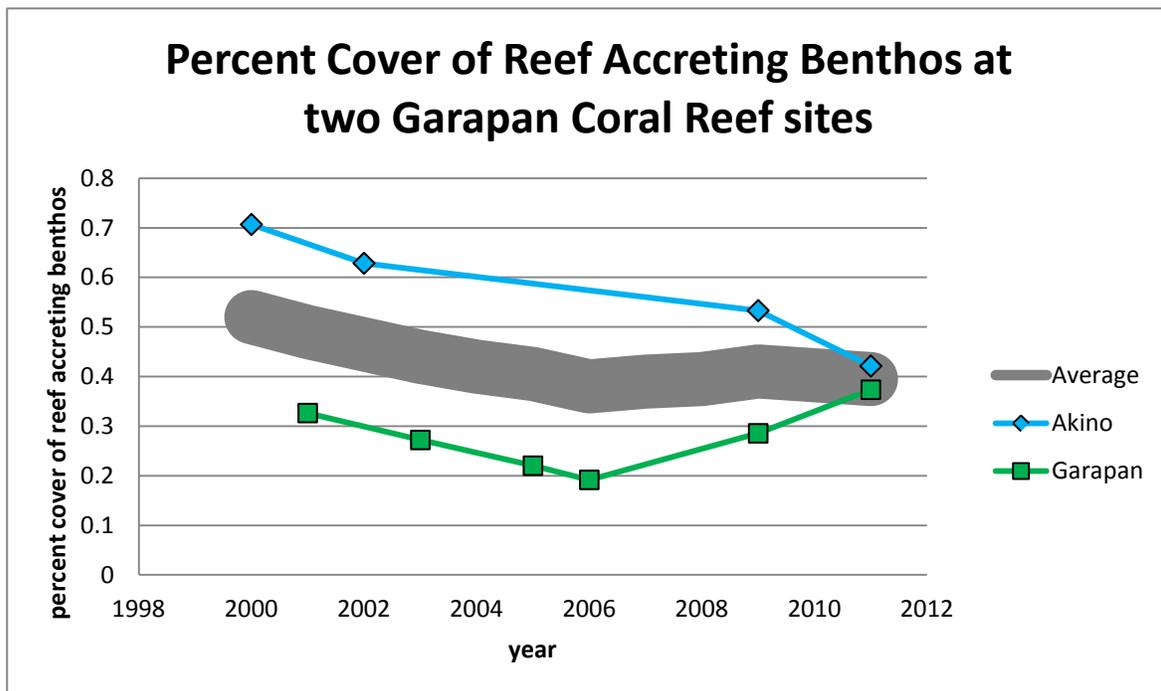


Figure 15: Percent cover of reef-accreeing benthic substrate includes coral, coralline crustose algae, and branching coralline algae which are conducive to coral recruitment. This indicator is rated as “poor” contributing to an overall benthic habitat rating of “fair”. Data provided by the DEQ Marine Monitoring Team.

## APPENDICES

### APPENDIX 1: CAP WORKSHOP PARTICIPATION LIST (SEPTEMBER 10-13, 2012)

NAME	AGENCY
<b>Alberto Ignacio</b>	PDM Promoters
<b>Alfredo DeTorres</b>	NMC
<b>Angel Palacios</b>	DEQ
<b>Annie Agulto</b>	CRM
<b>Barbara Alberti</b>	NPS
<b>Becky Skeele</b>	CRM
<b>Ben Cepeda</b>	Forestry
<b>Carlos Ketebengang</b>	DEQ
<b>Clarissa Bearden</b>	DEQ
<b>Dana Okano</b>	NOAA
<b>Dave Benavente</b>	CRM
<b>Derek Chambers</b>	DEQ
<b>Doris Chong</b>	CRM
<b>Ed Santos</b>	SNISWCD
<b>Rep. Edmund Villagomez</b>	Legislature
<b>Fran Castro</b>	DEQ
<b>Francis Buniag</b>	DFW
<b>Frank Villagomez</b>	DFW
<b>Gene Weaver</b>	Fisherman's Assoc.
<b>Geralyn Dela Cruz</b>	DPW
<b>Greg Moretti</b>	PMRI/Chamber of Commerce
<b>Ike Cabrera</b>	SWCD
<b>Jessie Camba</b>	PDM Promoters
<b>Jihan Buniag</b>	DEQ
<b>Joe Kaipat</b>	DEQ
<b>John Fraser</b>	DEQ
<b>John Furey</b>	APASEEM
<b>John Gourley</b>	Marianas Conservation
<b>John Iguel</b>	DEQ
<b>John Riegel</b>	CUC

NAME	AGENCY
<b>Jose Quan</b>	DEQ
<b>Juan Iguel</b>	NMC Student
<b>Judy Torres</b>	MVA, deputy
<b>Julius Reyes</b>	NMC Student
<b>Kendal Hicks</b>	NRCS
<b>Kodep Ogumoro-Uludong</b>	MINA
<b>Manny Borja</b>	DEQ
<b>Manny Tenorio</b>	NMC Student
<b>Marlyn Naputi</b>	NMC Student
<b>Matthew Crane</b>	NMC, MRC
<b>Mike Tenorio</b>	DFW
<b>Mike Trianni</b>	NOAA
<b>Nicole Schafer</b>	CRM
<b>Pat Rasa</b>	DPL
<b>Perry Tenorio</b>	MVA
<b>Robbie Greene</b>	CRM
<b>Rose Pangelinan</b>	CRM
<b>Ryan Okano</b>	DEQ
<b>Sean McDuff</b>	DFW (Creel)
<b>Severino Alforeza</b>	NMC Student
<b>Shelly Kremer</b>	DEQ
<b>Shirley Tenorio</b>	NMC Student
<b>Sonya Dancoe</b>	DPW
<b>Steve McKagan</b>	NOAA
<b>Steven Johnson</b>	DEQ
<b>Steven Victor</b>	TNC
<b>Susana B. Deleon Guerrero</b>	Forestry
<b>Tammy Summers</b>	DFW
<b>Thomas Borja</b>	Mayor's Office
<b>Timothy Lang</b>	TRL Consultant
<b>Todd Miller</b>	DFW
<b>Tyler Willsey</b>	DFW

## APPENDIX 2: ACRONYMS

<b>AG</b> – Attorney General	<b>EPA</b> – (US) Environmental Protection Agency
<b>BEH</b> – Bureau of Environmental Health	<b>HPO</b> – Historic Preservation Office
<b>CAP</b> – Conservation Action Plan	<b>KEA</b> – Key Ecological Attributes
<b>CIP</b> – Capital Improvement Projects (office)	<b>MINA</b> – Mariana Islands Nature Alliance
<b>CNMI</b> – Commonwealth of the Northern Mariana Islands	<b>MVA</b> – Marianas Visitor’s Authority
<b>CPA</b> – Commonwealth Ports Authority	<b>NMC</b> – Northern Marianas College
<b>CRCP</b> – Coral Reef Conservation Program	<b>NMC-Crees</b> – NMC Cooperative Extension Service
<b>CRM</b> – Coastal Resources Management (office)	<b>NMFS</b> – (NOAA) National Marine Fisheries Service
<b>CUC</b> – Commonwealth Utilities Corporation	<b>NOAA</b> – National Oceanic and Atmospheric Administration
<b>DEQ</b> – Division of Environmental Quality	<b>NRCS</b> – (USDA) Natural Resources Conservation Service
<b>DFW</b> – Division of Fish and Wildlife	<b>PIMPAC</b> – Pacific Islands Marine Protected Areas Community
<b>DLNR</b> – Department of Lands and Natural Resources	<b>PDM</b> – Paseo de Marianas (Promoters)
<b>DOT</b> – (US) Department of Transportation	<b>PMRI</b> – Pacific Marine Resources Institute
<b>DPH</b> – Division of Public Health	<b>TNC</b> – The Nature Conservancy
<b>DPL</b> – Department of Public Lands	<b>USDA</b> – US Department of Agriculture
<b>DPS</b> – Department of Public Safety	<b>USGS</b> – US Geological Survey
<b>DPW</b> – Department of Public Works	