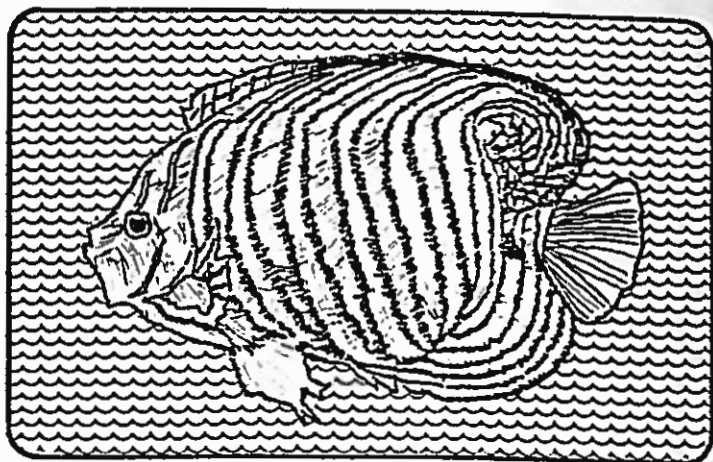
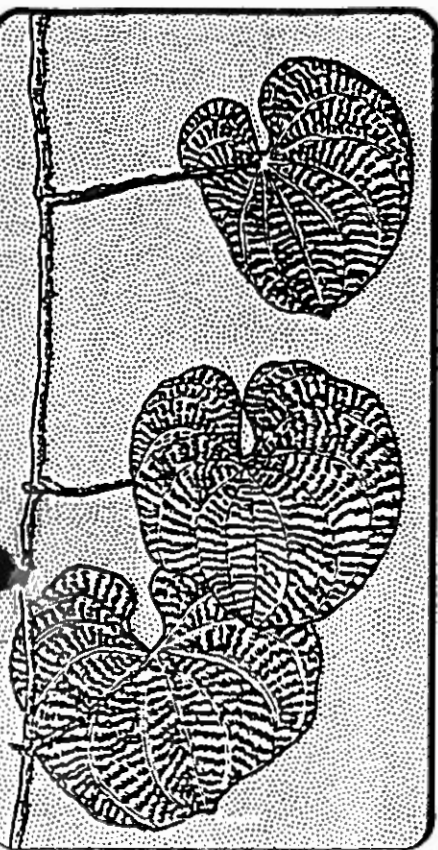


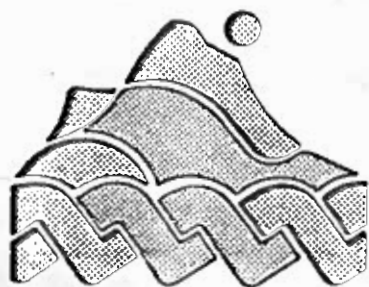
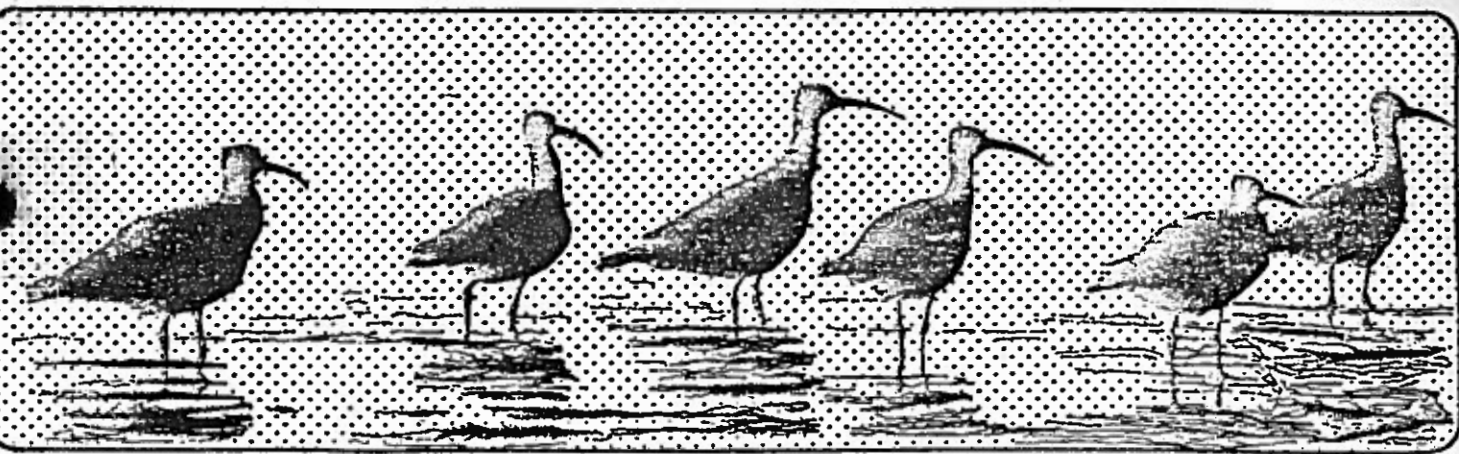
LAND-USE PLAN: GUAM

Prepared by: Bureau of Planning
1980

LAND-USE PLAN



• GUAM •



BUREAU OF PLANNING
GOVERNMENT OF GUAM
AGANA, GUAM

LAND-USE PLAN: GUAM

**Bureau of Planning
Government of Guam
Agana, Guam**

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I. OVERVIEW

A. Purpose

The most important factor determining the quality of our environment is the use we make of our land and water resources. It is the purpose of the Land-Use Plan to establish a long-range blueprint for development on Guam. Envisioned growth takes place in a manner which reflects the need for expansion in all social and economic sectors but, at the same time, recognizes the need for establishing guidelines for growth in areas where unplanned development would have a significant negative impact upon the well-being of the people of Guam.

A blueprint for land and water use is not a fixed plan. Like the growth it seeks to guide, it is dynamic, flexible, and subject to revision as the myriad of factors influencing development themselves change.

B. Approach

If the island of Guam was much larger, if we had a great abundance and variety of resources, and if the population growth was much lower, we would not have to worry as much about what type of development would occur and where. Since Guam is small (212 square miles), much of the land is owned by the Federal government (31.5%), resources are few and limited, and the growth rates relatively high, we must seek a balance of proposed development against the public benefit gained from that development. Due to our limited land area, we must assure that this balance recognizes both the need for growth, and the location of that growth in areas which can support it without producing unacceptable impacts on both the land and people of Guam. (See Figure 1)

Figure 1: THE LOGICAL APPROACH TO A BALANCED RESOURCE USE

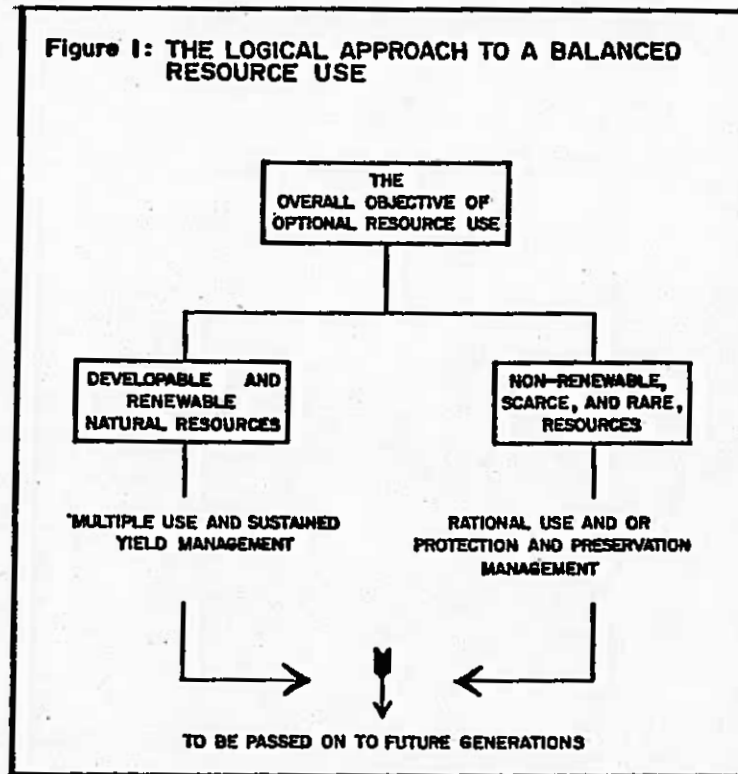
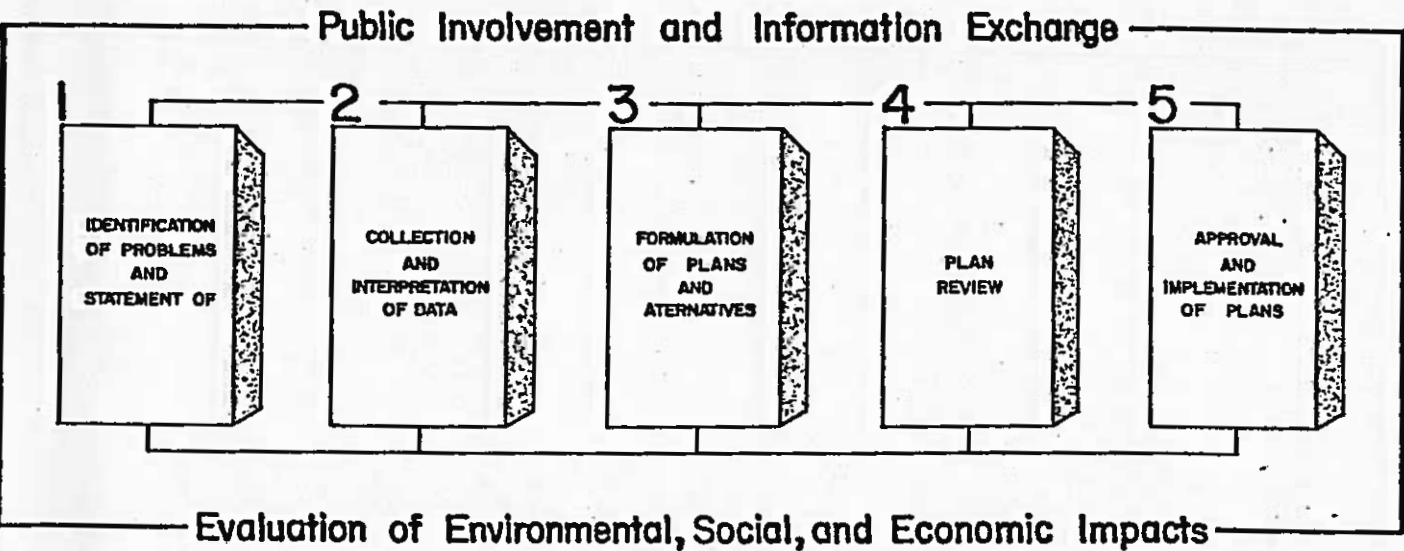


Figure 2: THE LAND-USE PLANNING PROCESS



C. Relation to Master Plan

The Land-Use Plan is an integral element of the broader planning progress involved in the Guam Comprehensive Development Plan as defined by Public Law 12-200. While the Guam Comprehensive Development Plan defines future development in the terms of all determinants of growth and change (economic, political, social, and physical), the land-use part of the overall plan is the physical interpretation of those other elements of the plan on the geographic areas of Guam. It is primarily concerned with the arrangement and types of land use, their impact upon the environment, and relation to community development.

Basically, the planning process consists of a number of conceptually distinct phases as shown in Figure 2.

D. Objectives

The major objective which a Land-Use Plan attempts to address can be expressed in a single statement: "to organize, coordinate, and guide the process of growth-caused development so as to protect what the people of Guam most value as the environmental, cultural, and aesthetic characteristics of the island while meeting the essential needs of an increasing population." The following objectives relative to the land-use planning effort were established:

Land-Use: Strive for an environment that promotes the general health and welfare, provides for all land uses and choices among living, working, cultural, and recreational opportunities.

Natural Resources: Develop Guam's natural resources according to a balanced management program. This involves rational use of renewable and non-renewable resources and protection of those areas, both natural and manmade, which are critical to our health, safety and welfare.

- Recreation:** Develop Guam's recreational resources to satisfy the desires of visitors and residents, and to preserve the island's scenic vistas, historic sites, natural areas, and beaches.
- Cultural Heritage:** Preserve and promote Guam's historical and cultural heritage so that future generations may understand their past as well as their development as a society.
- Housing:** Assure that safe, sanitary housing is available within the financial reach of every family.
- Economy:** Continue on the road to self-sufficiency and manageable economic growth by developing a broad basic economy emphasizing military activity, small business, tourism, agriculture, and fishing.

E. Land-Use Policies

The preparation of the Land-Use Plan required at the outset a statement of policies which serve to guide the formulation of specific guidelines and standards. The following policies were developed and incorporated into the Guam Comprehensive Development Plan and Guam Coastal Management Program. They were set forth in Executive Order No. 78-37 on November 15, 1978.

1. Governmental Processes Policy

More effective administration of natural resource related laws, programs, and policies shall be achieved through:

- . revision of unclear and outdated laws and regulations;
- . improved coordination among local agencies;
- . improved coordination between territorial and federal agencies;
- . educational and training programs for local government personnel, and refinement of supporting technical data.

2. Development Policies

. Shore Area Development

Only those uses shall be located within the Seashore Reserve which: (1) enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or (2) can demonstrate dependence on such a location and the lack of feasible alternate sites.

. Urban Development

Uses permitted only within Commercial, Multi-Family, Industrial, and Resort-Hotel zones; and uses requiring high levels of support facilities shall be concentrated within urban districts as outlined on the Land-Use Districting Map.

. Rural Development

Rural districts shall be designated in which only low density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure, including functional sewerage, is provided.

. Major Facility Siting

In evaluating the consistency of proposed major facilities with the goals, policies and standards of the Comprehensive Development and Coastal Management Plans, the Territory shall recognize the national interest in the siting of such facilities including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment, and major reservoir sites.

. Hazardous Areas

Identified hazardous lands including floodplains, erosion-prone areas, air installation crash and sound zones and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety, or welfare of the people of Guam, and complies with land-use regulations.

- Housing

The government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and manmade hazards, and recognize the limitations of the island's resources to support historical patterns of residential development.

- Transportation

The Territory shall develop an efficient and safe transportation system while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, and other coastal resources.

- Erosion and Siltation

Development shall be limited in areas of 15% or greater slope by requiring strict compliance with erosion, sedimentation, and land-use district guidelines, as well as other related land-use standards for such areas.

3. Resource Policies

- Conservation of Natural Resources-Overall Policy

The value of Guam's natural resources as recreational areas, critical marine and wildlife habitats, the major source of drinking water, and the foundation of the island's economy, shall be protected through policies and programs affecting such resources.

- Air Quality

All activities and uses shall comply with all local air pollution regulations and all appropriate federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality.

- Water Quality

Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuarine, reef and aquifer areas.

- Fragile Areas

Development in the following types of fragile areas shall be regulated to protect their unique character; historic and archaeologic sites, wildlife habitats, pristine marine and terrestrial communities, limestone forests, and mangrove stands and other wetlands.

. Living Marine Resources

All living resources within the territorial waters of Guam, particularly corals and fish, shall be protected from overharvesting and, in the case of marine mammals, from any taking whatsoever.

. Visual Quality

Preservation and enhancement of, and respect for the island's scenic resources shall be encouraged through increased enforcement of and compliance with sign, litter, zoning, subdivision, building and related land-use laws, visually objectionable uses shall be located to the maximum extent practicable, so as not to degrade significantly views from scenic overlooks, highways, and trails.

. Recreational Areas

The Government of Guam shall encourage development of varied types of recreation facilities located and maintained so as to be compatible with the surrounding environment and land uses; adequately serve community centers and urban areas, and protect beaches and such passive recreational areas as wildlife and marine conservation areas, scenic overlooks, parks, and historic sites.

. Public Access

The public's right of unrestricted access shall be ensured to all non-federally owned beach areas and all Territorial recreation areas, parks, scenic overlooks, designated conservation areas and other public lands; and agreements shall be encouraged with the owners of private and federal property for the provision of reasonable access to, and use of, resources of public nature located on such land.

. Agricultural Lands

Critical agricultural lands shall be preserved and maintained for agricultural use.

II. PHYSICAL AND CULTURAL SETTING

A. General

Guam is the southernmost and largest island in the Marianas Chain, an archipelago in the Southwest Pacific. It lies 13 degrees 28'29"N and 144 degrees 44'55"E at Agana, the capital city on the central western coast. The island is approximately 30 miles in length with a northern width of 8½ miles and a maximum southern width of 11½ miles. Northern and southern land areas taper at the central waist to a width of 4 miles. Excluding reef areas, the land area is 212 sq. miles or 550 sq. kilometers. The axis of the island is in a northeast-southeast direction. Guam is generally classified as a high island with 12 small islands along the reef. One large offshore island is Cocos Island. The island is a raised portion of the barrier reef encircling an atoll-like lagoon.

B. Climatic and Seismic Conditions

Generally, the climate on Guam is warm and humid regardless of time of year. The relative humidity commonly exceeds 84% at night, all year long, and the average humidity is at least 66% every month. The daytime temperatures are commonly between 83 and 88 degrees with night temperatures falling to the mid-seventies during the coolest part of the evening. The two distinct climatic seasons on Guam are the wet and dry season. The dry season is generally from January to May and the wet season from July to November. December and June are considered transitional months. The mean annual rainfall ranges from approximately 80" along the coast to 95" for the higher mountains areas; (20-24%) falls in the dry season and 63-66% in the wet season. The remaining rainfall occurs during the transitional months. A great deal of variation in rainfall can occur from year to year. In 1952, a maximum of 145.45" was recorded with a minimum of 60.42" of rain recorded in 1955. Severe droughts are a normal

occurrence on Guam. The period of greatest drought hazard is February through April. Inversely, intense rainfall can occur with tropical storms or typhoons. Small-scale storms or squalls can occur at anytime with varying frequency and character. Major storms or typhoons, with winds greater than 65 knots, have made direct hits on Guam. The likelihood of typhoons is greatest during July through September, however, as evidenced by the last direct hit, they may occur during any month. On May 21, 1976, Typhoon Pamela devastated the island with recorded sustained winds of 115 mph and recorded gusts to 159 mph.

Located 70 miles southwest of the Marianas Trench, Guam is subject to earthquakes and seismic sea waves at presently unpredictable frequency and intensity. Devastating sea waves have been absent during recorded history. Numerous earthquakes and tremors have occurred with the most damaging quake being recorded in 1902. Guam is structurally divided into six blocks by seismic fault zones that are defined by distinct divisions in the land surface.

C. Northern Guam

The northern half of Guam is geographically characterized by a raised limestone plateau with a maximum elevation of 600 feet which gently slopes downward in a southwestern trend to less than 100 feet in the central mid-section of the island. The northern limestone is composed of the consolidated remains of reef coral and sediments. The northern limestone terraces and cliffs represent an ancient barrier reef, with the inland limestone terrain comprised of the sedimentary remains of the lagoon sediments. The central limestone is hard and valuable for mineral extraction. The central limestone is extremely permeable, thus rainfall quickly soaks into the ground and recharges three main aquifer areas. A lens of freshwater floats upon saltwater and provides the bulk of the island's freshwater supply.

A very thin soil layer covers most of the northern limestone and hosts forest vegetation known as the limestone forest. The limestone forest is comprised of trees that form a canopy for understory shrubs, herbs, epiphytes, and lianas. Many of the plants grow from bare limestone. Many of the areas of limestone forest have been cleared by wartime efforts and postwar urban and military developments. The remaining areas are concentrated along coastal slopes and represent the critical habitat for many of Guam's endangered plants and animals.

The northern limestone plateau is interrupted by volcanic upthrusts at Barrigada Hill and Mt. Santa Rosa. The volcanic basalt is exposed at Mt. Santa Rosa and has resulted in the buildup of lateritic clay soil along an adjacent inland area. This region represents the only major sector of agriculturally developable land in the northern half of the island.

D. Central Guam

Geologically, the central waist of Guam, from Agana Bay to Pago Bay, represents a transitional zone between the northern limestone and southern volcanic formations. The limestone in this area is argillaceous or yellowish in color from the volcanic sediments that mixed with the white reef coral during the later development of the northern reef adjacent to the older southern volcanics. The relief features are characterized by sloping hills that are intersected by low-lying basins that are periodically flooded during the wet season. They appear as grassy flats and are important for recharge of the central aquifer. The central aquifer is the smallest lens, yet least affected by saltwater intrusion. It reaches the surface at Agana Springs and disperses water

over a floodplain or wetland wildlife habitat, known as Agana Swamp, which eventually flows into Agana Bay via Agana River -- the northernmost river on Guam.

Despite the small land area, geologic characteristics and unique ecology of Central Guam, the area is the location of the major concentration of urban development on the island. Approximately 30% of the island's population resides in this small land area. Commercial, industrial and residential development has expanded from Agana, the major trade center and seat of both governmental and religious power structure.

E. Southern Guam

The southern half of the island is geologically characterized by two distinct volcanic formations that developed in different geological eras. The Alutom formation or mountainous ridge adjacent to Central Guam, is the oldest formation. The highest peak is Mt. Alutom at 1,076 feet. The southern range, known as the Umatac formation is characterized by high peaks or a cuetal ridge that is steep on the seaward side and gently slopes inland toward the interior basin where the two formations merge. The highest peak is Mt. Lamlam at 1,334 feet. The rugged upland surfaces of volcanic areas are weathered. Exposed volcanic rock and conspicuous erosion scars are present. Major land areas, however, are covered with savannah grasslands that have adapted to the dry and nutrient deficient clay soils of the upper slopes. Water quickly drains from sloped surfaces and forms a surface drainage pattern that comprises the freshwater resources of Southern Guam. A relatively small amount of rainfall soaks into the underlying rock strata. More than 40 rivers and streams form a surface drainage pattern that dissects the volcanic regions. These rivers flow into the sea at coastal embayments where

floodplains and wetlands typify the estuarine areas. A heavy growth of tropical vegetation borders the inland areas of rivers and represents a plant community known as the ravine forest. Sharp divisions between the savannah grasslands and ravine forest lends a particularly aesthetic contrast to Southern Guam. The southern uplands are some of the only expanses of unspoiled terrain on Guam.

Only 24% of the island's population resides in southern communities because of terrain restrictions. Village centers are most often along coastal lowlands with a traditional lifestyle and architecture producing a sharp contrast with northern and central urban development patterns. The reliance on farming and fishing for subsistence is more persistent in the south. Topographic, geologic and ecological conditions have caused the deposition of fertile soil into southern interior basins. Large tracts of prime agricultural lands lie between the southern communities of Inarajan and Talofofo. Other portions of the interior basin, where the two major volcanic formations meet, however, are characterized by eroded reef coral that forms a jagged Karst topography. These areas are concentrated on federally restricted property near the Fena Reservoir, a man-made reservoir that supplies 10% of the island's water consumption.

F. Coastal Features

Being a small island with human settlement concentrated along coastal areas, the dynamic features and processes that occur at the shoreline or ocean-land interface are among the most important natural resources on Guam. Much of Guam is surrounded by coral reef, a diversified ecological community that is represented by different types at different locations. The northern coastline is generally characterized by an immediate reef front at the base of steep cliffs. However, as sandy beaches occur, the

presence of a reef flat becomes more prevalent along central and southern shores. The reef flat is a level base of limestone that consists of the remains of ancient reef coral that has built seaward to the present offshore reef front of living coral. The reef front suppresses the force of all except the largest storm waves and contributes to the buildup of sand along the beaches. As a transition between the reef and beach, the reef flat area is sometimes exposed during low tides, however, it represents an important shelter for many small fish, shellfish, crustaceans, algae and other forms of sea life.

Two barrier reefs, which encircle lagoon areas, are represented on Guam. Cocos Island, at the southern extreme is a relatively pristine area that is important as an area for both schools of juvenile deep-water fish and the species associated with the coral community. The existing and potential use of the area is primarily recreational.

Apra Harbor, another barrier reef located along the central-west coast, still represents important underwater resources. The outward appearance, however, is vitally different than seen at Cocos Island. The offshore Cabras Island and Luminao Reef have been linked and covered with surface development to form the Glass Breakwater. Apra Harbor is the only deep-water port on the island. As the major port area, it serves both the military and civilian communities. Being a strategic location and situated on major trade routes, the harbor is the focal point of the most sea traffic and transshipment in the Western Pacific. Industrial development, in this area, increases yearly to meet islandwide demands for imported supplies and energy development.

Natural shoreline configuration is generally represented by rocky coastline, sandy beaches, mangrove mudflats and river estuaries. The rocky coastline comprises 62% of Guam's shoreline. It is characterized by a waterline niche that is cut by algae, limpets and chitons.

The sandy beaches of Guam comprise a significant portion of the shoreline, 31%. They are sloping landforms composed of unconsolidated sand, gravel, broken shells, coral and foraminifera. They extend landward from the water's edge to a distinct break in the landform or to a point where terrestrial vegetation covers the substrate. They extend seaward as far as the sandy bottom is appreciably affected by the tide, currents and wave movements.

Mangrove mudflats are represented in only two locations on Guam. An extensive stand of mangrove species has been increasing in size along the inner shore of Apra Harbor. The other area of mangrove shoreline is along the extreme southern coastline between Merizo and Inarajan, along the inner shoreline of Cocos Lagoon. They assist in natural shoreline stabilization and represent an important ecological community.

Guam's shoreline is interrupted by numerous bays, most of which are associated with estuaries or river mouths. The surrounding river valleys and immediate edge of the river are wetland communities. A diversity of aquatic plant and animal species rely on the specific environment of estuarine areas. The constant inundation of water also makes these areas valuable for aquaculture development. Beach areas at river mouths are usually formed by a combination of reef material and riverine substances that originate from inland areas. Thus, beaches at embayments have a higher content of solid and organic material than the white sandy beaches.

G. Historical and Cultural Setting

Approximately 1500 B.C., the precontact Chamorros migrated from the direction of islands in Southeast Asia and established multiple chiefdoms. The island was territorially divided and individual royal families, who traced ancestry through a female line, ruled over the common people. The Chamorros flourished with an advanced fishing, horticultural and hunting society. A remarkable diversity of stone age tools, utilizing natural materials such as shell, bone, wood and fibers characterized their adaptive technology. Sporadic warfare among chiefdoms added to the characteristics of the lifestyle. Much cultural reconstruction, however, is speculative and based upon comparisons with similar Pacific cultures and the analysis of remains such as artifacts and skeletons or area features such as the latte stone house supports. From archaeological evidence, it is estimated that the population grew to 80-100,000 members or relatively the same number of people as inhabit the island today.

Ferdinand Magellan discovered Guam, for the Western World in 1521.

Rapid colonization by Spanish conquistadores followed, accompanied by a period of warfare, disease and missionization. The population rapidly declined and a Chamorro Mestizo culture emerged as Guam was established as a link in the early trade route between Mexico and the Philippines. The remaining population was centralized in Agana and barrios developed within the city. Many new customs were introduced from Spain, Mexico, the Philippines and other island groups. Major changes in technology took place with the introduction of steel. Ovens replaced underground firepits. Catholicism dominated beliefs in ancient spirits and new foods were introduced. There was a major shift from growing rice to growing corn. These changes happened so rapidly, that historical reports are scarce and brief.

During the Spanish Colonial Period, from 1521-1899, new styles of architecture appeared on Guam. Due to World War II and the effects of time, many original Spanish structures were destroyed and only remnants remain. They include Santa Agueda, Ft. Soledad, Plaza de Espana and Spanish bridges. The bridges, constructed of hand-hewn stones, are seen in Taleyfac, Taelayag, Sella Bay and Agana.

World War II, which added to the disappearance of many structures, left its own unique relics that now have historical value. Massive artillery, tanks and important battle sites and command posts add another link in the chain of events that lead to the present. Though the Japanese Occupation was relatively short-lived, its impact on the body of cultural knowledge and physical appearance of the island environment was profound. Many existing communities and land-use patterns have developed in response to infrastructure that was originally constructed to service military facilities. Communities such as Talofofo developed around civilian wartime camps. Many coastal areas, such as Agana and Agat had to be completely cleared of rubble and subdivided. Still other communities such as Santa Rita, developed as residents were relocated as a result of land acquisition by the U. S. military.

Presently, many people value the traditional architecture of southern villages and desire to retain their present appearance. Inarajan's historic district represents the last remaining major concentration of building styles and character with a prewar 19th century flavor. Though this adds to the scenic character of the island, many homeowners wish to improve their property and utilize modern building materials. Many areas of Guam reflect a period of technological transition from frame houses and tin roofs to typhoon-proofed, concrete-based structures. An increasing incidence of subdivision development denotes a trend toward insular neighborhoods and a western lifestyle.

Land-use patterns and trends affect over 100,000 residents, approximately half of which are of Chamorro Guamanian heritage. Throughout multiple phases of colonial heritage, the Chamorros have adapted to the pressures of introduced lifestyles. They still retain a body of knowledge concerning the island's traditional use of land and sea resources.

A traditional facet of Chamorro culture, the land tenure system, considerably affects the course of development. Within many families, there are multiple owners of property. When several heirs all own title to a single parcel of land, conflicting interests often necessitate non-development. Distribution of land to heirs can also encourage residential development, when for example, land may be in a prime agricultural district. Often, landowners all live together in a traditional extended family relationship. Several generations of relatives often reside in adjacent houses. The system of land ownership on Guam is typical of the Pacific. Since the Chamorro Guamanians have been exposed to varied phases of colonial dominance through the years, they have adapted land-use traditions as a countercheck against overdevelopment of land on a fragile sea-bounded island.

In Yona and Sinajana, two central communities on Guam, urban renewal has changed this style of living. Low-cost housing tracts and proposed urban renewal in other communities will enhance this urbanization process that changes social and economic patterns. Urban renewal and subdivision planning involves sensitive judgements as to whether extended family settings, shared outdoor cookhouses, and random traditional village appearances should yield to a more systematically planned and structurally sound environment. Land uses are importantly planned with maximum public input as developmental change sometimes poses a threat to the island's cultural diversity.

One such activity that is prevalent on Guam and must be considered in resource planning and management is fishing. There are few full-time fishermen today as existed in precontact times. In earlier years, a majority of residents were occupied full-time in fishing and its associated technology. With the introduction of industrially manufactured items and alternative employment, less time is spent in fishing. However, despite the decline in the number of full-time fishermen, there is still an abundance of part-time fishermen. A large volume of knowledge exists concerning local fish names, fish habitats and the use of a variety of traditional fishing methods, particularly net fishing.

As planning often denotes areas of preservation, the Chamorro culture also has traditional environmentalists that act in a conservation manner. These are the taotaomona or spirits of the island's ancient inhabitants. It is a widespread belief that the spirits live in the wild and bring illness upon those who would wantonly destroy part of the environment. They reward those who would respect their jungle and reef habitat with a good food catch. The spirits are believed to favor large banyan trees as their abode. Often, bulldozer operators will leave an area with a banyan tree untouched. This in itself is a factor thwarting development.

If it is felt that an illness is spirit-caused, the island resident may go to the traditional curers, known as suruhanos, for treatment with an ancient system of medicine. A central facet of the treatment is the use of medicinal herbs. The suruhanos and other residents have a tremendous store of knowledge concerning valuable medicinal flora. There is knowledge of the ethnobotanical value of plants in every plant community on Guam. Ethnobotanical use involves the use of an herb, weed, shrub, tree or vine for food, medicine or material culture. Some trees such as the coconut are used for multiple purposes. The establishment of

of districts and areas of particular concern on Guam, is not only essential for the maintenance of many endangered and threatened plants and animals, but preserves the cultural knowledge and identity of island residents.

III. POPULATION PROJECTIONS

A. Background

The changing population pattern of Guam is closely related to Guam's economic situation. These factors of population and economic conditions largely shape both the character of and resource demands placed on particular areas on Guam. Existing population data are imprecise, but are the only base upon which to make projections. These figures will continued to be revised until a sufficiently complete data base is established with which to make more definite projections. These figures will have to be revised further at the time of each census. Present data provides a range of projections which vary significantly. Figure 3 summarizes several of the population projections that are available. This range of population projections is comprised of series developed by: Quinton-Budlong, a firm contracted by the Government of Guam in 1972; Prof. Roy Chung, a research demographer at the University of Guam in 1970 and the Bureau of Planning. The projections developed by the Bureau of Planning in 1977 for land-use planning are being extensively used in related agency planning and generally considered to be the most functional, as limited information is available regarding the methodology used to develop the other series.

Table 1 — Selection of Population Projections, 1970 - 2000*

		<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>
1.	Chung (D) (no military)	85,380 (63,380)	105,400 (83,400)	126,000 (104,000)	165,400 (143,400)	206,660 (183,660)
2.	QB (B) (no military)	89,890 (67,890)	106,310 (84,310)	126,956 (104,956)	179,352 (157,352)	236,000 (214,000)
3.	Chung (C) (no military)	85,380 (63,380)	107,400 (85,400)	132,200 (110,200)	198,000 (176,000)	268,000 (246,660)
4.	BP L-USE (no military)		106,700 (84,700)			188,500 (167,500)

*Note: Parentheses () indicate that the constant 22,000 military population is not included.

Figure 3: SELECTION OF POPULATION PROJECTIONS

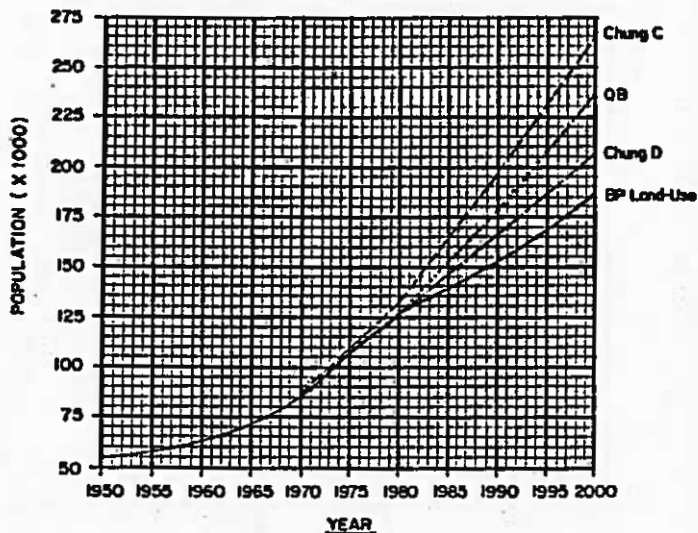
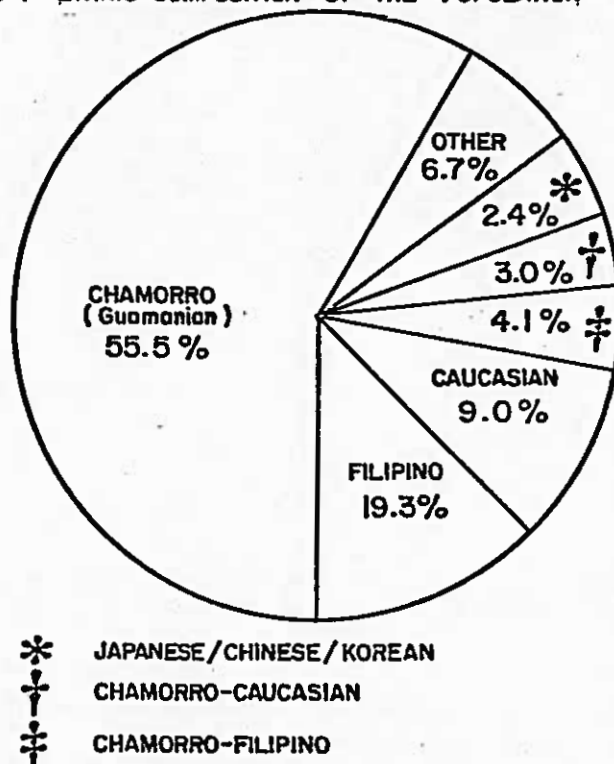


Figure 4: ETHNIC COMPOSITION OF THE POPULATION



Using aerial photos, completed in 1975, actual densities for recent housing developments, data relative to planned developments, as well as certain geographic constraints to development, the Bureau of Planning, in cooperation with several agencies developed area-specific growth projections. Population projections on a neighborhood scale within the community areas designated on Community Design Plans are shown in Appendix 2.

Table 2 - Summary of Municipality Growth Rates to the Year 2000*
(See Appendix No. 2 for Specific Community areas)

Municipality	Estimated Existing Population	Projected Population Year 2000
Umatac	700	1,600
Agana	1,094	2,550
Asan	1,440	2,700
Piti	1,570	2,645
Merizo	1,635	2,580
Inarajan	1,790	2,765
Agana Heights	2,125	4,000
Talofofo	2,155	2,675
Sinajana	2,545	4,750
Chalan Pago-Ordot	2,762	4,958
Santa Rita	3,200	5,050
Mongmong-Toto-Maite	4,022	5,100
Yona	4,098	8,460
Agat	4,230	9,450
Mangilao	5,694	19,482
Barrigada	5,818	11,474
Yigo	6,097	13,600
Tamuning	11,849	27,500
Dededo	21,877	36,250
TOTALS	84,701	167,589

*Does not include military personnel and dependents.

IV. LAND-USE DISTRICTS

A. Introduction

This section outlines the distribution of projected use of the land area of Guam by utilizing the mechanism of land-use districting and providing development guidelines for general land use. District definitions encourage optimal use within different land areas as the most general level in progression toward more specific land-use delineations. (See Land-Use Districting Map) Land-Use Districting Guidelines are set forth in E.O. 78-23.

B. Definition of Land-Use Districts

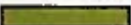
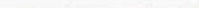
A land-use district is a land area identified by its development potential, existing characteristics and environmental restrictions or ecological complexity as being suitable for one of four general types of use: Urban, Rural, Agricultural, or Conservation.

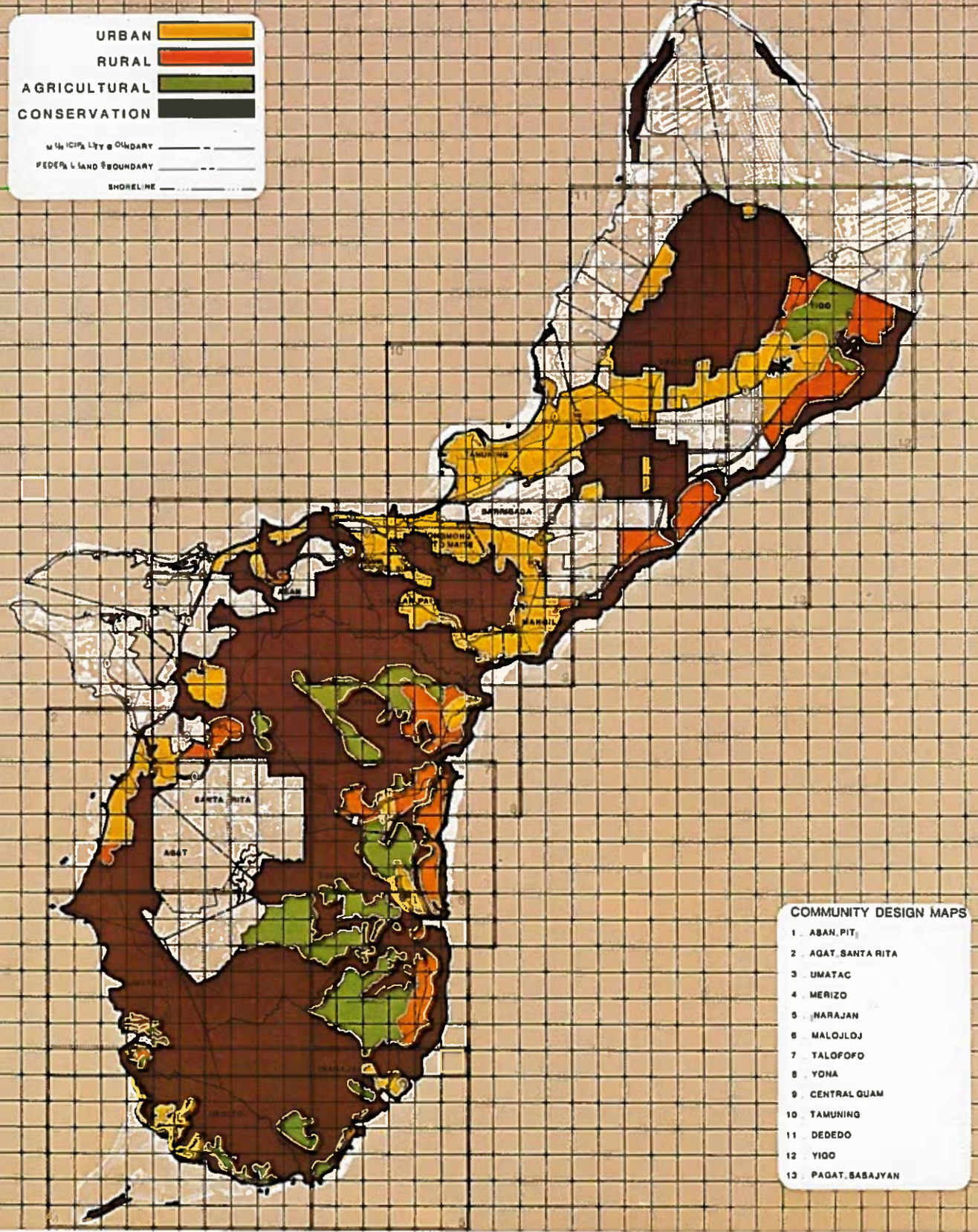
1. Urban

Urban districts include those areas characterized by and designated for higher concentrations of people, structures and streets, proximity to basic services such as sewers, water, sanitation, police and fire protection power and other major facilities and areas of high intensity use.

Unplanned Urban Form. The most striking characteristic of the urban pattern on the island of Guam has been the adoption of a random pattern of land utilization and building typology which has resulted in the misuse of land and an urban form unsuited for the whole of society.

Particularly evident is the lack of neighborhood design, since all design efforts are limited to the scale of single buildings. No improvement for the protection of scenic or aesthetic resources in

URBAN 
 RURAL 
 AGRICULTURAL 
 CONSERVATION 
 MUNICIPALITY BOUNDARY 
 FEDERAL LAND BOUNDARY 
 SHORELINE 



COMMUNITY DESIGN MAPS

1. ASAN, PITI
2. AGAT, SANTA RITA
3. UMATAC
4. MERIZO
5. NARAJAN
6. MALOJLOJ
7. TALOFOFO
8. YONA
9. CENTRAL GUAM
10. TAMUNING
11. DEDEDO
12. YIGO
13. PAGAT, BABAJAN

an urban setting can be undertaken unless urban development is conceived within the framework of responsible community design.

Any type of land development is expensive, however, there is substantial evidence that the economic costs are strongly affected by development patterns. In terms of total public and private investment costs to developers, occupants, taxpayers and local government, a study entitled Costs of Sprawl has found that a high density planned community costs 21% less than the combination mix community and 44% less than the low-density sprawl community. Figure 5 shows that sprawl is the most costly development pattern.

Urban Design. The urban design tools which allow for the protection of natural resources and a responsible human environment within developed areas, suited to a wide range of residents' needs include:

- . Block design or cluster housing instead of random single building design. This requires that the buildings in a given area be planned in a coordinated scheme.
- . Greater variety of building height in high-density districts.
- . Neighborhood density and neighborhood open space ratios.
- . Neighborhood view corridors.
- . Separation of traffic flow (bicycle, pedestrian, cars) at the neighborhood scale.
- . View corridors from densely built areas towards the ocean shoreline, or sloping terrain.
- . Integration of neighborhood parks with an urban network of green space pedestrian and bicycle lanes.

Planned urban form is based on human scale, community design and neighborhood organization. It provides for greater access to and protection of natural resources, greater energy saving and responsible, aesthetic and efficient development to meet human needs.

Figure 6: LAND-USE COST COMPARISON

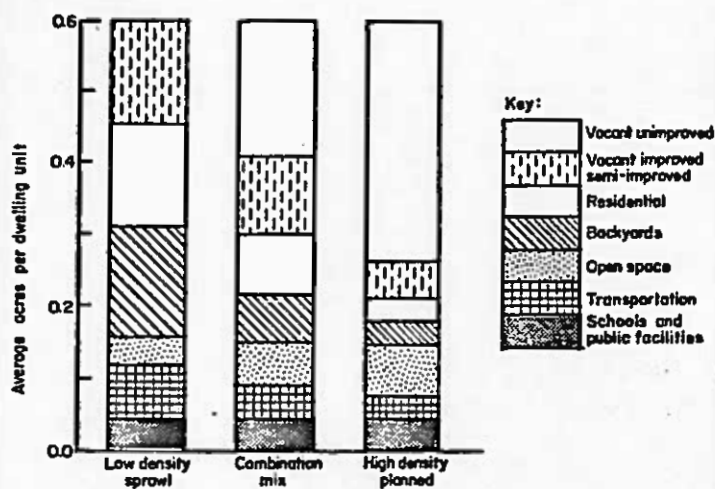
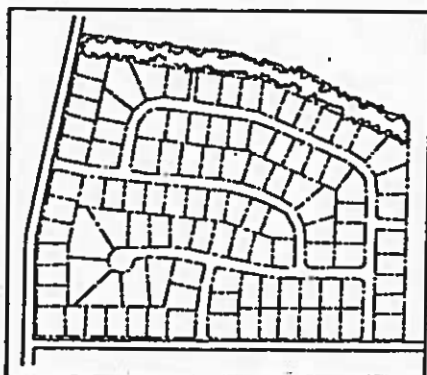


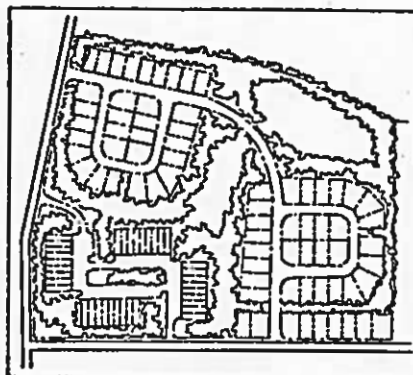
Figure 6 Comparison of Conventional Subdivision and Cluster Development.

CONVENTIONAL SUBDIVISION



Number of lots: 108
Open space: 10%
Linear feet of streets: 5,400
Linear feet of sewer lines: 5,400

CLUSTER DEVELOPMENT



Number of lots: 108
Open space: 50%
Linear feet of streets: 4,900
Linear feet of sewer lines: 3,900

Cluster Housing. Where possible, low-density residential development should be clustered to retain as much open space as possible. Cluster housing gives an area an aesthetic residential appearance as compared with the symmetrical arrangement of houses in rows and at right angles, where people tend to feel that they occupy one equal place in a rigid pattern of conformity. Even more socially, economically and aesthetically inefficient is random urban sprawl. Traditionally, urban development has randomly consumed vast amounts of land space, leaving little open space for recreation or ecology. This problem can be increasing number of subdivisions can only benefit from more carefully planned subdivision development that is both in the developer's and the public interests. (See Figure 6)

2. Rural

Rural districts include those areas composed of small farms mixed with low-density residential lots where urban-like concentrations of people, structures, streets and levels of services are absent. Rural districts may include those areas determined to be capable of adequately supporting services and population densities characteristic of urban districts in the future, but which are currently rural in character.

3. Agriculture

Agriculture districts include those areas characterized by the cultivation of crops, orchards, forage and forestry; farming activities or uses related to animal husbandry; services and uses clearly accessory to the above activities including, but not limited to, living quarters or dwellings, storage facilities, processing facilities and roadside stands for the sale of products grown on the premises; and open recreation facilities.

Agricultural Support. The delineation of agricultural districts has specifically been limited to land areas that are fairly level and contain adequate soil conditions. Soil data is concerned with depth, texture, drainage, stoniness, and fertility. The proximity to watershed areas (irrigation sources) enhances agricultural growth potential within individual district areas. Agricultural land, however, is kept at a buffered distance from major surface drainage, rivers or aquifer recharge areas due to the potential adverse effects of pesticides, fertilizers, and leachate from animal waste on water quality.

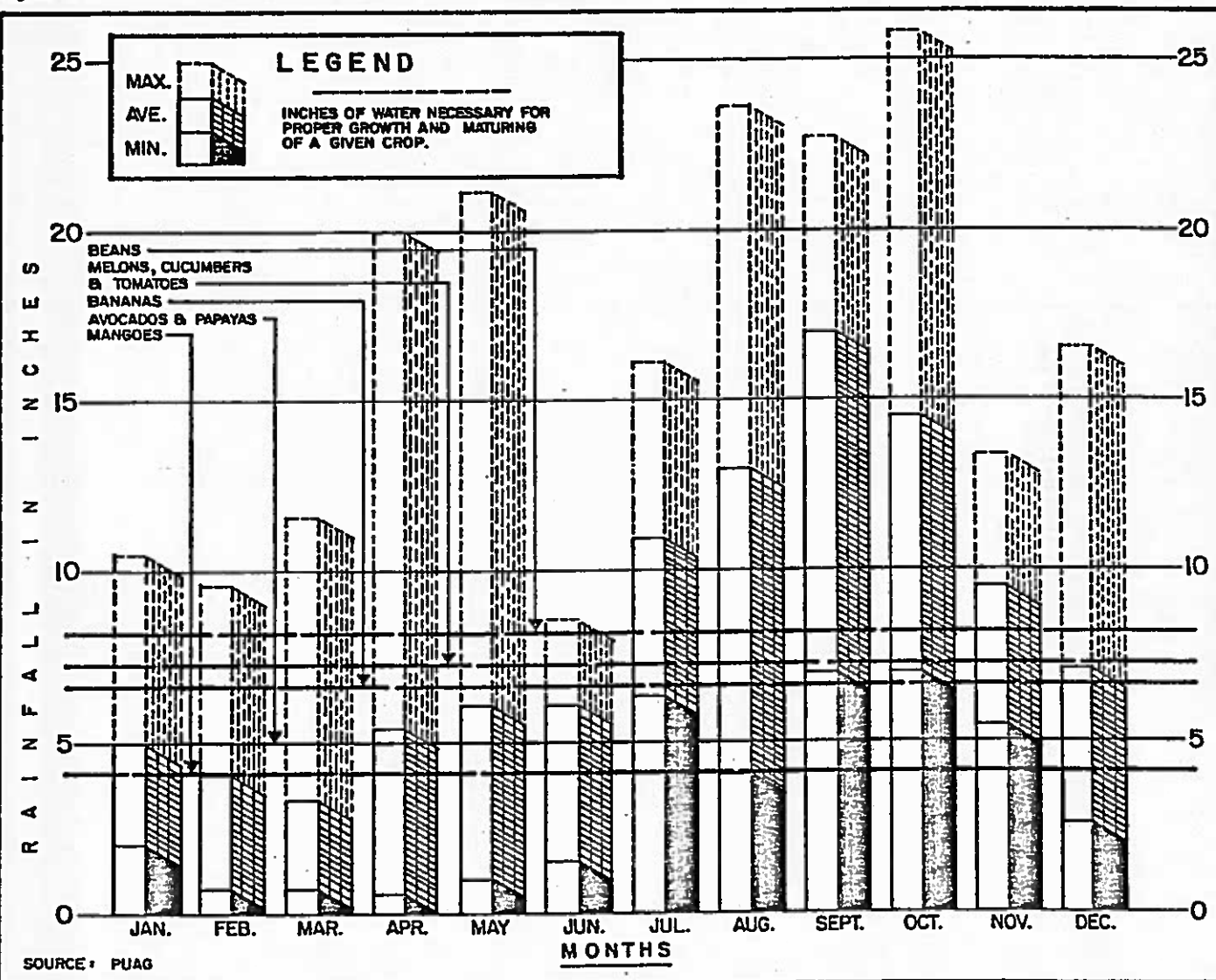
The major potential agricultural areas are in Inarajan, Malojloj and Talofofo. Smaller areas are in Yona, Merizo, Umatac. The only area of agricultural land in the northern half of the island is located in Yigo. Inland of Mt. Santa Rosa, soil that has developed as a result of the abrasion of volcanic material has been deposited in the areas between Lupog and Mataguac. The total amount of agricultural land that has been districted is approximately 15.5 square miles. With an island of 212 square miles of land surface, the potential agricultural land is roughly 7.3% of the island. This does not sound like much land, however, only a small amount is currently used for agricultural production and if preserved for agricultural use. With the designation of prime agricultural lands, the needs of farmers can be better realized by government agencies and private interests.

Three main factors are utilized in the delineation of agricultural districts. These are aerial photographs that depict topography, soil data, and climate. Land classification has been greatly facilitated by a set of aerial photographs that were taken in 1975. Aerial photos, with an overlay of contour lines, show such features as

slopes, rivers, and existing areas of cultivation. Lands that are level or gently sloping are well adapted for agriculture. The climate, mostly rainfall, is an important factor in agricultural development, as rainfall is not only needed for crops, but for the replenishment of watershed areas that are necessarily proposed for irrigation purposes. (See Figure 7). Soil data is the basic element in the delineation of agricultural land. The major source of soil data is the Military Geology of Guam, a document prepared by the U. S. Army Corps of Engineers in conjunction with the U. S. Geological Survey in 1959. There have been no exhaustive studies of agricultural land since this date, so this engineering soils study is the basic source of data. Soil data more specifically analyzes five soil characteristics:

1. Soil Texture. Texture refers to the proportion of sand, silt, and clay in a soil and affects the water-holding and nutrient retention properties, as well as workability of the soil. Medium-texture soils are most desirable for crops. Fine-textured soils can be desirable for wet crops such as taro. Coarse-textured soils such as coral sands are not suitable for crops unless excessive irrigation and fertilizer are used.
2. Soil Depth. Depth refers to the thickness of the soil layer that is available to the roots of plants. Deeper soils provide a larger volume of soil from which the plants can obtain moisture, nutrients, and anchorage.
3. Soil Drainage. Drainage refers to the rapidity and the extent of removal of excess water from the soil. Soils that are well drained are best suited for most crop production. Special crops such as taro and rice can be cultivated on poorly drained soils.
4. Stoniness. Stones in the soil profile or on the surface affect the use of the land, especially if tillage machinery is used. Rocks can hinder or prohibit the use of such machinery.
5. Soil Fertility. Fertility refers to the capacity of the soil to provide the required nutrients to the crop for optimum growth. Some lands require large quantities of fertilizer to maintain optimum crop yields. Soil tests are used to determine the degree of soil fertility.

Figure:7 MONTHLY RAINFALL FOR AN 11-YEAR PERIOD (1959-1969)



Agricultural Irrigation Needs. The availability of water is the most critical input that would enhance agricultural growth potential. Water of good quality is essential for all agricultural operations and some potential agricultural lands, do not have an adequate supply of water to meet irrigation demands during the dry season. Droughts are a common occurrence on Guam and, as indicated in the graph of rainfall, periods of minimum and sometimes even average rainfall are insufficient for the production of some crops. The graph was part of A Report Covering the Domestic and Agricultural Irrigation Water Supplies of the Island of Guam Which Indicates the Need for Conservation Areas. (See Figure 7). The report was prepared in 1970 by Austin, Smith and Associates, Inc., for PUAG. As the lengthy title suggests, watershed or reservoir areas are essential for agricultural growth. Reservoir and watershed sites have been proposed by the U. S. Army Corps of Engineers for the Umatac, Inarajan, Geus (Merizo) and Ugum (Talofofo) Rivers. The planning for the Ugum River Reservoir is furthest towards completion.

4. Conservation

Conservation districts include those areas necessary for protection of watershed and water sources, prevention of floods and soil erosion and preservation of archaeological, historic, scenic, and other natural and cultural resources; parklands, wetlands, beach and wilderness areas; areas necessary for conservation of endemic plants and animals; open-space areas which, because of their present use, natural condition or openness enhance the present or potential value of abutting or surrounding communities; areas of value for existing or future recreational purposes; agricultural preserves as defined under Section 12603 of the Government Code; and other permissible uses and related activities found not to be detrimental to conservation policies and objectives.

V. REVISED ZONING

A. Introduction

The present zoning code must soon be amended to include various mechanisms for the elimination of particularly offensive uses. Nationally, there is a growing recognition that unrestrained private use of land is not identical with the public good. As population density increases, so must controls over marginally legal uses of land, such that abuses by developers operating outside the law can be quickly identified and halted.

The zoning system presently in force (Residential R1 and R2; Commercial C0; Resort-Hotel H; Industrial M1 and M2; and Agriculture A) should be applied within designated urban, rural and agricultural districts as shown on the Land-Use Districting Map. Specifically, all zones except agriculture should be established within the urban district. A "limited" Residential (R1); and Agriculture (A) should be established within the rural district while the Agriculture (A) Zone should be established within the agricultural district. The conservation district should be managed by performance standards for specific subzones within conservation districts or a new Conservation Zone should be established.

Within this approach, zoning administration, including procedures for zone changes and variances, can remain in its present organizational framework.

B. Revision of Zoning Maps

A standard zoning map reflecting both the Land-Use Plan and Community Design Plans, must be prepared and put into effect by land-use related administrative and enforcement agencies. The Department of Land Management should continue to have the responsibility for maintaining the official zoning maps. Each change as it occurs should be placed on the official zoning maps. Further, a procedure for notifying agencies which should have an up-to-date zoning map must be instituted. In

addition, procedures for eventual changes in zoning designations must be developed.

There are certain areas, particularly in the commercial and industrial category, which are located in areas not suitable for the type of activity allowed. Any "downzoning" which takes place must avoid the "taking issue" (cases in which the owner could claim that the government is arbitrarily and capriciously preventing the highest and best use of the land.) This can be avoided through such mechanisms as land trading or amortization of capital investment in an existing land use after a certain period of time, but after that, an owner could be reasonably required to discontinue the use without payment of compensation.

VI. AREAS OF PARTICULAR CONCERN (APCs)

A. Introduction

An area of particular concern or APC is a term applied to specific geographic area where either natural resource values, geologic constraints or hazards play an important role in determining the capability or suitability of the land for particular uses.

The purpose of the APCs is to provide an additional management capability to ensure responsible development in areas either having a high degree of environmental sensitivity or that are, or will be, subject to intense development pressures in the near future.

Designation of areas of particular concern through a Land-Use Plan is not simply a method of identifying areas where no growth should occur. The purpose of a designation is to call attention to the importance of the area designated. In many cases, it will be possible to permit development which is regulated so as to be compatible with the basic environmental or renewable resources values or safety problems of the land in question. While it is true that uncontrolled or incom-

Figure No. 8 Priorities of Use Within Existing and Proposed Areas of Particular Concern

	APC	Use Classifications and Specified Activities																													
		Open Space (a)	Wildlife Reserve (a)	Special Habitat/Conservation	Camelaria	Water and Wetlands	Portals	Historic Transportation	Historic Preservation (a)	Cultivation (a)	Grazing (a)	Aquaculture	Low Density Residential	Medium Density Residential	Hotels and Resorts	Commercial Activities	Light Industry	Heavy Industry	Specific Activities	Dredging/Filling (b)	Dams	For Reclamation and Rehabilitation	Mineral Extraction	Marines	Clearing/Grading/Filling	Blasting	Energy Facilities	Discharges/Point Source	Commercial Forestry	Restoration (a)	
g	Mineral Extraction Sites (a)	2	2	3	3	2	2	1	2	2	2	3	3	3	3	2	2	1	3	3	NA	1	NA	1	1	2	2	2	1		
	Industrial and Commercial Support Areas (a)	2	2	3	2	1	1	1	2	2	2	3	3	3	2	1	1	1	1(c)	NA	1	2	1	1(c)	1(c)	1	2	2	1		
	Urban Waterfront (a)	1	1	2	2	2	1	1	2	NA	2	2	2	2	2	2	3	3	2	NA	2	3	2	2	2	3	2	NA	1		
e	Air Installation Compatible Use Zones (AICUZ)	1	1	3	1	2	1	1	1	1	1	2	2	3	3	2	2	2	NA	NA	1	1	1	2	2	2	2	1	1		
	Flood Hazard Areas	1	1	3	3	2	1	1	1	1	1	2	3	3	2	3	3	3	2	2	2	2	2	2	2	3	2	1	1		
	Slide and Erosion Prone Areas	1	1	3	3	3	1	1	2	1	NA	2	2	3	2	3	3	2	NA	2	NA	2	NA	2	2	3	3	2	1		
	Seismic Faults	1	1	3	1	2	1	1	1	1	2	2	2	3	3	3	2	2	2	3	NA	2	NA	2	2	3	2	1	1		
	Pristine Ecological Communities (Terrestrial)	1	1	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1		
	Critical Habitats	1	1	3	3	3	1	1	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1		
f	Limestone Forests	1	1	2	3	3	1	1	3	3	NA	3	3	3	3	3	3	3	NA	NA	NA	3	3	3	3	3	3	3	1		
	Wetlands	1	1	3	3	3	1	1	2	2	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2	NA	1		
	Karst Topography	1	1	2	2	2	1	1	1	1	1	2	2	3	3	3	3	3	NA	3	NA	3	NA	2	3	3	2	NA	1		
	Pristine Ecological Communities (Marine)	1	1	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	NA	1		

LEGEND:

1	HIGH PRIORITY
2	LOW PRIORITY
3	UNACCEPTABLE (d)
NA	NOT APPLICABLE

NOTES:

- (a) Certain uses such as open space, parks, conservation, cultivation, reforestation, etc., while not a "high priority" use within Development oriented APC's are certainly acceptable and encouraged within multiple use development plans and upon termination of the specified activity. Such post-development use is included in the "Restoration" activity category.
- (b) Dredging and filling means water related dredging and filling on the same site. "Filling" alone is covered under, "clearing, grading, filling."
- (c) Uses are necessary but not encouraged as "high priority."
- (d) Exception permitted only for facility in which an overriding national interest can be demonstrated. (15 CFR 923.52)

e. Officially designated by Executive Order No. 78-20

f. Officially designated by Executive Order No. 78-21

g. Officially designated by Executive Order No. 79-12

patible development would result in significant damage to the environment, life, or property, or the long-term public interest, it is equally true that some acceptable way to develop or use many such areas can be found; others must remain virtually unused or unoccupied if their values are to be preserved. (See Figure 8)

B. Intensive Development Areas

1. Mineral Extraction (See Map No. 2)

Synopsis. Comprised primarily of limestone, sand, and a potential of limited hard volcanic aggregate deposits, the island's mineral deposits have already been significantly developed. Major extraction activities are presently located on the northeast coastline of the island. Illegal extraction of beach sand from several areas is slowly being halted.

Envisioned Development. Producers, supplies of limestone and sand are adequate to meet the island's needs for the next 20 years without significantly expanding extraction operations to other areas of the island. Short-term operations such as repair of the Glass Breakwater, using the Cabras Island, quarry, can be expected. The Department of Public Work's Skid Reduction Program is engaged in an analysis of potential extraction sites for hard aggregate (basalt) in the southern part of the island. Initial geologic investigations of volcanic aggregate resources are encouraging in relation to the occurrence of a superior grade of unweathered basalt in the Northern Marianas (Pagan Island).

Performance Guidelines. The following guidelines indicate:

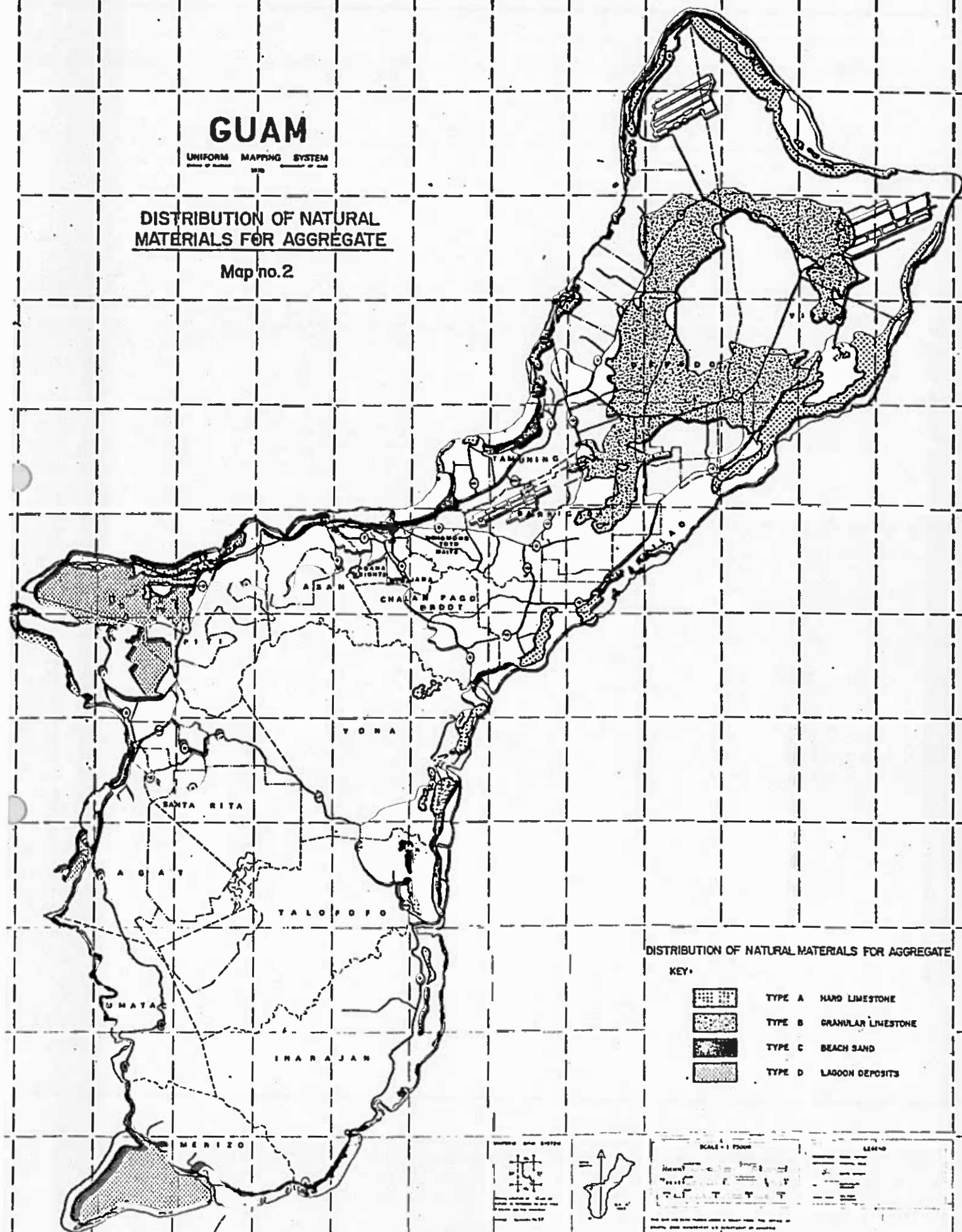
- . Existing extractive activities shall adhere to air, water quality, and erosion-sedimentation standards established by GEPA.

GUAM

UNIFORM MAPPING SYSTEM

DISTRIBUTION OF NATURAL MATERIALS FOR AGGREGATE

Map no.2

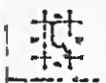


DISTRIBUTION OF NATURAL MATERIALS FOR AGGREGATE

KEY:

- TYPE A HARD LIMESTONE
- TYPE B GRANULAR LIMESTONE
- TYPE C BEACH SAND
- TYPE D LAGOON DEPOSITS

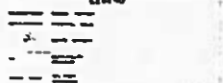
UNIFORM GRID SYSTEM



SCALE - 1:50000



LEGEND



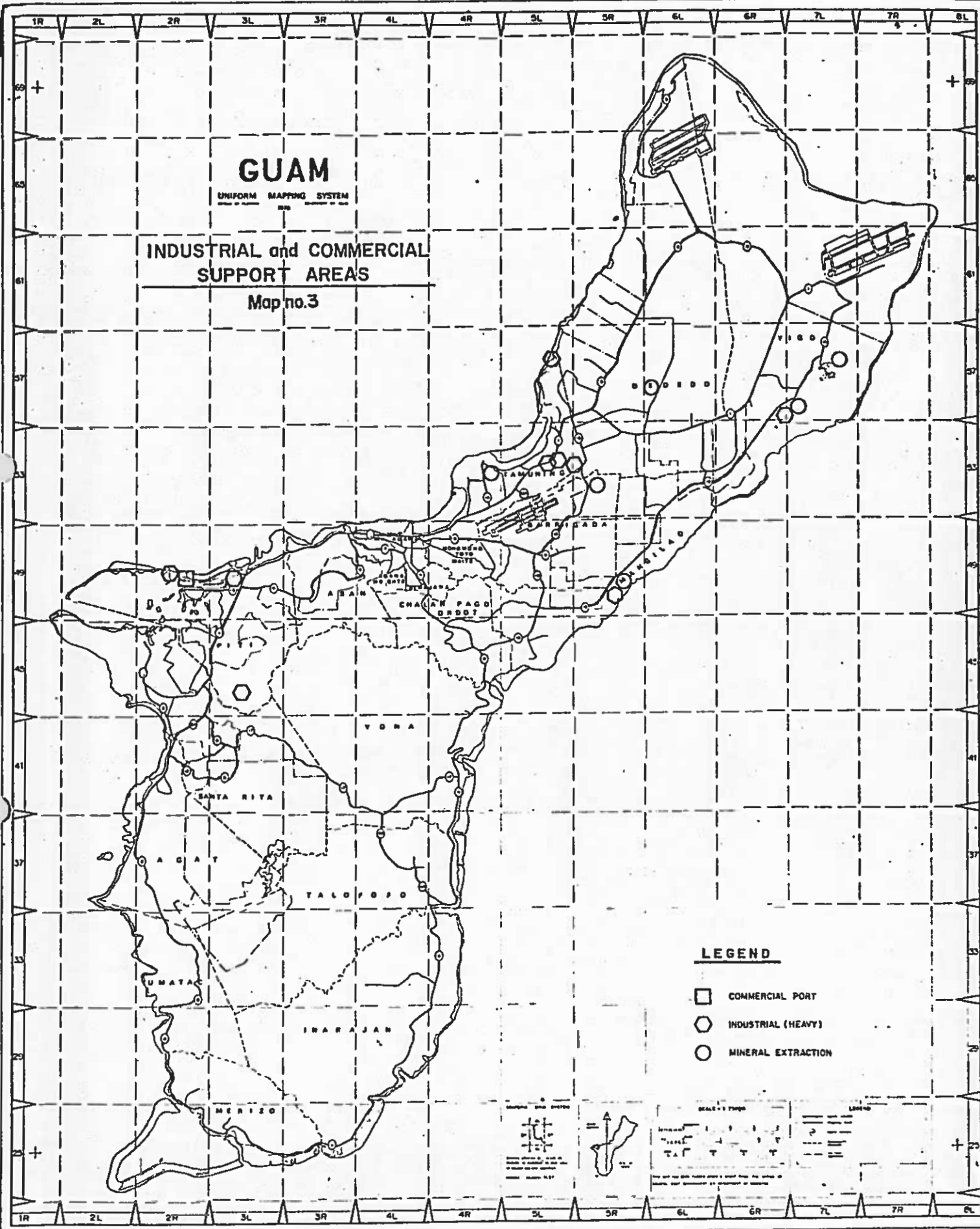
THE DATA AND DATA SOURCES USED IN THIS MAP ARE THE PROPERTY OF THE UNITED STATES GOVERNMENT AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.

2L 2R 3L 3R 4L 4R 5L 5R 6L 6R 7L 7R

- . Major new development of mineral extraction sites shall be closely evaluated relative to impacts on existing landforms, adjacent land use, and shall be designed to minimize adverse aesthetic impacts.
- . Actual extraction shall be undertaken in a pattern such that once the land is no longer in extractive use, it will be suitable for urban development or open space use, e.g., terracing for a residential subdivision use vs. a hazardous and unsightly pit.
- . The economic feasibility of proposed mineral extraction sites shall be closely examined such that a project will have a definite probability of success before land is irreversibly committed for that purpose.
- . Lands proposed for high-population-density or urban-like development shall not be committed for extraction purposes unless such action would be directly compatible with the proposed urban development.
- . Lands having significant ecological, historical, agricultural, or aesthetic values shall not be used for extraction purposes unless the developers can prove that no alternative sources exist as well as proving that the proposal is vital to the health and welfare of the entire island.
- . Beach strand mining for sand according to Government Code and/or Executive Order shall no longer be considered an acceptable use of the shoreline whether or not the resources are located on private property.
- . All coral or other dredging operations, below the Mean High Water Mark, shall fully adhere to existing local and federal statutes and minimally require an approved EIA before commencement of any operation.

2. Power Production and Transmission Facilities (See Map No. 3)

Synopsis. Cabras Island will, in all probability be the site for future power production facilities. The existing Government of Guam site has sufficient land area for two additional steam plants. Thereafter the adjacent site of the existing Piti Plants can be utilized as the present production facilities will probably be going off-line in 1994. Considerations of alternative production methods such as ocean thermal energy conversion, solar, wind generation and low-head hydroelectric are also being considered.



GPA's present land holdings are adequate for expansion of bulk fuel oil storage tanks adjacent to the existing pair of 268,000 gallon tanks. Additional tanks will be required at the time Tank No. 4 is programmed for installation at the Cabras Site. According to the study, no major changes or additions are required for fuel oil delivery, or transfer of pipeline systems for power plant fueling needs up to the year 2000. The existing 115KV transmission line and planned expansion will provide adequate voltage for Guam's power needs to the year 2000. Right-of-way widths depend on a conductor configuration which will probably remain in a two-circuit, vertical configuration (100 feet or greater) depending upon the span and height of the towers. Future emphasis in power transmission line developments should be on underground burial of lines in relation to visual aesthetics, or routing lines away from scenic vistas. Economic cost, however, is a major obstacle facing underground placement of facilities.

Performance Guidelines. Performance standards for sites of production facility development will be based on the following guidelines:

- . Commercial Port or other private enterprise location shall not interfere with projected area requirements for future energy facility location or around the present Piti or Cabras units.
- . Applicable local and federal standards for air and water quality shall be strictly enforced.
- . Impacts of thermal discharge (cooling water) into the Piti Channel shall be lessened, with future units disposing of heated water into the ocean rather than the harbor.
- . The water area adjacent to the existing production and storage facilities shall remain open to public access, and GPA planning shall encourage multiple-use, especially recreational boating, anchorage, etc., within these water areas, and replacement of any access or damaged facilities incurred in the process of expansion.

- . Any proposed dredging activities shall be carried out in such a manner as to minimize siltation damage to surrounding marine communities. Silt screens as well as proper timing of dredging activities shall be implemented in conformity with erosion control and water quality standards enforced by GEPA.

3. Commercial Port (See Map No. 4)

Synopsis. The Port Authority of Guam is located on Cabras Island and occupies 33 acres deeded to the Government of Guam by the Navy. The present land area, and 2,700 linear feet of pier are totally inadequate for present activity which, over the last three years, has averaged around 700,000 tons of cargo off-load per annum.

Envisioned Expansion. Plans for expansion include:

- . Development of additional container handling space.
- . Improvement of the Cabras Island access road.
- . Development of additional docking space.
- . Relocation of Yacht Club facilities.
- . Erection of additional warehousing and storage facilities.
- . Development of fish processing facility (cannery).
- . Development of a tuna transshipment facility.

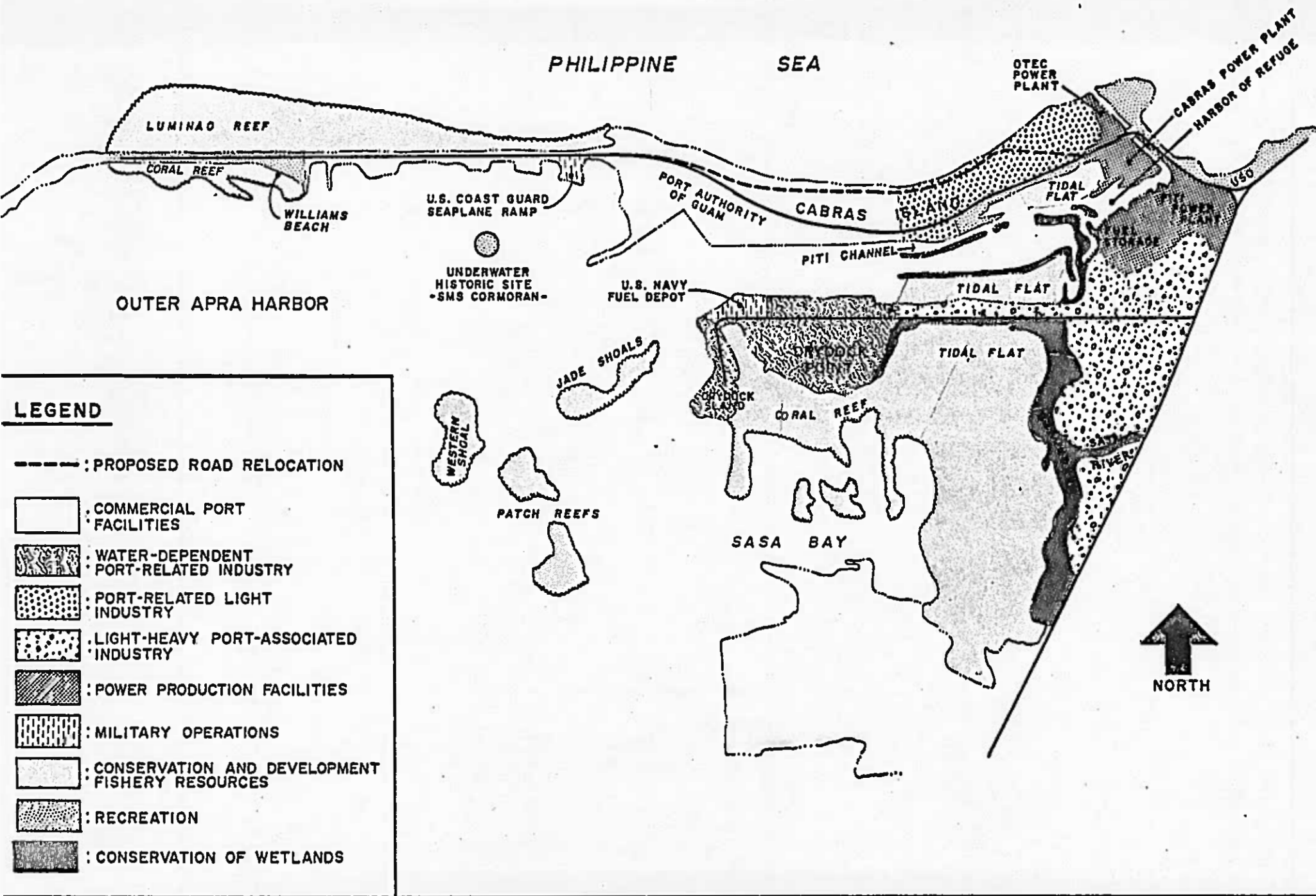
Details of envisioned developments are found in the Port Authority's Economic and Land-Use Plan for Cabras Island and Surrounding Area.

Performance Guidelines. Performance standards for development or port facilities will be based on the following guidelines:

- . Applicable local and federal air and water quality, sedimentation and erosion standards shall be strictly enforced.
- . Environmental Impact Assessments will be required for all major developments directly affecting fresh and marine waters and associated flora and fauna; addressing the social, economic, and environmental effects of proposed development.

OPTIMAL LAND-USE PLAN FOR CABRAS ISLAND AND SURROUNDING AREAS

Map no. 4



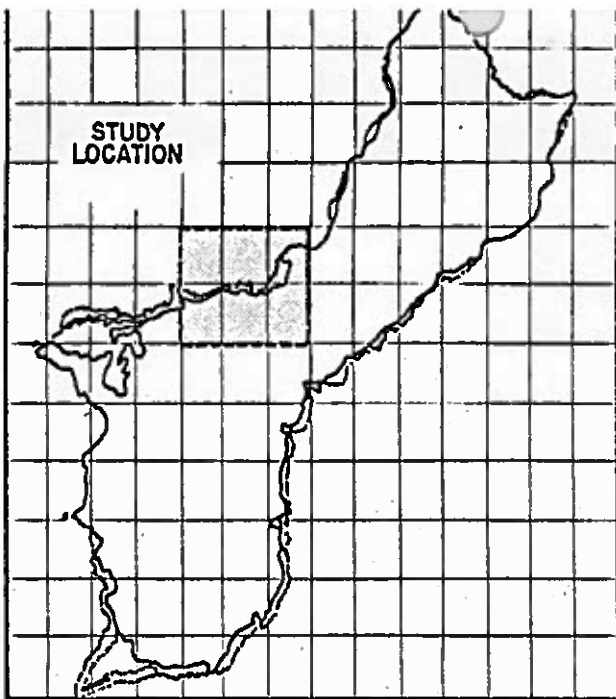
- . An adequate system of prevention and immediate reaction to potential oil or other toxic spills shall be implemented to deal with increased activities within the port area.
- . Construction activities shall be carried out in such a way as to minimize the damage to the environment, historic sites, or existing recreation areas.
- . Land alteration and construction practices shall include provisions of screening by landscaping of objectionable or unsightly industrial activities from public rights-of-way and any adjacent recreational areas which may be adversely impacted upon by such development, as well as replacement or relocation of public-use recreational facilities altered or destroyed as a result of expansion activities.
- . Provision of unrestricted public access to areas within the port such as the Glass Breakwater, Luminao Reef, and beach and boating facilities will be required.
- . A park or multi-recreational facility shall be retained for public use west of the present Hotel Wharf including Glass Breakwater, the adjacent beach, and Luminao Reef.

4. Agana Bay Urban Waterfront (See Map No. 5)

Synopsis. The 3.1-mile inland boundary of the Agana Bay Urban Waterfront is bounded by Marine Drive. The southern extreme is Adelup Point, not including the school to the northern portion of Agana Bay, which is visible from Marine Drive in Tamuning, not including the residential use of the Dungca's Beach-Sleepy Lagoon-Adelup Cove area. The land-use problems associated with an unsightly and incompatible mix of commercial, industrial, residential uses are of primary concern.

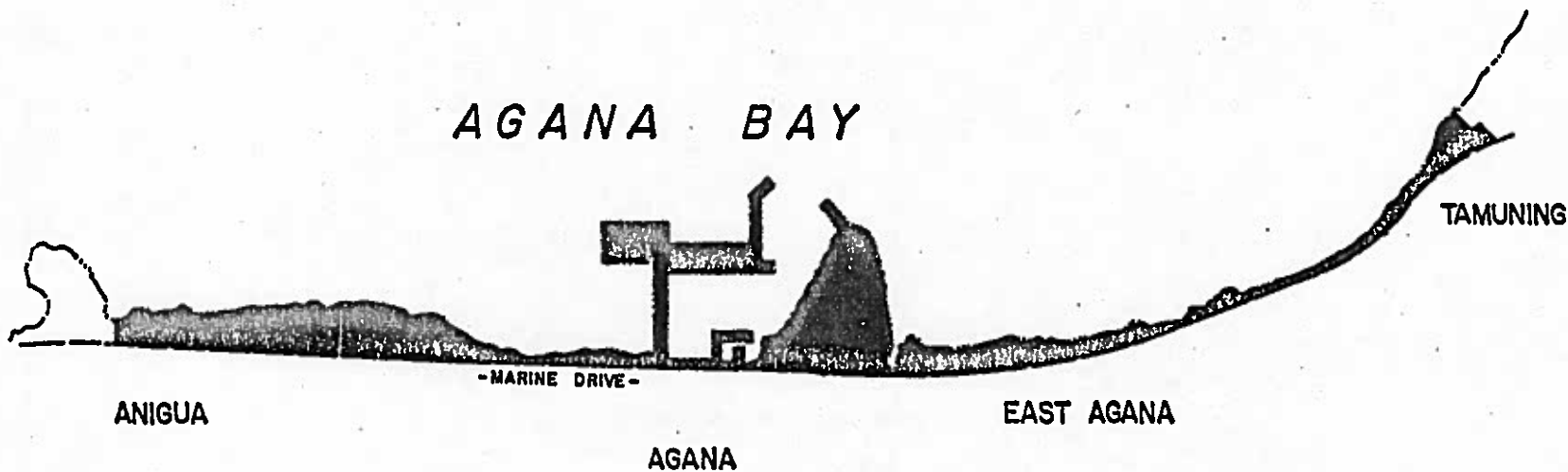
The Agana Bay Urban Waterfront has been identified as being highly blighted with a complexity of problems including:

- . pollution sources
- . restricted public access
- . flood prone conditions



AGANA BAY URBAN WATERFRONT

Map no. 5



URBAN WATERFRONT

- . lack of architectural design and substantial structures
- . poor landscaping
- . insufficient recreational facilities and space
- . insufficient parking and transportation problems
- . public health hazards
- . fragmented lot system
- . improper zoning and incompatible land use

Due to the many problems facing Agana Bay and its increasingly blighted condition, the Bureau of Planning's Guam Coastal Management Program, coordinating with other local agencies, drafted the Agana Bay Urban Waterfront Redevelopment Plan. The Governor, through Executive Order No. 79-12, created a multi-agency Urban Waterfront Task Force to implement the plan towards clearing up many of the existing problems. The Plan stresses compliance with legal land-use, health and environmental controls and presents action-oriented strategies to alleviate those problems that cannot be solved with legal solutions.

C. Land Conservation Areas

1. Wetlands (See Map No. 6 and Fig. 9)

Synopsis. Wetlands are unique components of the island ecosystem. They are the swamps, marshes, mangroves, and river valleys. These are areas that are constantly inundated with water and provide a wildlife habitat for aquatic species of plants and animals. Many wetlands also act as a source of freshwater supply or assist in recharging the aquifer. They primarily provide a nursery ground for many juvenile species of animals until the organism reaches a stage of growth when it can venture into another ecological niche. Wetlands are one of the most biologically productive areas on the island. They provide aesthetic scenery and are valuable

GUAM

UNIFORM MAPPING SYSTEM

WETLANDS

Map no.6

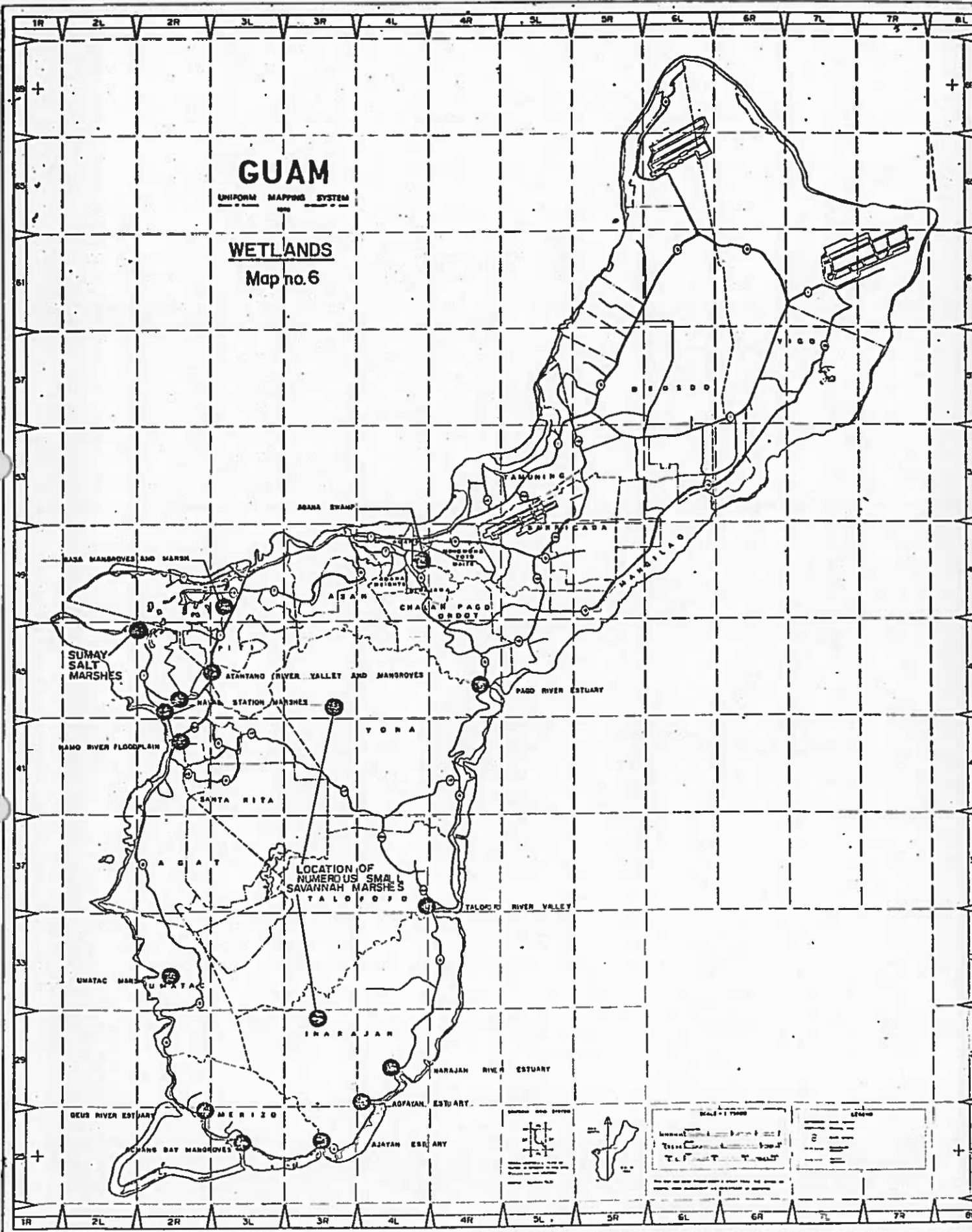
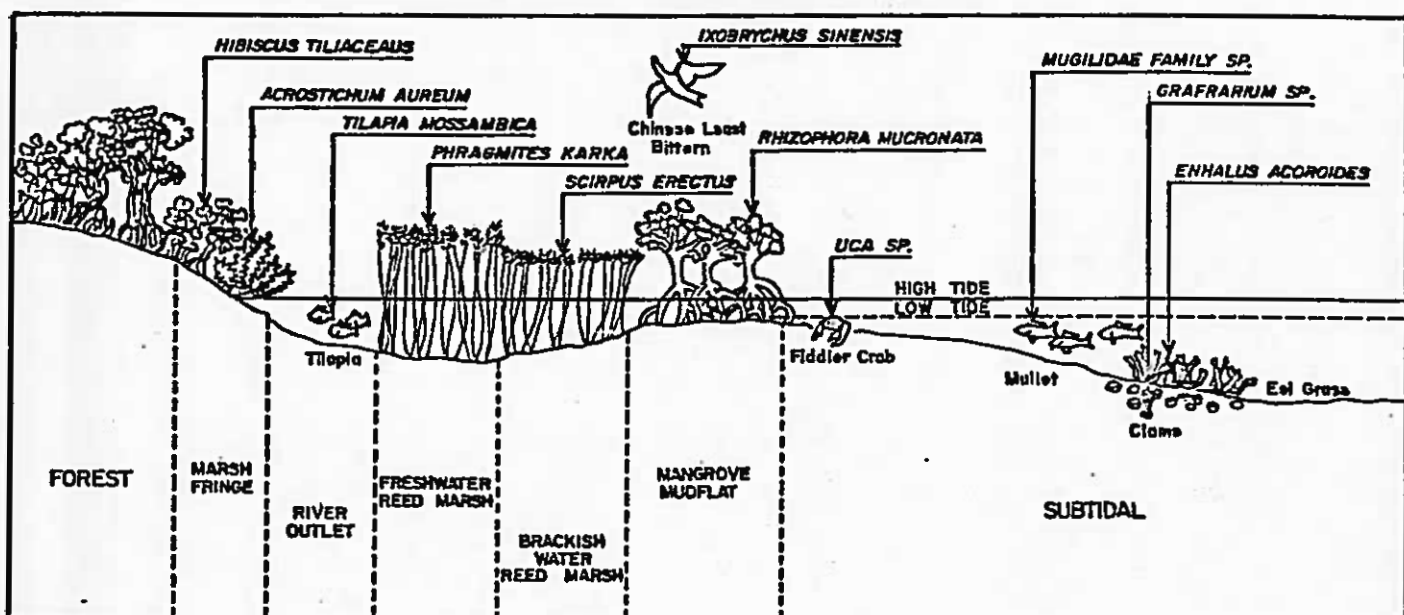


Figure 9: CROSS-SECTION OF THE SASA BAY WETLAND



locations for scientific research or sensitive aquaculture development.

In areas at the coast, there is a transition from freshwater to saltwater wetlands with zonations of vegetation delineating the changes in salinity. A diversity of plant life is found in these areas, many species of which assist in maintaining the balance of the habitat, supply nutrients to the water and have ethnobotanical values as food, medicine, or material culture. Wetland areas are often in floodplain areas and absorb excess overflow from rivers during periods of excessive rainfall. The mangrove fringe, represented in only two major locations on Guam, is not only an ecological habitat, but also functional as a shoreline stabilization mechanism which prevents erosion during periods of stormwave inundation. Mangroves are particularly resistant to typhoon force winds. Numerous small reed marshes exist in inland savannah areas where surface drainage is slowed by a level area of topography. Savannah marshes are mostly found in the Dandan, Sigua and Umatac areas. Some unique salt marshes can also be seen at Sumay on federal lands. These small savannah and salt marshes can best be identified by on-site field inspection.

The following performance standards were prepared by the Guam Coastal Management Program. They are a part of the Wetlands Rules and Regulations, mandated by Executive Order No. 78-21 and promulgated by the Territorial Planning Commission, effective October 1, 1978.

Performance Standards

- . All development within a wetland APC shall comply with all air and water quality, erosion and sedimentation control standards and other applicable pollution standards as promulgated by the Guam Environmental Protection Agency.

- . Wetland acreage shall not be reduced by filling or dumping material over submerged areas unless issued a Wetland Permit by the Commission.
- . Wetlands shall not be graded, dredged or subject to removal of large areas of productive plant life unless issued a Wetland Permit by the Commission.
- . The flow of water within or into wetlands shall not be altered so as to adversely effect the wetland by blocking or channelizing rivers (within or upstream from the wetland) or tidal flow or reducing natural spring discharge unless issued a Wetland Permit by the Commission.
- . Any development which substantially increases the potential for damaging flooding of properties within or adjacent to the wetland shall not be permitted within a wetland APC.
- . Development of any structure subject to damage, or posing a health or safety threat to the public or the wetland environment, due to flooding of the wetland shall not be permitted within a wetland APC.
- . Any developments, including aquaculture facilities existing within wetland APCs, at the time rules and regulations for wetland APCs are promulgated, do not require a Wetland Permit for existing use and structures, and are not subject to restoration requirements.
- . Proposed aquaculture operations, expansion of existing aquaculture operations and/or reactivation of aquaculture sites within wetland APCs shall require preparation of an EIA prior to issuance of a Wetland Permit by the Commission.
- . Proposed ponding or storage facilities, industrial, residential or commercial development may be permitted within wetland APCs only upon a finding by the Commission that no feasible alternative sites exist and that such development is dependent on location within a wetland.
- . Passive recreational and educational uses and structures such as unpaved foot trails, interpretive signs, elevated walkways, portable tables, etc., within wetland APCs shall not require Wetland Permits, but shall be subject to applicable Department of Parks and Recreation rules and regulations and Department of Agriculture hunting regulations.
- . Hunting, removing or otherwise disturbing threatened or endangered wildlife or plants within wetland APCs is prohibited unless such actions are in compliance with the rules and regulations of the Department of Agriculture and such actions are essential to the health, safety, and welfare of the general public and alternative actions are not feasible. Removal of small amounts of non-threatened or non-endangered wildlife for non-commercial home consumption or medicinal use does not require issuance of a Wetland Permit.

2. Terrestrial Pristine Ecological Communities (See Map No. 7)

Synopsis. These are the most undisturbed representatives of the specific habitats known as the limestone forest, ravine forest, savannah, coastal strand, and wetlands. Though each of these areas has its own performance standards, the most scientifically valuable representative requires a more strict control of permissible uses in order that it be preserved for the study of its unique ecology. Ecology is the relationship between the plants, animals, and natural features of an area. Being the least developed, they are usually the most aesthetically pleasing or beautiful examples of the different natural communities. Pristine ecological areas often contain the highest incidence of endangered and threatened species of plants and animals. These are species that are in immediate danger of extinction or would reduce to a critically low number if adverse land uses were permitted to operate.

3. Wildlife Refuges

Synopsis. Pristine ecological communities, delineated through ongoing research, often overlap with other larger, unique wildlife habitats. As pristine areas are more specific in location, the the larger Government of Guam Conservation Areas are maintained for the preservation of large tracts of wilderness land. They are precisely delineated on the Community Design Plans as wildlife refuges.

4. Critical Habitats

Synopsis. Even more expansive are critical habitats for most resident birds. The majority of bird species on Guam are threatened or endangered and the Division of Aquatic and Wildlife Resources

GUAM

UNIFORM MAPPING SYSTEM

TERRESTRIAL PRISTINE ECOLOGICAL COMMUNITIES

Map no. 7

URUNO BEACH
LIMESTONE FOREST

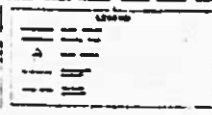
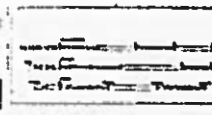
N.C.S. FRESHWATER
POND AREA

TARZAN FALLS
RAVINE FOREST
AND SAVANNAH

SELLA, AND
CETTI BAY
COASTAL
STRAND

DANDAN
MARSH

INARAJAN



is delineating critical habitats for possible consideration by Federal fish and wildlife regulations. Critical habitats are the natural areas where particular species find the requirements for survival and protection from predators. The largest areas to be proposed may include much of the limestone forest around the northern coastal cliff lines. The Fena Reservoir area, Orote Peninsula, and Cocos Island may be additional proposed critical habitats. For example, Orote Island is the only nesting site on Guam for the brown booby and the ironwood trees on Cocos Island provide the nesting site for white fairy terns.

5. Limestone Forest (See Map No. 8)

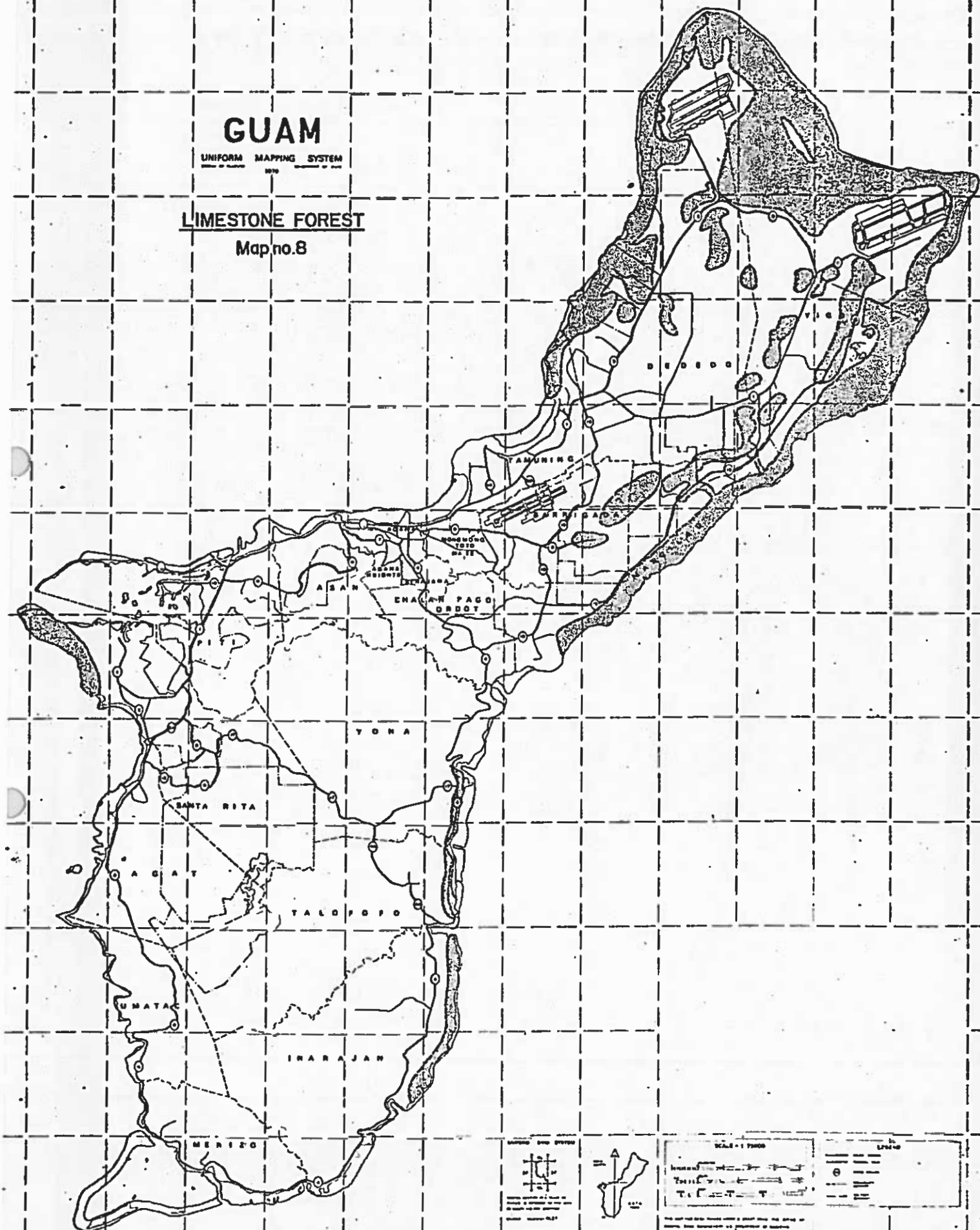
Synopsis. The limestone forests of Guam are so named because they grow in minimal soil upon the northern limestone plateau, Orote Peninsula, and areas of the southern coastline. They are a finite resource as land development has cleared many forested areas. Unlike mainland forests, reforestation is not possible because introduced "invader" species of vegetation prohibits the re-establishment of native flora. Limestone forests are characterized by native trees that provide a shaded canopy over understory shrubs, herbs, and lianas. Numerous epiphytic ferns, mosses and orchids cover the rocks and larger trees. Due to periodic typhoons, the limestone forest never reaches a climax stage of maximum growth potential. The importance of forested areas is multiple when weighing the public benefits of preservation and developmental needs. They provide a wildlife habitat for many unique and endangered species of plants and animals. They also provide an area for collection of medicinal plants and edible animal life such as the popular coconut crab. As an aesthetic resource, they are valued for hiking, nature observation and scientific investigation. Of less visibility,

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UNIFORM MAPPING SYSTEM
1970

LIMESTONE FOREST

Map no.8



but not of less importance, much of the limestone forest lies over areas of the water lens system. Surface runoff is negligible and natural areas inhibit the infiltration of pollutants that are associated with urban development.

Performance Guidelines. The performance guidelines for the latter four described types of unique terrestrial ecosystems are kept at a general level because the degree of preservation is different depending on the nature of an individual area and many areas overlap.

As unique, fragile, and valuable wildlife habitats, these are generally reserved for limited recreational or scientific uses.

Urban, rural (medium-high density) uses will not be encouraged.

- . Medium-high density and agricultural uses, adjacent to these areas, must be sensitively planned to avoid spillover impacts. It is recommended that an openspace buffer zone be maintained adjacent to pristine ecological communities.
- . Infrastructure development within pristine communities and wildlife refuges shall be limited to minimal access roads, up to but not entering, the area. Transmission lines, lighting, signs (other than trail identification markers), and any off-road vehicular traffic (jeeps, cars, trucks, motorcycles) shall be prohibited within pristine communities and wildlife refuges.
- . Disposal of solid waste (dumping and littering) within all unique terrestrial ecosystems shall be prohibited. Planned placement of trash receptacles along hiking trails is encouraged. While solid waste disposal is regulated on an islandwide basis, it is especially critical in these areas. Discharge of pollutants into all water resources shall be prohibited in all unique terrestrial ecosystems.
- . Plant, animal, or rock collection shall be prohibited in pristine ecological communities and wildlife refuge habitats, except for scientific or educational purposes.
- . Collection of plants for medicinal, food, or other purposes is permitted as a cultural activity within areas of the limestone forest and proposed critical habitats that are not protected as government-owned wildlife refuges.

- . Hunting within critical habitat areas and the limestone forest shall adhere to regulations established and enforced by the Division of Aquatic and Wildlife Resources and shall not be permitted within pristine ecological communities.
- . Hiking trails, steps, and benches, etc., if required, shall be planned and maintained to discourage the proliferation of excessive trails and off-trail hiking within pristine ecological communities and wildlife refuges.
- . Reforestation and related restoration activities are encouraged in erosion-scarred or other damage areas of natural terrain that are within unique terrestrial ecosystems.

6. Unique Geological Formations

a. Karst Topography

Synopsis. Karst topography consists of areas where limestone solution of uplifted reef coral is so extensive that large holes, crevices, and craggy geological configurations are at a surface level. Human habitation of these areas is a safety hazard and the ground base is too unstable for most types of development. Topsoil is negligible. These are areas that, by geologic nature, are fit only for conservation and scientific investigation. They generally exist in two geographic areas and in two basic configurations. Eroded areas exist in the southern half of the island between the Alutom and Umatac volcanic formations. These two volcanic formations arose at different time periods and the reef formation, between, was uplifted. Karst topography exists in this dissected area and has developed as a result of continuous drainage of surface water from volcanic regions into the lower limestone surfaced valley. The calcium carbonate in the limestone is carried away in solution and the most insoluble material is left. Most

rainwater quickly disappears, but where surface drainage enters a Karst area, the stream may flow underground and emerge at the surface further downstream. Trace areas of Karst topography also exist on the summit of the Alutom formation, but most is found in the area known as the southern interior basin. In the northern limestone plateau, Karst topography is in the form of deep, round sinkholes that are sometimes found singly or in clusters. They are not as massive or localized as in the southern areas. Sinkholes are generally protected by open-space conservation use for the protection of water resources. The majority of both forms of Karst topography is located on federally-owned lands. Since the major area of Karst topography is adjacent to highly restricted ammo bunkers in the Fena Reservoir area, it is naturally protected from adverse development. It would only become a high priority concern if this land was ever opened for public use or development. Further study is needed to define the extent and geologic nature of Karst regions before precise performance guidelines can be recommended. Presently, federal properties, open-space, and water quality guidelines are sufficient for the management of this unique geologic ecosystem.

b. Caves and Waterfalls

Synopsis. In addition to the highly unique Karst areas, other geologic formations deserve management attention for the scientific study and recreational enjoyment of their aesthetic character. Within areas of raised limestone, numerous caves have formed. Natural caves are subterranean hollow spaces, in relatively horizontal configuration, formed when water

seepage dissolves limestone. Their size may range from the small cliffside shelters that are numerous in some northern precontact village sites to larger coastal caves with stalactite formations. Larger caves are primarily important for geologic study of the composition, structure and history of the earth. Basically, performance guidelines managing sloping terrain should be adequate for the protection of caves. In addition, rock souvenirs should not be taken from cave areas and areas should be kept free of litter and fires associated with picnicking and overnight camping.

Waterfalls are locations where steep topography causes surface drainage of a major river to vertically cascade to a lower river course. Waterfalls impede navigation, however, they greatly enhance scenic vistas and offer a potential power source. Performance guidelines for slide and erosion control as well as water quality standards should sufficiently protect waterfall areas. Below listed are the major waterfalls on Guam.

1. Talofofo Falls
2. Sigua Falls
3. Upper Sigua Falls
4. Inarajan Falls
5. Malojloj Falls
6. Tarzan Falls
7. Fintasa River Falls
8. Sella River Falls
9. Laelae River Falls
10. Imong River Falls
11. Agaga River Falls
12. Cetti River Falls
13. Cotal Falls
14. Cannon Falls

7. Freshwater Resources (See Map Nos. 9, 10 and 11)

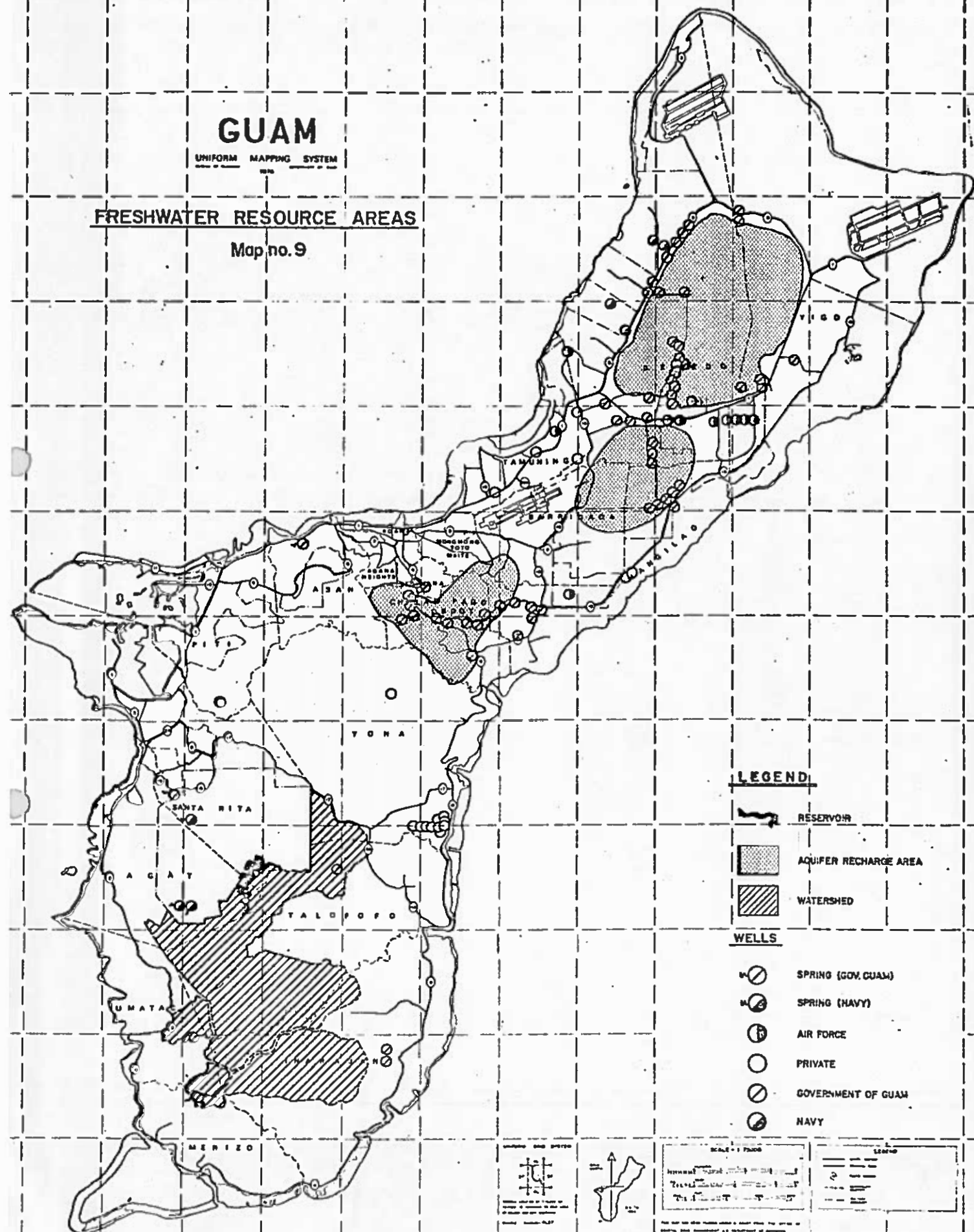
Synopsis. The underground aquifer systems of Northern Guam provide the bulk of the island's freshwater supply. A layer of freshwater floats upon saltwater and forms a basal lens. The lens is reple-

GUAM

UNIFORM MAPPING SYSTEM

FRESHWATER RESOURCE AREAS

Map no. 9



LEGEND

- RESERVOIR
- AQUIFER RECHARGE AREA
- WATERSHED

WELLS

- SPRING (GOV. GUAM)
- SPRING (NAVY)
- AIR FORCE
- PRIVATE
- GOVERNMENT OF GUAM
- NAVY



SCALE: 1:100,000

Horizontal Scale: 1 inch = 1.6 miles

Vertical Scale: 1 inch = 1.6 miles

The distance between the two points is 1.6 miles.

Legend

Wells

Spring (Gov. Guam)

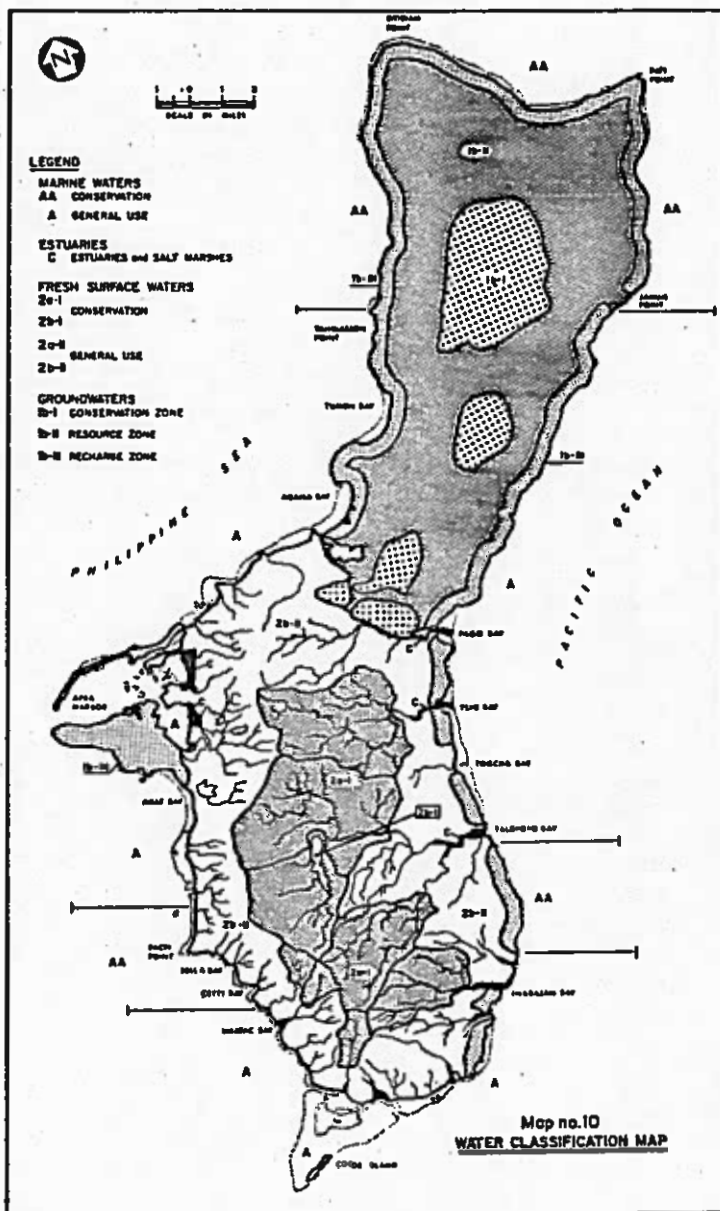
Spring (Navy)

Air Force

Private

Government of Guam

Navy



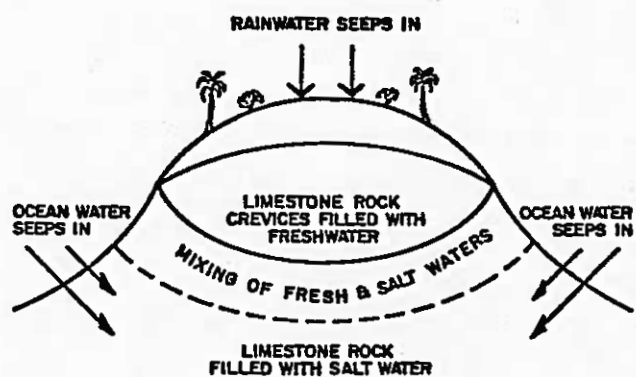
nished by rainfall percolation through the limestone of the northern plateau (See Fig. 10). There are three main aquifer areas - Dededo-Yigo, Barrigada, and Chalan Pago-Ordot in Central Guam. Forthcoming research may indicate that the three aquifer areas are interrelated. In the area over the two northernmost aquifers, numerous sinkholes cause rapid injection of water into the lens system. These areas are particularly critical in terms of pollution of underground supplies as even partial filtration is not in effect. Where urban development surfaces the land over aquifer recharge areas, ponding basins are sometimes needed to assist in rainwater recharge of the underground lens.

In the Central Guam aquifer area, where southern volcanic uplands meet the northern limestone plateau, the topography is intersected by low-lying basins that appear as grassy fields that are flooded during the periods of rainfall in the wet season. These natural low-lying basins, like the northern sinkholes, assist in aquifer recharge and are depicted on the more detailed Community Design Plans.

In the southern half of the island, rainfall does not penetrate the volcanic rock as rapidly as limestone and surface water gathers in the form of rivers, streams and wetlands. Surface drainage from watershed areas can be directed into reservoirs such as the existing Fena Reservoir.

Because water resources are vital for activities such as human consumption, maintenance of wildlife habitats, agricultural use and industrial needs, they deserve special performance guidelines. Water is a basic human need. The adverse effects of insensitive use can deprive the island of this fragile, finite and valuable resource.

Figure:10 CROSS-SECTION OF THE NORTHERN AQUIFER



Presently, PUAG, GEPA, USGS and Navy PWC all cooperate in the management of water resources. The U. S. Army Corps of Engineers constructs reservoirs and defines watershed areas. Proposed watersheds and reservoirs are depicted on Community Design Plans as conservation uses. GEPA is the primary agency involved in the enforcement of water quality performance standards and erosion control standards which are directly related to water quality.

The federal Safe Drinking Water Act provides for the establishment of a review procedure for federally-funded projects within those aquifer areas determined by the federal Environmental Protection Agency (EPA) to create a significant public health hazard if contaminated.

On November 20, 1975, the Governor petitioned EPA to designate the northern groundwater system as a sole aquifer under provisions of Section 1424(e) of the Act. After federal agency review of the proposal, it was determined that the northern groundwater system is a principal source of drinking water and the resources should be protected from contamination. On April 26, 1978, notice was published in the Federal Register in which the Administrator of USEPA designated Guam's sole aquifer. The designated area is comprised of those groundwaters north of the southern municipal boundaries of Agana, Agana Heights and Chalan Pago-Ordot. Also, the portions of the Pago and Fonte River basins, south of the Adelup-Pago fault line, are in the designated area (See Map No. 11).

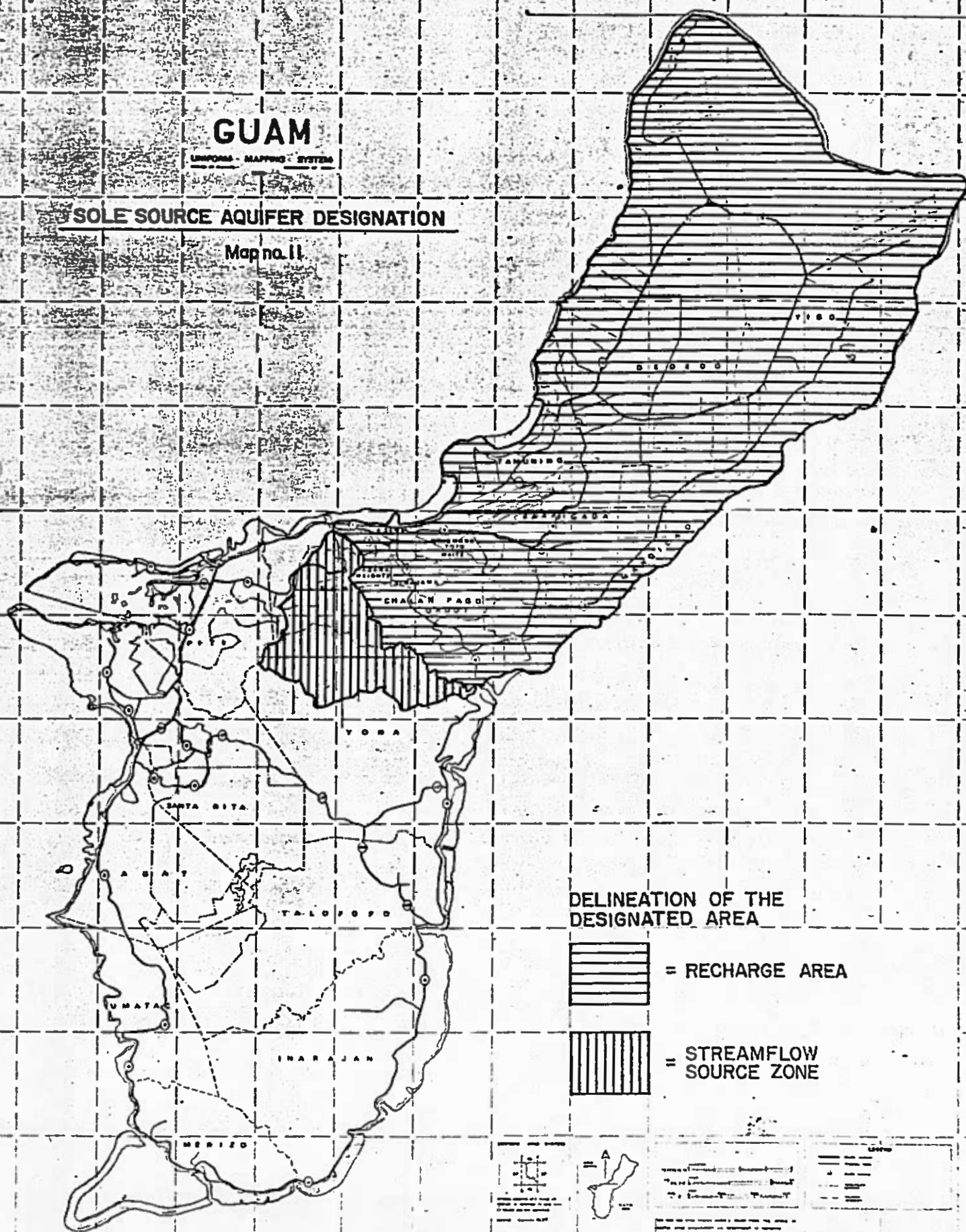
USEPA and GEPA jointly administer the Guam Sole Aquifer Protection Program under a memorandum of understanding. GEPA is not concerned with reviewing small isolated commitments of financial assistance such as individual home mortgage loans, but may conduct review of

GUAM

UNIFORM - MAPPING - SYSTEM

SOLE SOURCE AQUIFER DESIGNATION

Map no. 11



DELINEATION OF THE DESIGNATED AREA



= RECHARGE AREA



= STREAMFLOW SOURCE ZONE

the cumulative impact if a large number of such projects is of concern. Review is aligned with the guidelines of the National Environmental Policy Act for which preparation of EIA's or EIS's and public hearings are required.

Performance guidelines for land use over aquifer systems may ease as ongoing research of the nature of groundwater resources further defines the extent of supplies and the capacity to absorb pollutants. A study, Groundwater Resources of Guam: Occurrence and Development, by John F. Mink, has been published by the University of Guam Water Resource Research Center as their Technical Report No. 1. The Guam Water Quality Management Plan, prepared by GEPA, outlines the strategies for management of water resources and is highly consistent with the Land-Use Plan and Guam Coastal Management Program.

Performance Guidelines. A general performance guideline for water resource use is that all existing and all proposed water-related development shall adhere to the Water Quality and Erosion and Sedimentation Control Standards established and enforced by the Guam Environmental Protection Agency and all agencies and private developers shall support the objective of eliminating all point source and non-point sources of adverse pollution. Specific performance guidelines are listed below.

- . All agencies and owners of residential and commercial buildings or sewage treatment facilities shall obtain required permits from GEPA and Public Works for septic tank installation or sewer connection with plans showing that construction or connection will not adversely affect water quality;
- . All agencies, individuals and corporations wishing to drill or operate water wells shall obtain a Well Drilling License, Well Drilling Permit, and Well Operating Permit from GEPA to protect groundwater from contamination or overpumpage by unskilled personnel or improper construction and equipment.

- . Anyone, including GovGuam, selling, distributing or importing pesticides shall obtain a required Pesticides Dealer's License and Registration of Pesticides to ensure competency of all persons dealing in pesticides and that knowledge of imported pesticides products is monitored by EPA.
- . All government agencies, individuals and corporations planning to develop or maintain a dump on private or public property shall obtain Authorization for Solid Waste Disposal from GEPA to ensure health, sanitation, land-use compatibility and prevention of soil waste leachates from contaminating freshwater resources;
- . Anyone, including government agencies, intending to clear or grade land shall obtain a required permit from Public Works and clearance from GEPA to ensure adequate provisions have been made for erosion and sedimentation control.
- . Open space and environmentally sensitive recreational or agricultural uses shall be encouraged in aquifer recharge and watershed areas. Urban-type uses are discouraged in such areas unless a thorough EIA determines that such development will not adversely affect water quality or quantity.
- . Open space shall be maintained in sinkholes and natural low-lying basins. (Open space is defined as essentially undeveloped natural areas, strategically located where most needed to exclude intensifying urbanization patterns.) In areas where development is already present in low-lying basins and sinkholes, such development shall be permitted as a non-conforming use so long as it conforms to Guam Water Quality Standards.
- . Field farming, hydroponics and aquaculture, as agricultural uses, shall be monitored and planned such that nutrient discharges into surface waters or through seepage into groundwater supplies shall not produce adverse effects on water quality.
- . Livestock slaughterhouses and industrial land uses (involving petroleum and chemicals) shall be discouraged as uses over aquifer recharge areas.
- . Within proposed areas of intensive residential development within primary aquifer recharge areas, the surface drainage shall not be significantly altered; and ponding basins shall be required to ensure that surface development does not adversely affect rainwater recharge of groundwater supplies.

D. Marine Conservation Areas

1. Coral Reefs (See Map No. 12)

Synopsis. Coral reefs are geological formations created by living marine organisms and include the living ecological communities on the surface of the reefs. Two deep lagoons surrounded by coral barrier reefs occur in Guam: Apra Harbor and Cocos Lagoon. Elsewhere, fringing coral reefs border over one half of Guam's present shoreline, forming wide reef flats of shallow water, separating the shore from the deeper ocean. At times of lowest tides, these shallow reef flat areas may be exposed to a great extent, but depressed areas within the reefs and the outer margins of the reefs are always submerged, allowing for the growth of corals and associated organisms.

Coral reefs provide protection of the shoreline, especially beaches, from storm waves and erosion. Reefs provide additional protection from the potential damage of tidal waves or tsunamis. They also provide recreational areas for swimming, boating, water-skiing, snorkeling, diving and numerous kinds of fishing. The rich diversity of corals, fishes and other reef organisms on Guam make the coral reefs an outstanding location for scientific research. Reefs are biologically highly productive and economically important as a source of fish, corals and shellfish; and an outstanding tourist attraction.

Living corals of several hundred species are the basic resources determining values of coral reef areas. The total ecological community and physical features are largely maintained in direct relation to the maintenance of living corals. These require

constant submergency in saltwater, 79-80 degree temperatures, sunlight, water circulation (oxygen) and a solid substrate. Natural variations in these and other physical parameters result in distinct zonations and a wide variety of reef communities.

Performance Guidelines

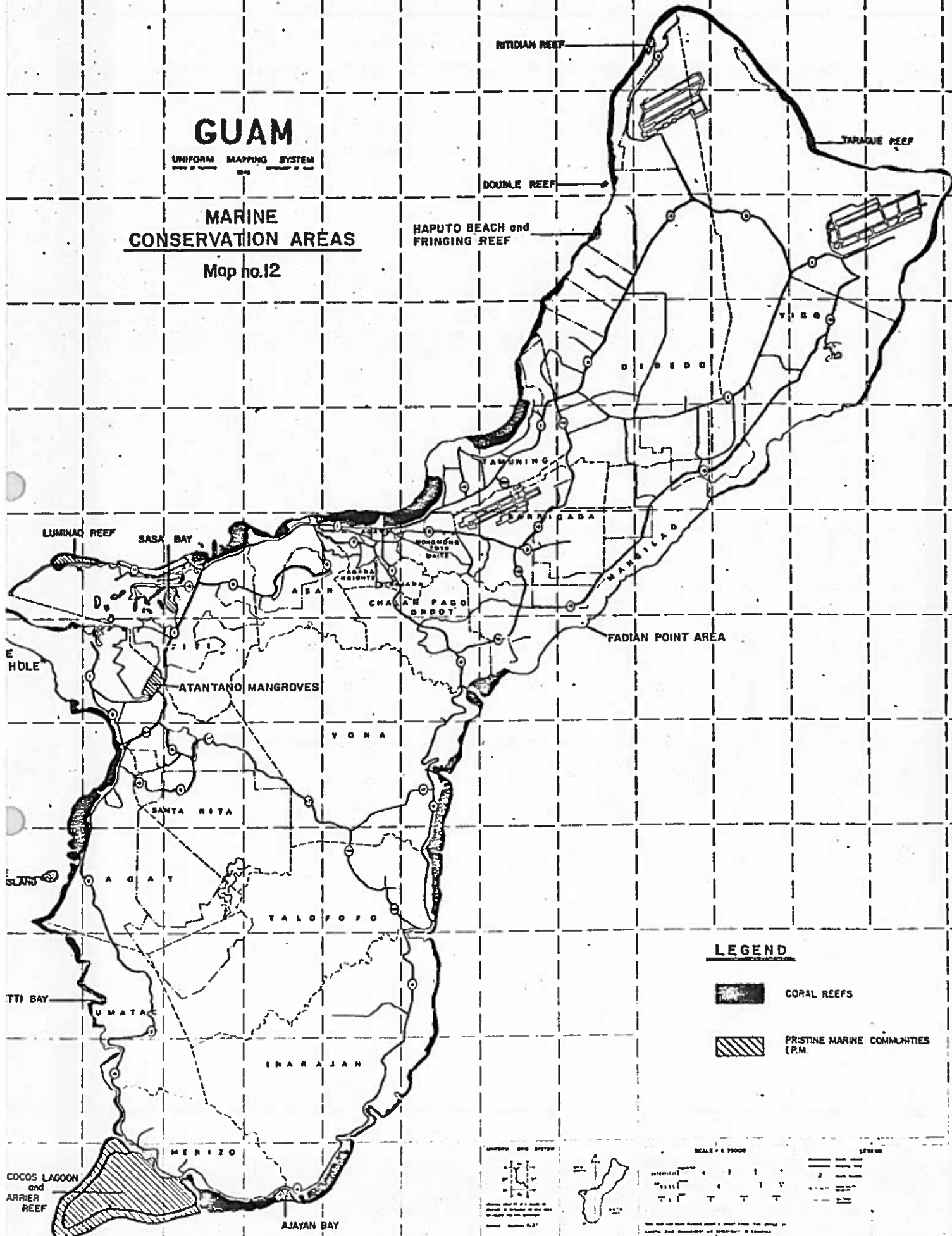
- . Removal of coral shall not be allowed except under permit and supervision of the Aquatic and Wildlife Resources Division of the Government of Guam.
- . Areas of living corals shall not be filled or dredged nor shall they be damaged by siltation or sedimentation from adjacent development, unless it is proven by the developer that no alternative is possible and the resultant benefits exceed the environmental, social, recreational, and other costs in an EIA.
- . Development that may alter currents and sediment transport shall provide current studies of the area throughout tidal cycles and all seasons and predict change caused by the development prior to approval of the project. Any major change in long-shore currents should be avoided and if shoreline erosion is expected, the development should not be approved.
- . Turbidity and siltation control mechanisms such as silt screens and weirs shall be used to protect water quality in areas adjacent to dredging.
- . Sewage outfalls, communication cables, pipelines, and similar structures which are developed across reef flats shall be buried in trenches which are refilled and concreted to restore the original reef flat contours.
- . Solid waste disposal and sanitary land fills shall not occur on reefs.
- . Coral cover that has been damaged in areas adjacent to dredging, filling, and other changes in the marine environment should be re-established by transplanting developed coral colonies to the area if a sufficient parent stock is available and if water turbidity and other conditions, as well as transportation mortality, do not prevent transplantation.
- . All land development, especially adjacent to living coral areas, shall be designed with stringent runoff controls to contain and filter excessive sediments and polluted discharges capable of degrading or destroying nearby marine resources.

GUAM

UNIFORM MAPPING SYSTEM
1983

MARINE CONSERVATION AREAS

Map no.12



LEGEND



CORAL REEFS



PRISTINE MARINE COMMUNITIES
(P.M.)

UNIFORM MAPPING SYSTEM
1983
Map no.12



SCALE = 1:50,000

LESSON

THE MAP WAS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND NAVY DEPARTMENT OF THE ARMY.

2L 2R 3L 3R 4L 4R 5L 5R 6L 6R 7L 7R

- . Change of ambient natural conditions, including turbidity, salinity, temperature, dissolved solids, suspended matter, dissolved oxygen, nutrients, current, etc., shall not be allowed in the water immediately around living corals.
- . Legal effluent outfall and pollution system mixing zones shall not be located in live coral areas. Outfall sites shall be in deep, offshore areas.
- . Addition of pesticides, petroleum product bleach and other toxic substances shall not be allowed in any waters, including those surrounding living coral.

2. Marine Pristine Ecological Communities (See Map No. 12)

Synopsis. Marine Pristine Ecological Communities include a typical representative of each of the major marine ecological communities on Guam, including: estuaries, fringing reefs, barrier reefs, patch reefs, barrier reef channels, fringing reef channels, mangrove swamps, seagrass beds, cut benches and submarine cliffs. Each of the selected representative areas has retained its natural character or successfully re-established it after disturbance. This natural character includes components of scientific, educational and aesthetic value. Of specific interest is the preservation of the natural ecological stability through diversity and the protection of critical habitats for rare, uncommon, threatened or endangered species. Although many of these areas are included in the coral reef category of APCs, these most valuable areas require a stricter control of permissible uses. Cocos Lagoon has been nominated as a candidate marine sanctuary under the federal Office of Coastal Zone Management.

Performance Guidelines

- . The performance guidelines for coral reefs shall apply to pristine marine ecological communities.'
- . Coral harvesting permits shall not be given for harvesting in these areas.

- . Anchoring of boats, shelling, fishing with spears, nets, lines, may have to be controlled if needed, to retain the natural character of these areas.

E. Hazard Areas

1. Flood Hazard Areas (See Map No. 13)

During periods of adverse weather conditions that bring persistent rainfall, the natural and developed drainage systems can overflow into developed areas of human settlement. If improperly used, floodplains can become problem areas as a result of deterioration of flood-damaged structures and the recurrence of public expense for relief and repair of flood-damaged facilities and failing sanitary systems. When floodplains are left open, practically no flood losses occur.

The following performance standards were prepared by the Guam Coastal Management Program in compliance with requirements of the National Flood Insurance Program. These standards were mandated by Executive Order No. 78-29 and are implemented by DPW as part the official Flood Hazard Areas Rules and Regulations promulgated by the TPC, effective October 2, 1978.

Performance Standards

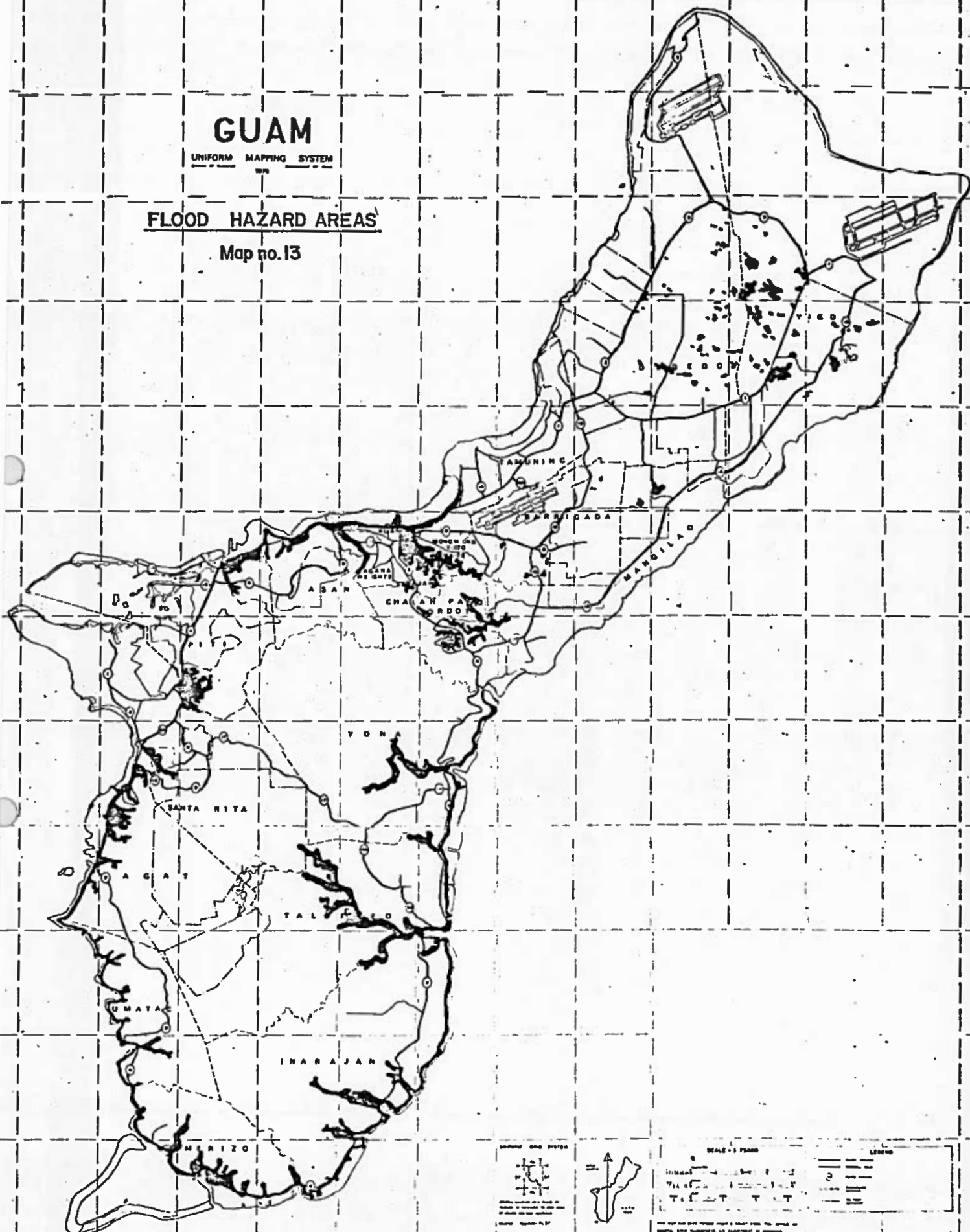
- . All development within flood hazard areas shall comply with all water quality, erosion and sedimentation control standards and other applicable pollution standards as promulgated by the Guam Environmental Protection Agency and, if applicable, Wetland and Rules and Regulations as promulgated by the Territorial Planning Commission.
- . Flood hazard areas shall not be graded, dredged or filled such that natural topographic drainways are altered unless issued a Flood Hazard Area Permit by the Department of Public Works.
- . Approved developments shall be designed to the maximum extent practicable to maintain the natural flow during flood conditions, not create backwater effects or expand a flood hazard area into previously non-flood prone areas.

GUAM

UNIFORM MAPPING SYSTEM

FLOOD HAZARD AREAS

Map no. 13



SCALE - 1:50,000
 1 inch = 1 mile
 1 centimeter = 1000 meters

LEGEND	
[Symbol]	Water
[Symbol]	Highway
[Symbol]	Other roads
[Symbol]	Boundaries
[Symbol]	Settlements
[Symbol]	Vegetation
[Symbol]	Topography

- . All approved bridges and culverts shall have openings of sufficient width for adequate passage of flood discharge and debris during a 100-year flood.
- . New septic tanks, leaching fields, outhouses or other on-site sewage disposal systems shall not be permitted within flood hazard areas. All approved sewage disposal shall be connected to government sewerage at the developer's expense. Sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharges from the systems into flood waters.
- . New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems.
- . No development shall be permitted, within sinkholes or low-lying basins, as designated on the Bureau of Planning's Community Design Plans, which would inhibit the recharge of water into the underground aquifer system or be subject to flood damage.
- . Fill materials (including trees and vegetation) shall not be discarded into flood hazard areas such as to impede the natural flood flow or velocity by creating an accumulation of loose debris.
- . Open storage of significant quantities of bouyant, light, or unsecured material shall be prohibited within flood hazard areas.
- . Storage within flood hazard areas of toxic chemicals, fertilizers, pesticides, biological wastes, or other contaminant substances which would be subject to dispersal into flood waters during periods of inundation shall be prohibited (even though storage of such substances might be in conformance with pollution control standards during non-flood conditions).
- . Excessive removal of natural vegetation in a flood hazard area (though not promoting erosion during non-flood conditions) which would promote erosion during flood conditions shall be prohibited, unless demonstrated to the satisfaction of the Guam Environmental Protection Agency that erosion control measures would satisfactorily prevent erosion and sedimentation or that such action is necessary for agricultural field farming. (Note: Deep-rooted natural vegetation such as trees and shrubs absorb water to greater depths and reduce flood levels much more effectively than shallow-rooted grasses and weeds that dominate lands after natural vegetation is cleared).
- . All approved flood control measures and structures shall be periodically maintained and immediately repaired in cases of failure. Flood control measures shall not increase flood heights in upstream areas or cause erosion of lands not

previously subject to a higher flood level or increased flood velocity. (Note: Channelization can particularly increase flood velocity due to a reduction in natural impediments to flow. Thus, channeled flood waters should be directed to a suitable point of discharge).

- . Flood control measures or development shall not reduce the water supply or biological productivity of a wetland habitat.
- . An approved seawall for stormwave protection shall not impair public access, contribute to shoreline erosion or significantly disturb scenic vistas or visual quality and shall be sufficiently storm-resistant and structurally safe so as not to create a health or safety hazard.
- . All approved developments within flood hazard areas shall be floodproofed to the maximum extent practicable. (Note: All exposed doors should be watertight and exposed glass should be wire-reinforced). (Use of materials which easily deteriorate when exposed to water should not be used).
- . Below-ground basements, building space, storage or parking shall be prohibited within flood hazard areas.
- . Libraries, schools, post offices, museums and other public-use structures, whose maintenance is at public expense or which are used for storage of valuable flood-vulnerable materials, the preservation of which is in the public interest, shall not be located within flood hazard areas.
- . Cemeteries shall not be located within flood hazard areas. Expansion of existing cemeteries within flood hazard areas shall be permitted as a non-conforming use.
- . All electrical equipment and the lowest floor of approved structures shall be elevated above the maximum known flood elevation.
- . All approved structures, including mobile or modular homes and other lightweight structures, shall be anchored to prevent flotation, collapse or lateral movement of the structure or portions of the structure during flood conditions. Ties shall be provided at each of the four corners of the home with two additional ties per side at intermediate locations.
- . Posts, piles or similar techniques for elevating structures in flood hazard areas shall be secured in concrete footings or by imbedment in the ground to a depth sufficient to withstand hydrostatic or hydrodynamic loads, anticipated scour and/or uplift.
- . Approved structures shall be planned for construction with the longitudinal axis parallel to the direction of flood flow or wave assault whenever possible and additional or adjoining structures shall be planned for placement on the same flood-flow lines as the established structures.

- Recreational development such as ballparks or agricultural field farming which does not involve major structural developments does not require issuance of a Flood Hazard Area Permit if outside wetland habitats. Archaeological investigation or restoration of historical sites does not require Flood Hazard Area Permit. (Note: Floodplains have a high capability for low-intensity uses such as open-space scenic areas, wildlife habitats, groundwater recharge areas, outdoor recreation, field farming and livestock grazing).

2. Slide and Erosion Zones (Slopes in Excess of 15%) (See Map No. 14)

Synopsis. With a few exceptions, large-scale development has not yet occurred on steep lands. In the future, however, population increase and demands for more housing (urban expansion) may seek hillsides as development occupies available level terrain (ex. Barrigada Heights). Often home-builders and resort developers wish to take advantage of the vistas obtained from higher terrain. A historical preference for flatland as being more feasible for development could change as a result of economic pressures for use of land once considered marginal as far as development potential. Therefore, performance guidelines must facilitate protection of slopes as an extremely important area of particular concern.

Approximately half of Guam's total acreage (43%) has a slope in excess of 15%. Steep terrain generally occurs on the savannah grasslands of the southern half of the island and on coastal cliffs and terraces. Because of a multiplicity of problems that can occur with land-use activity on hillsides and cliffhines, open space is encouraged as the predominant land use. The majority of sloping terrain has been designated as conservation districts because the terrain and vegetation constitutes a natural watershed, an aesthetic resource, and an important area for recreational activities such as hiking and observation of ecological habitats. The vegetation, wildlife, drainage patterns, soil conditions,

GUAM

UNIFORM MAPPING SYSTEM

SLIDE and EROSION ZONES

Map no.14



SLOPE = 15 % and over

Legend



Legend



Legend

Scale 1:100,000
 Horizontal scale 1 inch = 1 mile
 Vertical scale 1 inch = 100 feet
 Map not to scale unless noted to the contrary. Map shown in outline and projection is not to scale.

Legend

Legend

and underlying geology all suggest an emphasis on open space rather than urban or agricultural development in steep areas.

Construction on hillsides can promote erosion which destroys protective vegetative cover, limits land use, and degrades water quality and visual appearance. Unplanned development can also lead to landslides and increase flood hazard areas. The weight of structures on steep hillsides can cause unstable soils to "slump" and weaken foundations. In extreme cases, mud slides may cause building damage and/or threat to human life. When ground cover is disturbed or removed during development, exposing the soil, potential for erosion has been introduced. As the surface area available for absorption of rainwater is reduced by impervious surfaces (roofs, roadways, parking lots, etc.), runoff is increased and the potential for erosion increased along with it. As a rule, slopes are more easily eroded than level lands; the extent of erosion during construction and prior to soil stabilization is substantially increased on steep terrain. Septic tanks and leaching fields installed on steep slopes are more susceptible to failure than similar installations in more level landscapes. Where provision is made for the public power, water, telephone, or sewage systems, the difficulties and costs are significantly greater on steep slopes. In addition, the acreage requirements for roads and also for structures increase with slope. In short, land area cannot be used as efficiently on steep slopes as on level land. Efficiency is related to cost and some cost of developing land on steep slopes must be borne by the public, as local government must maintain roadways or other utilities or when erosion, water sedimentation, or slide damage occurs.

Topography. The topographic characteristics of an area are one of the most important determinants of the suitability of the area for residential land use development. The ratings for land-use topography are shown in Table 3.

Slopes in the 2% to 5% range are steep enough to provide for good surface drainage and interesting siting, and yet flat enough so that no significant site development problems will be encountered. Some drainage problems may be encountered in the 0% to 2% range, but these can be readily overcome. The site plan in the 5% to 10% range may be more interesting than in the 2% to 5% range, but will be more costly to develop. Slopes over 10% present problems in septic tank filter field layouts that will be difficult to overcome. In addition, street development costs will be significantly higher than in the 0% to 10% range. Severe limitations in domestic sewage disposal and street development will be encountered on slopes over 20%.

Table 3: TOPOGRAPHY RATINGS

Rating	Slope, in percentage
(a) Rural Residential	
Optimum	2 to 5
Satisfactory	0 to 2 and 5 to 10
Marginal	10 to 20
Unsatisfactory	20+
(b) Urban Residential	
Optimum	0 to 5
Satisfactory	5 to 10
Marginal	10 to 20
Unsatisfactory	20+

Performance Guidelines. A general guideline for land use in slide and erosion zones is that all proposed and existing development shall adhere to the Erosion Control Standards established and enforced by the Guam Environmental Protection Agency. Specific guidelines for land use on slopes must consider:

- . Open space is encouraged as the most compatible land use on slopes in excess of 15%. The steeper the slope, the more the requirement for open space.
- . Hilltops shall be avoided as building sites for urban development as the natural horizon line is interrupted and structures are highly visible. Buildings, located below hillcrests, are more sheltered from typhoon force winds, less visible from distant viewpoints, and less prone to cause erosion problems (See Fig. 11).
- . When necessary to locate on sloping terrain, roads and other infrastructure shall be planned to follow the contours of the site. Structural and infrastructural development, if straight up and down slopes, requires more grading, expense, maintenance, and increases the potential for erosion.
- . If necessary on sloping terrain, land grading should be done during the dry season and during the shortest feasible time span to reduce the risk of sedimentation runoff during periods of heavy rainfall.
- . Where urban development must occur on slopes, natural vegetation should be saved wherever possible and unsurfaced, graded areas should be replanted with a vegetative cover.
- . Proposed development on slopes shall include plans for the safe disposal of increased water runoff caused by roofs, pavement, and land grading. This involves mechanisms such as temporary sediment basins, silt screens, ditches, and dikes during construction. Once construction has been completed, altered soil and surface conditions may require permanent inlets and storm drains to convey the increased runoff to an adequate storm water drainage system.
- . Where an area hazard study denotes unstable soils where potential landslides may occur, land use within the hazard area shall be restricted to low-population density activities unless structural means of landslides protection are implemented.

Figure 11

DESTRUCTIVE AND COMPATIBLE DEVELOPMENT ON SLOPING TERRAIN

Destructive
development



Compatible
development



- . Generally, slopes are rocky or do not possess the fertile alluvial soils of basin lands and costs of transporting irrigation water to upland terrain is considerable, however, if field farming is considered feasible on steep terrain, mechanisms of erosion control such as contour plowing, terracing, ground cover crops, or natural vegetative zones should be employed to minimize potential erosion problems.
- . Reforestation efforts shall be encouraged as a responsible mechanism of erosion control for the repair and enhancement of natural or man-made eroded areas.
- . Lack of fire control on large grassy areas in Southern Guam destroys as much as 40% of the visible areas during periods of drought. Most fires are caused by illegal trash burning, camp fires, or illegal use of fire to flush game or clear terrain. Strict adherence to fire control regulations enforced by the DPS Fire Department and Burning Permits required by GEPA shall be enforced.

3. Seismic Fault Zones(See Map No. 15)

Synopsis. During eras of the island's geological development, different blocks of land have uplifted and subsided. The six blocks are divided by fault lines or geologic structural subdivision zones. In case of seismic or earthquake activity, the most potentially hazardous areas are along these zones. Major geologic activity occurs over such a long expanse of time, though, that the potential hazard along fault lines is slight. The land is stable enough for most land uses. The six major blocks have been mapped and described in the Military Geology of Guam, published in 1959 as a joint effort to the U. S. Army Corps of Engineers and the U. S. Geological Survey. Further geologic and seismological studies are needed before a more precise determination of the extent of the hazards associated with fault lines is known and more precise guidelines can be established.

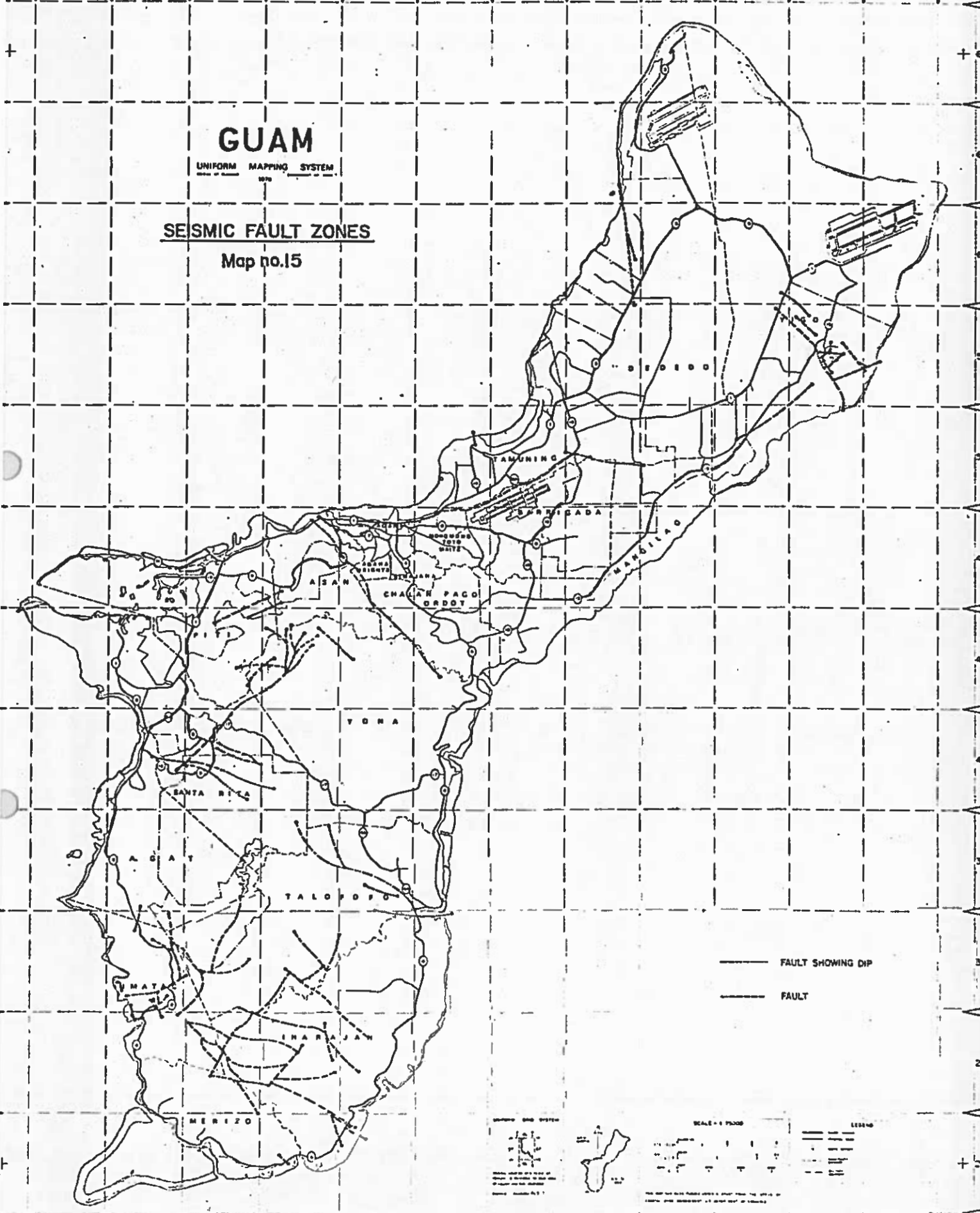
1R 2L 2R 3L 3R 4L 4R 5L 5R 6L 6R 7L 7R 8L

GUAM

UNIFORM MAPPING SYSTEM
1:50,000

SEISMIC FAULT ZONES

Map no.15



Performance Guideline. The basic guideline for this APC is that high-rise structures with a high-population density use and emergency service facilities (police and fire stations, clinics, hospitals, apartments, condominiums, office buildings) shall not be constructed on a defined fault zone.

4. Airport Accident Potential and Sound Zones (See Map Nos. 16 & 17)

Synopsis. Accident potential and airport sound zones, unlike most areas of particular concern, are not areas to be preserved for their ecological or historical significance. The nature of airport technology has produced noise levels and accident potential zones that require specific performance standards. Noise levels can be incompatible with human activity and wildlife preservation and hazard zones can necessitate low-population density oriented land-use activities in certain areas adjacent to airfield. The Guam International Airport, NAS, AAFB and adjacent areas of specific noise levels and accident potential zones comprise this area of particular concern. Because a military airfield adjoins the Guam International Airport, federal coordination is of major importance in this area.

Performance Guidelines.

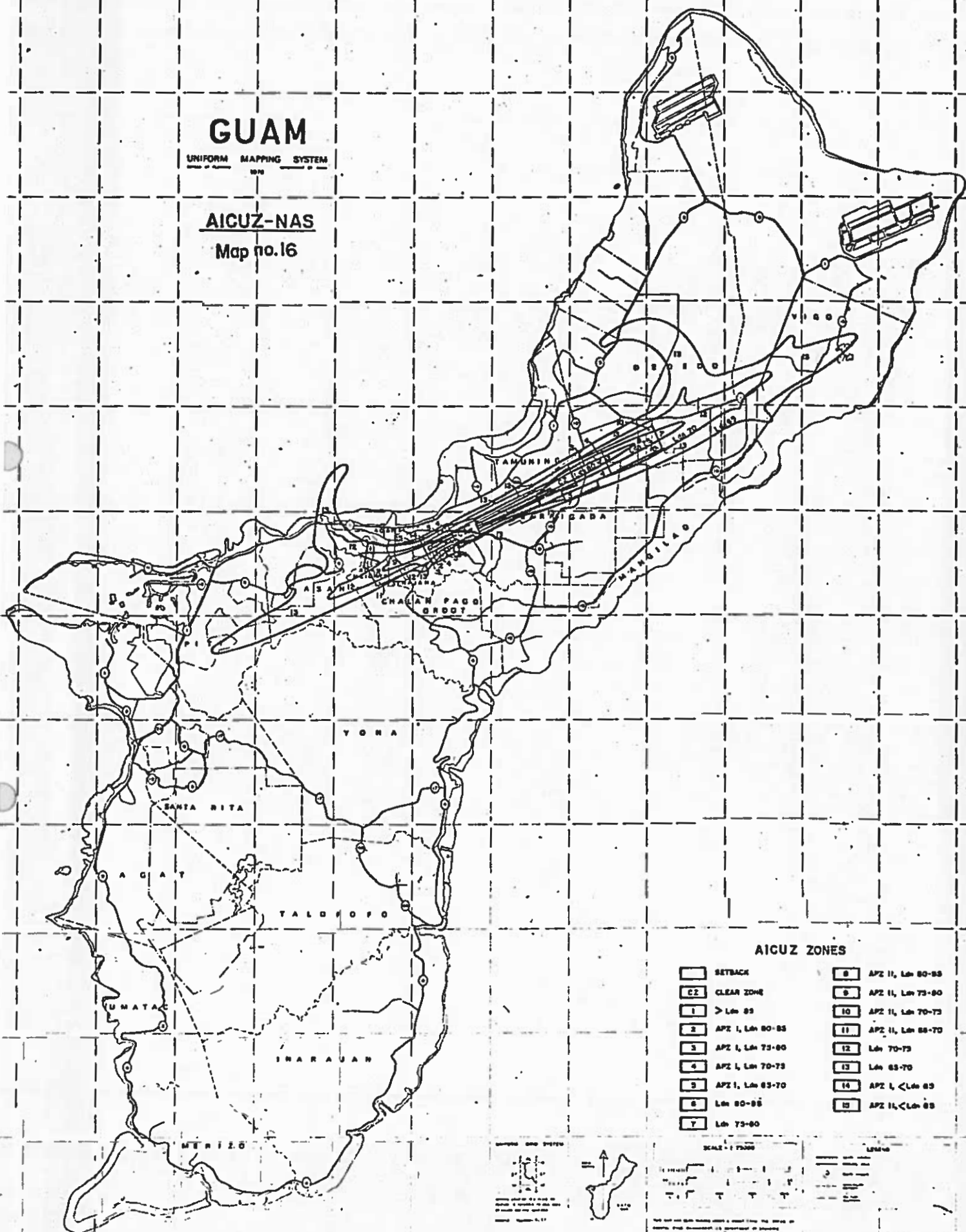
- . Uses compatible with the identified hazard zone delineations shall be reflected in a revised zoning map.
- . Existing non-compatible uses (particularly in the Mongmong-Toto-Maite area) will be permitted to continue as non-conforming uses.
- . At such a time as a present non-conforming use ceases, the use designated for such parcels of land shall be consistent with the hazard area use standards.
- . There will be no variance permitted in primary crash and noise zones insofar as location of high-population density uses.

GUAM

UNIFORM MAPPING SYSTEM
1970

AICUZ-NAS

Map no.16

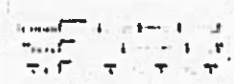


AICUZ ZONES

SETBACK	8	APZ II, Ldn 80-85
CZ CLEAR ZONE	9	APZ II, Ldn 75-80
1 > Ldn 85	10	APZ II, Ldn 70-75
2 APZ I, Ldn 80-85	11	APZ II, Ldn 65-70
3 APZ I, Ldn 75-80	12	Ldn 70-75
4 APZ I, Ldn 70-75	13	Ldn 65-70
5 APZ I, Ldn 65-70	14	APZ I, <Ldn 65
6 Ldn 80-85	15	APZ II, <Ldn 65
7 Ldn 75-80		

SCALE 1:75000

LEGEND

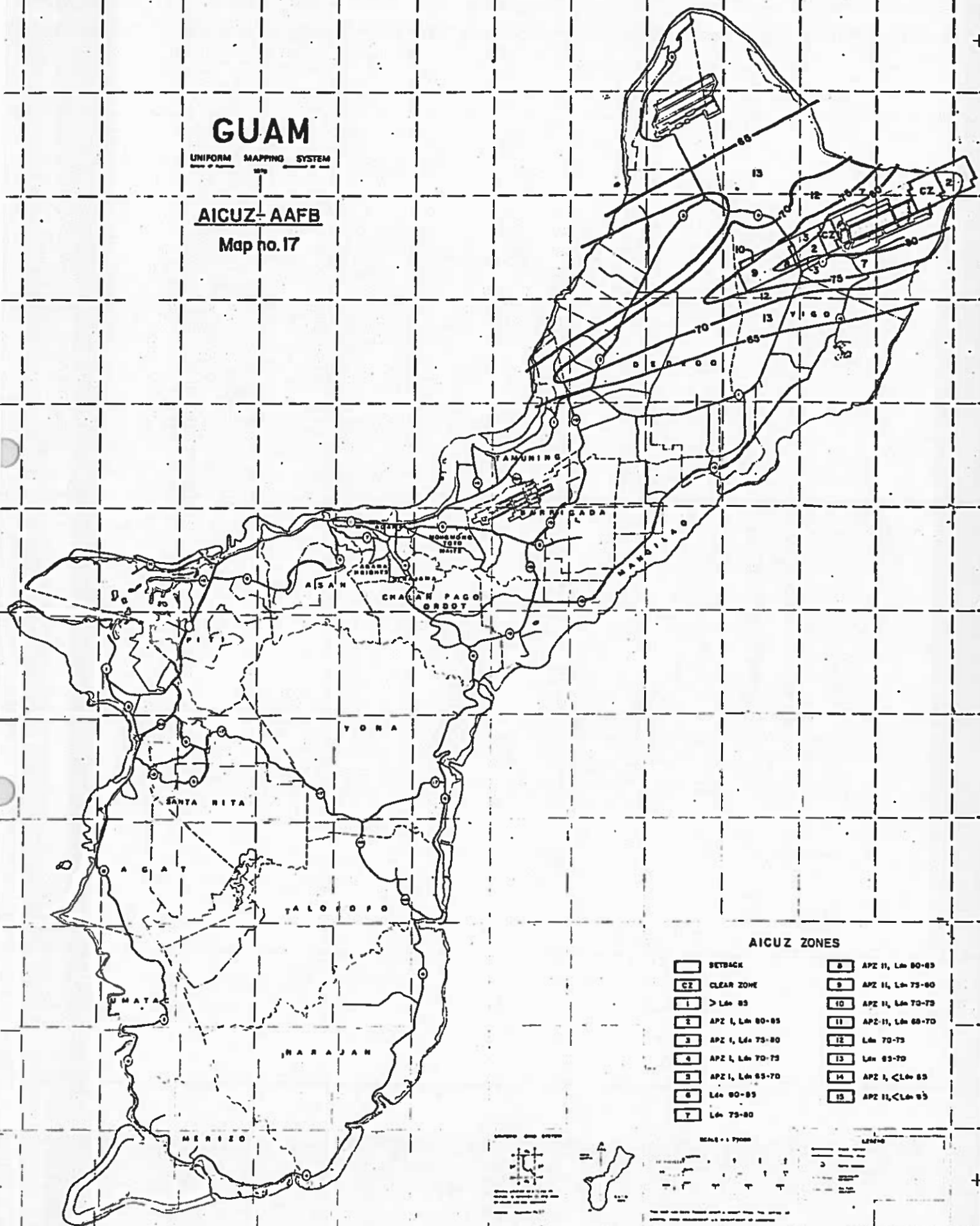


THE DATA AND SCALE SHOWN ON THIS MAP ARE THE RESULT OF AERIAL PHOTOGRAPHIC INTERPRETATION AND FIELD SURVEY DATA.

UNIFORM MAPPING SYSTEM

AICUZ- AAFB

Map no. 17



AICUZ ZONES

0	SETBACK	8	APZ 11, Lda 80-83
CZ	CLEAR ZONE	9	APZ 11, Lda 73-80
1	> Lda 83	10	APZ 11, Lda 73-75
2	APZ 1, Lda 80-85	11	APZ-11, Lda 68-70
3	APZ 1, Lda 73-80	12	Lda 70-73
4	APZ 1, Lda 70-73	13	Lda 63-70
5	APZ 1, Lda 65-70	14	APZ 1, < Lda 63
6	Lda 80-83	15	APZ 11, < Lda 63
7	Lda 73-80		

NEALE & FROMM

Abstract

Figure 12 LAND USE COMPATIBILITY MATRIX

		LAND USE											
		RESIDENTIAL - LOW DENSITY	RESIDENTIAL - MEDIUM/HIGH DENSITY	COMMERCIAL - HIGHWAY	COMMERCIAL - AMUSEMENTS	SERVICES - BUSINESS /PROFESSIONAL	SPECIAL USE - SCHOOLS , CHURCHES	SPECIAL USE - GOVERNMENT SERVICES	INDUSTRIAL - MANUFACTURING	RECREATIONAL - PLAYGROUNDS , PARKS	RECREATIONAL - GOLF COURSE	AGRICULTURAL	OPEN SPACE
 CLEARLY UNACCEPTABLE													
 NORMALLY UNACCEPTABLE													
 NORMALLY ACCEPTABLE													
 CLEARLY ACCEPTABLE													
AICUZ ZONES													
CZ CLEAR ZONE													
1 > LDN. 85													
2 ACCIDENT POTENTIAL ZONE I, LDN. 80-85													
3 ACCIDENT POTENTIAL ZONE I, LDN. 75-80													
4 ACCIDENT POTENTIAL ZONE I, LDN. 70-75													
5 ACCIDENT POTENTIAL ZONE I, LDN. 65-70													
6 LDN. 80-85													
7 LDN. 75-80													
8 ACCIDENT POTENTIAL ZONE II LDN. 80-85													
9 ACCIDENT POTENTIAL ZONE II LDN. 75-80													
10 ACCIDENT POTENTIAL ZONE II LDN. 70-75													
11 ACCIDENT POTENTIAL ZONE II LDN. 65-70													
12 LDN. 70-75													
13 LDN. 65-70													
14 ACCIDENT POTENTIAL ZONE I < LDN. 65													
15 ACCIDENT POTENTIAL ZONE II < LDN. 65													

SOURCE: U.S. NAVY AICUZ STUDY

- A maximum effort will be made to alter present takeoff-landing procedures to produce the least impact of existing uses. This involves modification of takeoff and landing approach angles and reduction of night landings and takeoff.
- A maximum effort will be made to utilize noise reduction devices for jet engine testing. This and the above standard are actual requirements within the AICUZ Program.
- As operations at the airport change, a maximum effort will be made to ease restrictions created by present and expected use patterns.

F. Recreational Areas

Recreation, active or passive, is an extremely important part of Guam's population. The island is fortunate to have a multitude of existing and potential recreation opportunities to offer to island residents and visitors. If the recreation program is to continue providing an increasing population with adequate parks, facilities, and activities for various types of recreation, existing and potential areas must be protected from development pressures which would have negative impacts on these resources.

1. Historic and Prehistoric Sites

Synopsis. There are many areas on Guam where past human activity has left structures and artifacts that are highly valued as links with a rich cultural heritage. These are areas of particular concern because of their archaeological significance, aesthetic value and fragile nature. Unplanned development can destroy these areas or limit their use as areas for observation, recreation and educational experience. The three elements of historic preservation are historic sites, archaeological sites and architectural sites. Included in historical sites are precontact village areas characterized by a prevalence of artifacts and associated features such as latte stones, rock shelters and mortar stones.

Since much of the island's present lifestyle has been influenced by a Spanish heritage, buildings that have survived this colonial era are valuable historic sites. Also, of historic significance are World War II relics that provide a fascinating retrospect, for both residents and visitors, into the past time of conflict. Presently, many residents value the traditional architecture of southern villages. Inarajan village, in particular, represents the remaining concentration of a traditional architectural style and is proposed as a historic architectural district with plans for preservation and improvement of damaged structures.

Public Law 12-126 declares that it is the public policy and in the public interest to engage in a comprehensive program of historic preservation. Detailed description of historical resources, proposed historical park plans and preservation guidelines are outlined in the Guam Historic Preservation Plan and the Inarajan Village Historic Architectural District Plan, of the Department of Parks and Recreation.

Performance Guidelines. Specific guidelines are outlined in the above mentioned documents. Basic guidelines for prehistoric sites involve:

- . Notification shall be given to the Department of Parks and Recreation of intention to clear, construct, alter or improve a site that is suspected as having historical value.
- . Development of a site listed in the Guam Register of Historic Places shall not begin until three months notice has been given to the Department of Parks and Recreation.
- . Notification shall be given to the Department of Parks and Recreation of intention to develop previously uncleared land for agriculture so a survey team can record a description of its features and make a surface collection of artifacts.

- . Individuals or groups shall not collect prehistoric artifacts, especially by digging indiscriminate holes on or near prehistoric sites (latte stones, village sites, caves, or rock shelters).

2. Scenic Vistas

Synopsis. Aesthetic or beauty is seen in different things by different people, however, the cultural learning process causes most people to generally agree on the scenic value of different vistas. The maintenance of visual access or a clear view of different geographic areas is important so that the overall beauty of Guam is preserved. Visually pleasing views enhance the quality of life for the resident and promote tourism as a valuable facet of the island's economy. Scenic vistas include unrestricted overlooks and ground level views of both developed and undeveloped areas of the island.

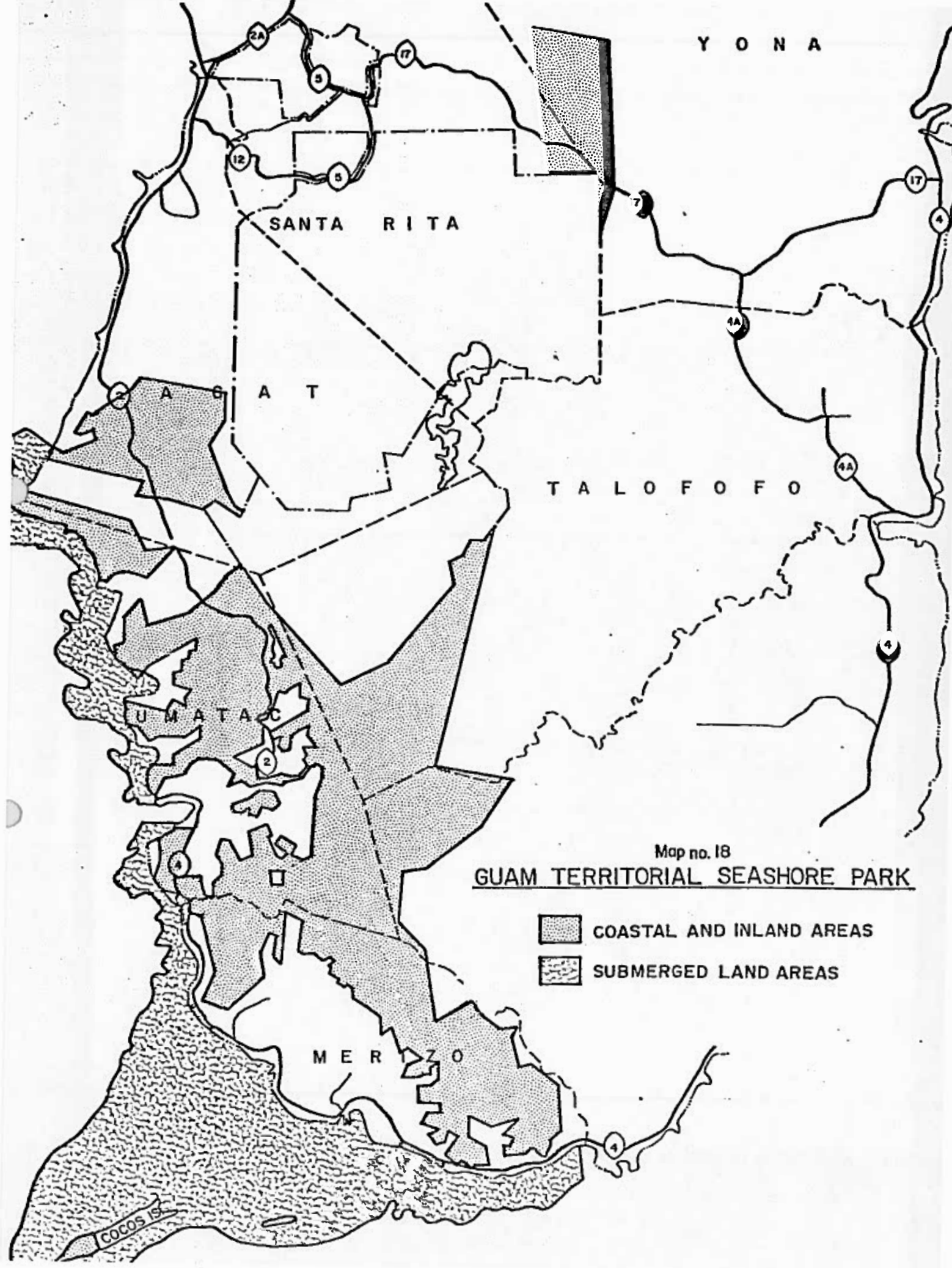
Performance Guidelines. Compliance with performance guidelines for other areas of particular concern will naturally protect natural scenic vistas, as areas such as slopes in excess of 15%, limestone forests, wetlands, and pristine communities are often components of a scenic vista. In scenic areas of urban development such as resort areas and subdivisions, building codes and zoning regulations can effectively protect and enhance scenic quality. Water quality and erosion control standards also directly affect scenic quality. General guidelines, which must also be considered, are listed below.

- . Structural and infrastructural development in natural scenic areas shall be planned to complement existing features or form a natural continuum so that aesthetic quality is enhanced rather than degraded. Fences, transmission lines, towers or other forms of tall infrastructure shall be planned so as to not obstruct visual access of natural scenic vistas.

- . Particular concern shall be given to sensitive siting of structures within the Seashore Reserve which can potentially interrupt the homogeneity of views from either the shore or more distant overlooks from which the skyline can be interrupted by improper siting of structures such as tall, flat-topped buildings.
- . Public access to scenic overlooks and shoreline areas shall be, wherever feasible, kept unrestricted.
- . Within areas of industrial development, location of facilities shall consider siting and design of structures which have architectural (structural, graphic, color) interest.
- . Within industrial areas, where unsightly storage of scrap materials or equipment is necessary, landscape and structural screening shall be employed as mechanisms to enhance area aesthetics.
- . The amount of litter, due to abandoned cars, beverage containers and other solid waste is nearly twice that reported in other parts of the United States. Dumping into authorized sanitary landfills only shall be strictly enforced by GEPA in conjunction with the litter laws enforced by DPS.
- . Abandoned, dilapidated housing and other structures represent both a health hazard and disrupts aesthetic quality and shall be removed pursuant to the requirements of the Department of Public Health and Social Services.

3. Guam Territorial Seashore Park (See Map No. 18)

Synopsis. Southwest Guam is a distinct and valuable resource area and protection of its natural, scenic and historical features is of paramount concern to the residents of Guam. Comprised of mountains, valleys, beaches, reefs, numerous historic/prehistoric sites and other unique features, Southwest Guam has long been the subject of numerous federal and local park proposals. On December 12, 1978, the area was officially designated as the Guam Territorial Seashore Park through Executive Order 78-42. The Department of Parks and Recreation has prepared a Master Plan for the Guam Territorial Seashore Park.



Y O N A

SANTA RITA

A G A Ñ A

T A L O F O R O

U M A T A C

M E R I Z O

Map no. 18

GUAM TERRITORIAL SEASHORE PARK

- COASTAL AND INLAND AREAS
- SUBMERGED LAND AREAS

COCOS IS.

Park Objectives.

- . Insure that an opportunity exists for expansion of the present communities. Residents of Southern Guam will have the full right to maintain their culture without destroying the natural base of their lifestyle.
- . Provide economic benefits for this region of Guam. This region of Guam should be able to contribute and share in the prosperity with the rest of Guam. Due to the area's landforms and culture, their economic base is limited to the natural surroundings. Thus, with careful management, development of the area will open an extensive resource for tourist and local use while preserving the area's natural beauty.
- . Insure that certain renewable resources are available for the long-term use of the island's residents. Such resources as water supply are critically important to the Guam and to the growing population and economy of Guam. Without careful planning, these essential resources of Guam could be abused.
- . Provide opportunities for outdoor recreation. Guam's growing population, plus the visitors to the island, necessitates that these outdoor recreation resources be utilized. The area can provide an optimum opportunity for special recreation uses that cannot be found elsewhere on Guam.
- . Conserve significant historical features. Numerous historical features of significance, dating from prehistoric times through World War II, are found in this area and are unique reminders of Guam's Spanish-Chamorro heritage before the devastation of World War II. These merit preservation as reminders of America's, Guam's and man's past. Thirty-four historic features in this area have been identified of which thirteen are on the National Register and twenty-one on the Guam Register. Other historic features will probably be found in the area.
- . Conserve significant geomorphic, ecological, and scenic landscape features along with open space. The area's natural features represent a unique and concentrated blend of dissected volcanic uplands, interior basins, coastal lowlands and valley floors, spectacular coastline and coral reefs which should be protected due to their significance as a sample of various natural habitats, as scientific study areas, and as wildlife refuge areas. The area is the habitat of numerous rare and endangered species of wildlife. Included within this area are three National landmarks: Facpi Point, Mount Lamlam, and Fouha Rock.
- . Recognize the area as being largely government-owned and amenable to a use classification of conservational and recreational use without causing a severe impact upon private interests.

4. War in the Pacific National Historic Park (See Map No. 19)

Synopsis. The National Park Service has established a park which provides the opportunity to depict the epic story of WWII in the Pacific. Once completed, the War in the Pacific National Historic Park will emphasize the Battle for Guam as a classic example of the island to island fighting in the Pacific theater.

The 883-acre park is being developed at sites in Asan and Piti where, on July 21, 1944, American Marine and Army forces led an attack on Japanese shore installations. Present exploration of these areas of the island reveals that many of the historic sites are undisturbed and undeveloped. To preserve a representative portion of many of these sites and to provide a manageable park area, five separate units were established. These include Agat, Asan, Mount Tenjo, Mount Chachao and Mount Alifan units. Recreational activities being developed for these areas include trail hiking, shoreline recreation and interpretive displays.

5. Village Recreation Areas (See Map No. 20)

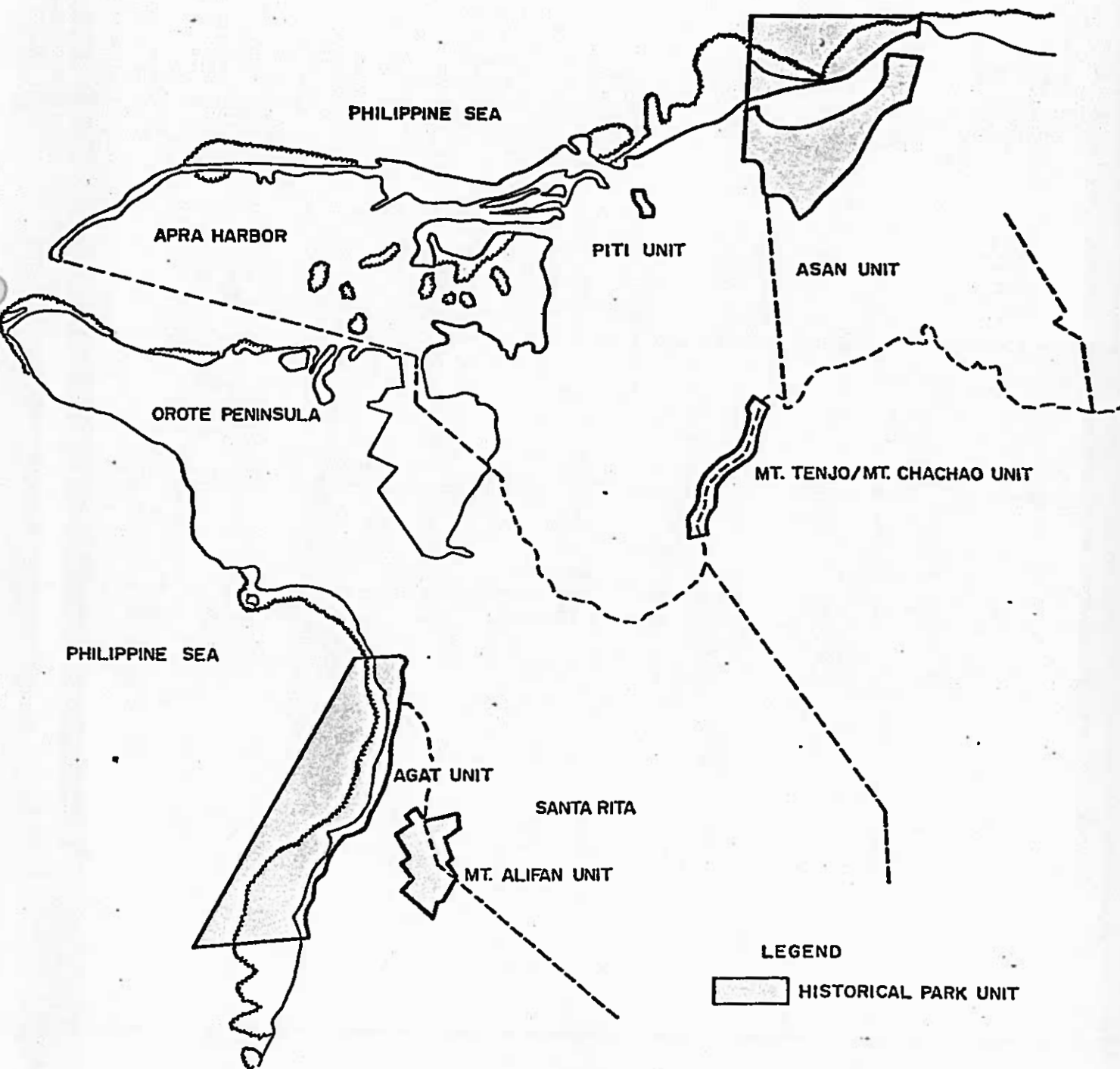
Synopsis. Community recreation facilities and areas are those which serve the recreational needs of the public and are maintained by the Department of Parks and Recreation and village commissioners. An inventory of these sites is provided in the Department of Parks and Recreation's annually updated Guam Comprehensive Outdoor Recreation Plan.

Performance Guideline. A general guideline for management of these areas is:

- . Activities within village recreational areas shall adhere to the Department of Parks and Recreation Rules and Regulations and such other standards as applicable.

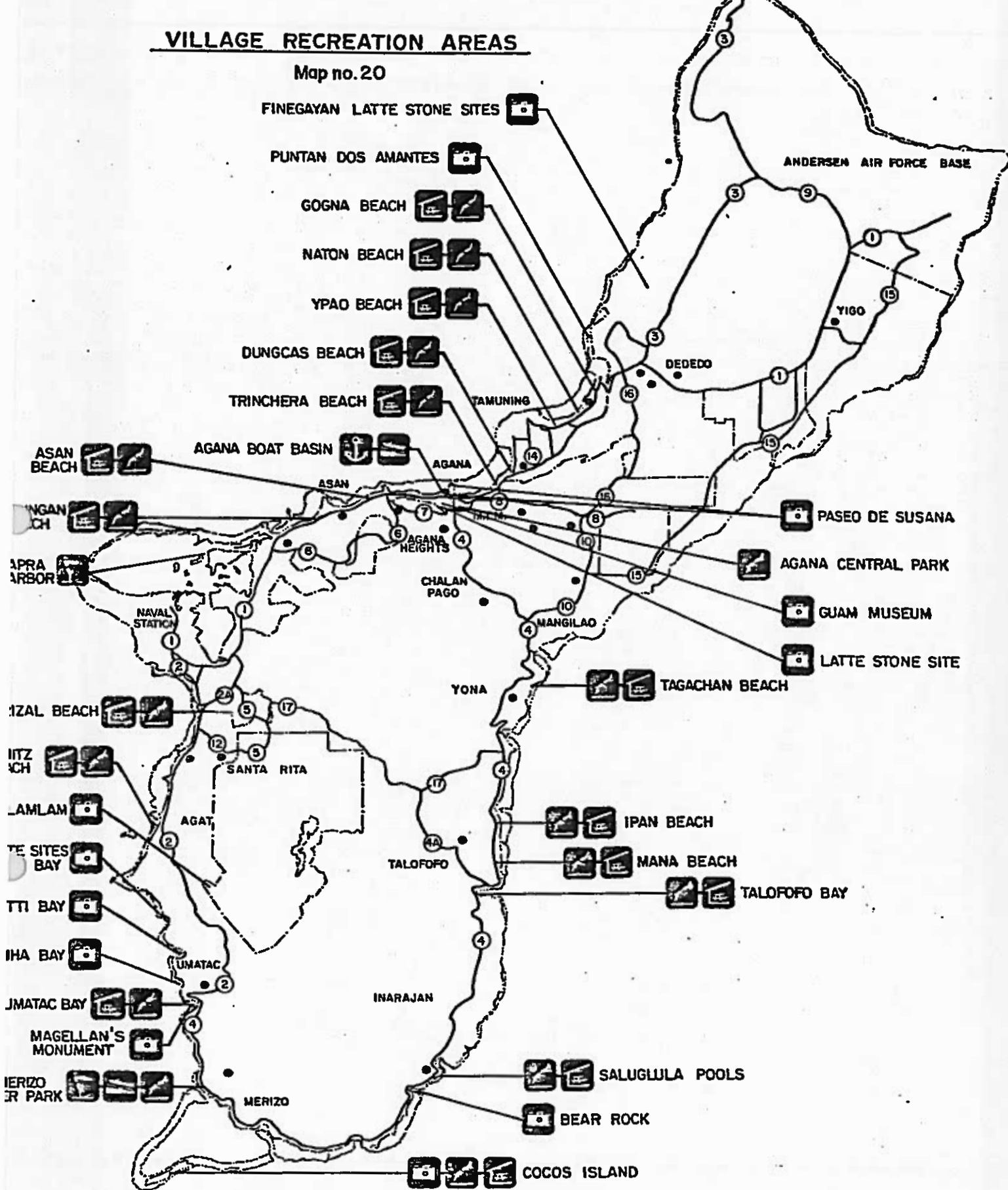
WAR IN THE PACIFIC NATIONAL HISTORICAL PARK

Map no.19



VILLAGE RECREATION AREAS

Map no. 20



SCENIC POINTS



MARINA



SWIMMING



WATER SKIING



LAUNCHING RAMP



PICNIC AREA

• RECREATION FACILITIES

6. Surfing Locations (See Map No. 21)

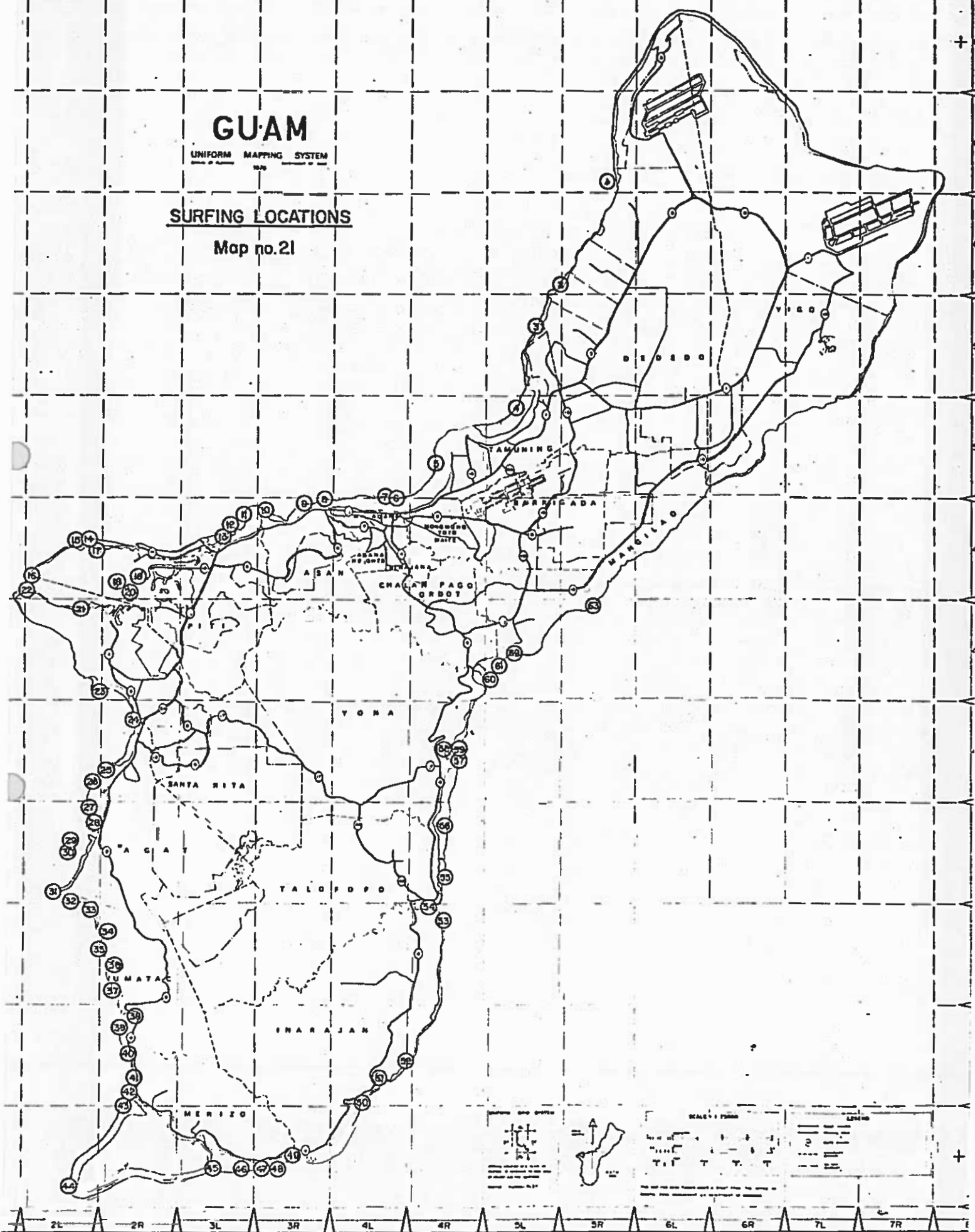
Synopsis. While offshore surfing sites are not usually negatively affected by developments, care should be taken to avoid, when possible, unnecessary intrusion upon these areas enjoyed by a sizeable number of enthusiasts. Map No. 21 depicts surfing sites which are actively used, those used, but requiring slight modification and those not frequently used, but considered potentially usable with minor modification. Some areas adjacent to northern federal lands have been unexplored as to their potential. The data was prepared by the Guam Surfing Association.

GUAM

UNIFORM MAPPING SYSTEM
1959

SURFING LOCATIONS

Map no.21



Surfing Locations (keyed to Map No.21)

A = Active
P = Potential
A/P = Active/Potential

1. Double Reef (A)
2. Shark's Cove (P)
3. Tanguisson Point (A/P)
4. Two Lover's Point-Ypao Point (P)
5. Rick's Reef (A)
6. Right Side Boat Basin (A)
7. Left Side Boat Basin (A)
8. Adelup Point (P)
9. "Coral Reef" (A/P)
10. Camel Rock, Asan (A/P)
11. Bomb Holes, Piti (A)
12. Magoo's, Piti (A)
13. Lanas Reef, Piti (P)
14. Magundos Left (A)
15. Magundos Right (A)
16. Glass Point (P)
17. Disneyland (A)
18. Western Shoal (A/P)
19. Jade Shoal (A/P)
20. Patch Reef (P)
21. Gabgab Beach (A)
22. Spanish Steps, Orote Point (A/P)
23. Turtles (A/P)
24. Rizal (A)
25. Gaan Point, Agat (A/P)
26. Meetings, Agat (P)
27. Meetings, Agat (A)
28. Nimitz (both sides of channel) (P)
29. Rosey's, Agat (A)
30. Corner Pocket, Agat (A)
31. Facpi Point (P)
32. Point Perfection (A/P)
33. Mortars (P)
34. Sella Bay (both sides) (P)
35. Pinay Point (P)
36. Cetti Bay (both sides) (P)
37. Fouha Point (A/P)
38. Umatac Bay (A)
39. Spanish Fort, Umatac (P)
40. Tubies, Merizo (A)
41. Rock Bottom (A)
42. Threes (right side) (A)
43. Threes (left side) (A)
44. Cocos Point (A)
45. Mannel Channel (both sides) (P)
46. Noname (P)
47. Mistoe's (A)
48. Fofos (A)

49. Agfayan Channel (both sides) (P)
50. Bear Rock (both sides) (P)
51. Inarajan Bay (A/P)
52. Mulona (both sides) (P)
53. Matalas (A)
54. Talofoto Bay (A/P)
55. Number Nine (A)
56. Togcha Channel (both sides) (P)
57. Ylig Point (P)
58. Ylig Bay (P)
59. Ylig (left) (A)
60. Pago Bay (both sides) (P)
61. Pago Reef (P)
62. Marine Lab Gold Spot (A)
63. Fadian Point (P)

Source: Guam Surfing Association

VII. COMMUNITY DESIGN PLANS

A. Introduction

The Bureau of Planning has completed an inventory of local physical resources and conditions along with analysis of basic demographic, economic and social trends and has projected them into the future. The focus has been on assessing conditions which will affect future demands for any improved lifestyle within communities. On the basis of a determination of the individual communities' development objectives and a utilization of the Bureau of Planning's understanding of the amount and character of growth that will inevitably occur and be distributed, the planners have formulated a plan for the future development of Guam's communities to the Year 2000. This element of the Guam Comprehensive Development Plan consists of Community Design Plans and definition of use classifications.

Community Design Plans primarily bring different land uses within an area of human settlement into a composite plan. As communities, these are areas where residents have a strong identification with the area, continued social interaction, and reside within a specific geographic location. In the past, there has been little systematic structuring of land uses into compatible relationships or an efficient environment. Development has often been in response to short-term economic conditions and personal objectives. Community Design Plans provide a basis for the responsible decision-making of both private citizens and governmental agencies. These plans assist in such specific planning as recreational parks, utilities and traffic circulation.

The community formation that is depicted on design maps is projected more importantly by historic, current and proposed uses rather than municipality lines. For example, separate municipalities such as

Agat and Santa Rita are both within one community design area. Their close proximity and similar adjacent uses necessitates a cohesive plan. Another example is that Baza Garden's infrastructure, identity formation and land proximity are more associated with Talofoto than Yona district, despite political affiliation with the latter.

Use classifications are delineated on ortho-topographic maps, based on aerial photographs taken in 1975. A uniform grid system, at a scale of 1:12,500 for community design, allows for the location of points on the maps by the use of coordinates (See Appendix No. 1).

Use classifications are color-keyed for easy reference and contrast. Municipality lines are depicted for jurisdictional delineation, however, they are generally not associated with use classifications or community design perimeters. Major existing and proposed roads depict the relationship of traffic circulation to use classifications. Rivers are shown to relate major surface drainage to associated land use.

B. Objectives

The major objectives of the Community Design Plans seek to:

- . Depict a logical progression of compatible land use, both existing and proposed, thereby creating public awareness of comprehensive planning and demonstrating the social, economic and ecological value of responsible planning.
- . Provide a mechanism for the long-range projection of land uses to the year 2000 so that the balance between preservation and developmental needs can optimally be met in the future.
- . Facilitate comprehensive planning for the developmental and preservation needs of island communities by providing an essential element of the Comprehensive Development Plan and a compliment to the Land-Use Districting.
- . Provide a mechanism through which public involvement can effectively incorporate the desires of area residents into comprehensive land-use planning.

- . Delineate and define land-use areas and establish use classifications for residents and private developers to promote responsible resource use and development in the interest of the larger society.
- . Provide a base study for the specific area planning interests of various Government of Guam agencies.
- . Provide a median between the specificity of districting and zoning as a base for zoning revision of urbanized areas, which provides more accurate property tax evaluation and analysis of lot-level land-use compatibility and conflict.
- . Encourage appropriate legislative bodies to participate in the planning process and give official recognition to the policies and goals embodied in the Guam Comprehensive Development Plan.
- . Provide a base study for legislative establishment of improved regulatory mechanisms for land-use controls.
- . Promote increased cooperation between local and federal agencies in planning for compatible land-uses on adjacent locally and federally-owned land.

C. Use Classifications

As land-use plans, Community Design Plans represent a step towards more specificity from the more general classification of Guam into four districts. The districts are Urban, Rural, Agriculture, and Conservation lands. Utilizing more specific breakdowns of the four districts and incorporating designations of areas of particular concern, Community Design Plans provide a partial basis for more specific and forthcoming revised zoning in urbanized areas. Districted land is classified into the following uses which are keyed on the Plans.

Urban

1. Residential (Low Density). Single family residential use.
2. Residential (Medium High Density). Multiple-family dwellings or apartments and condominiums.
3. Resort. Development such as hotels and related support services.
4. Commercial. Retail and shopping areas providing goods and services.

5. Industrial (Heavy). Existing areas of a specific type of industrial activity such as a refinery or port facilities.
6. Industrial (Light). Assembly, light manufacturing, and related use.
7. Airport. Airfields, terminals, and related support facilities.
8. Public and Semi-Public. Schools, churches, cemeteries, community centers, government buildings, and grounds and similar uses.

Rural

1. Residential. Agriculture and limited single-family residential use.

Agriculture

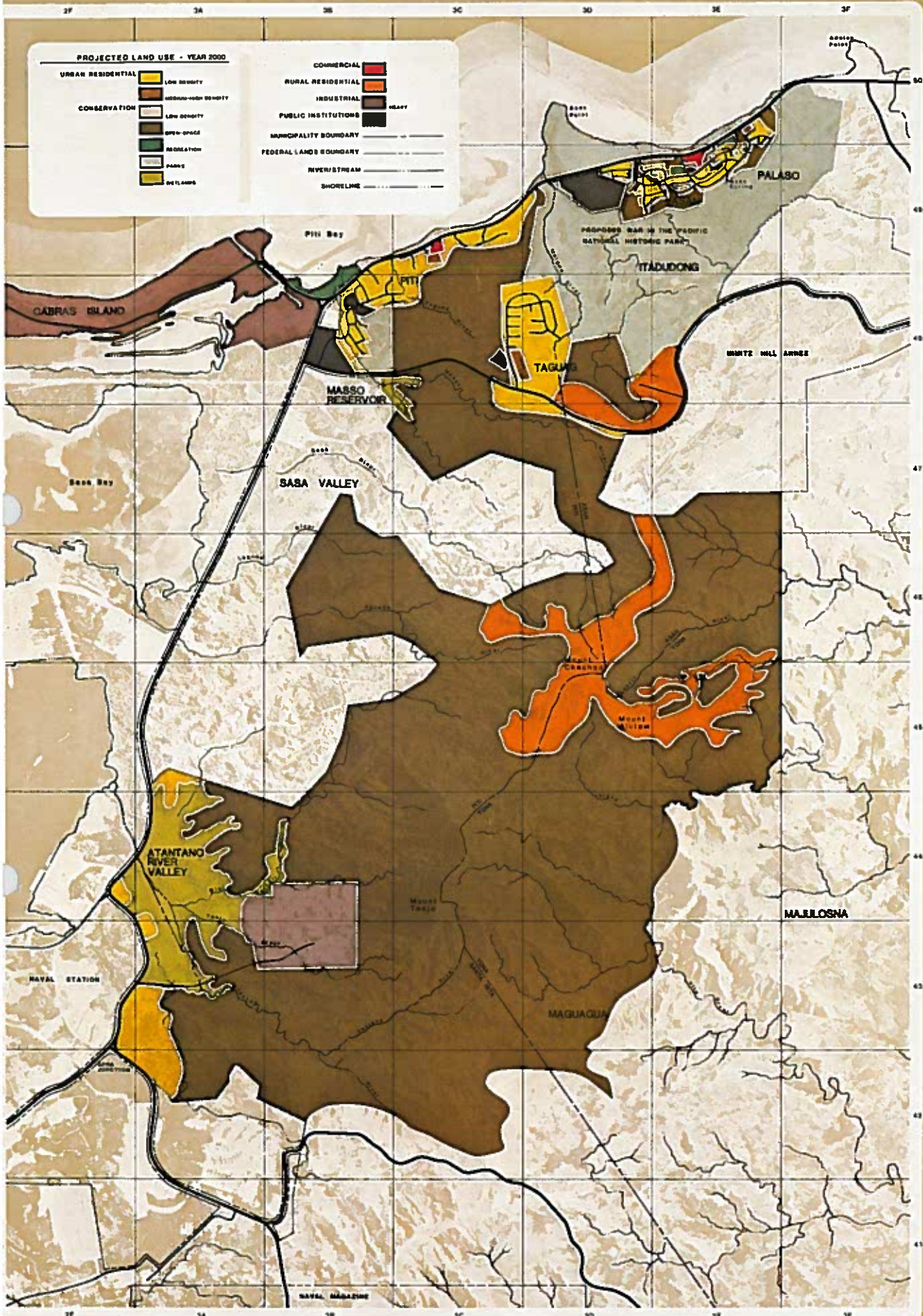
1. Cultivation. Land of relatively flat terrain and fertile topsoil for raising of crops and livestock.
2. Aquaculture. Areas presently used for the raising of fish, eels, and shrimp and other aquatic species.

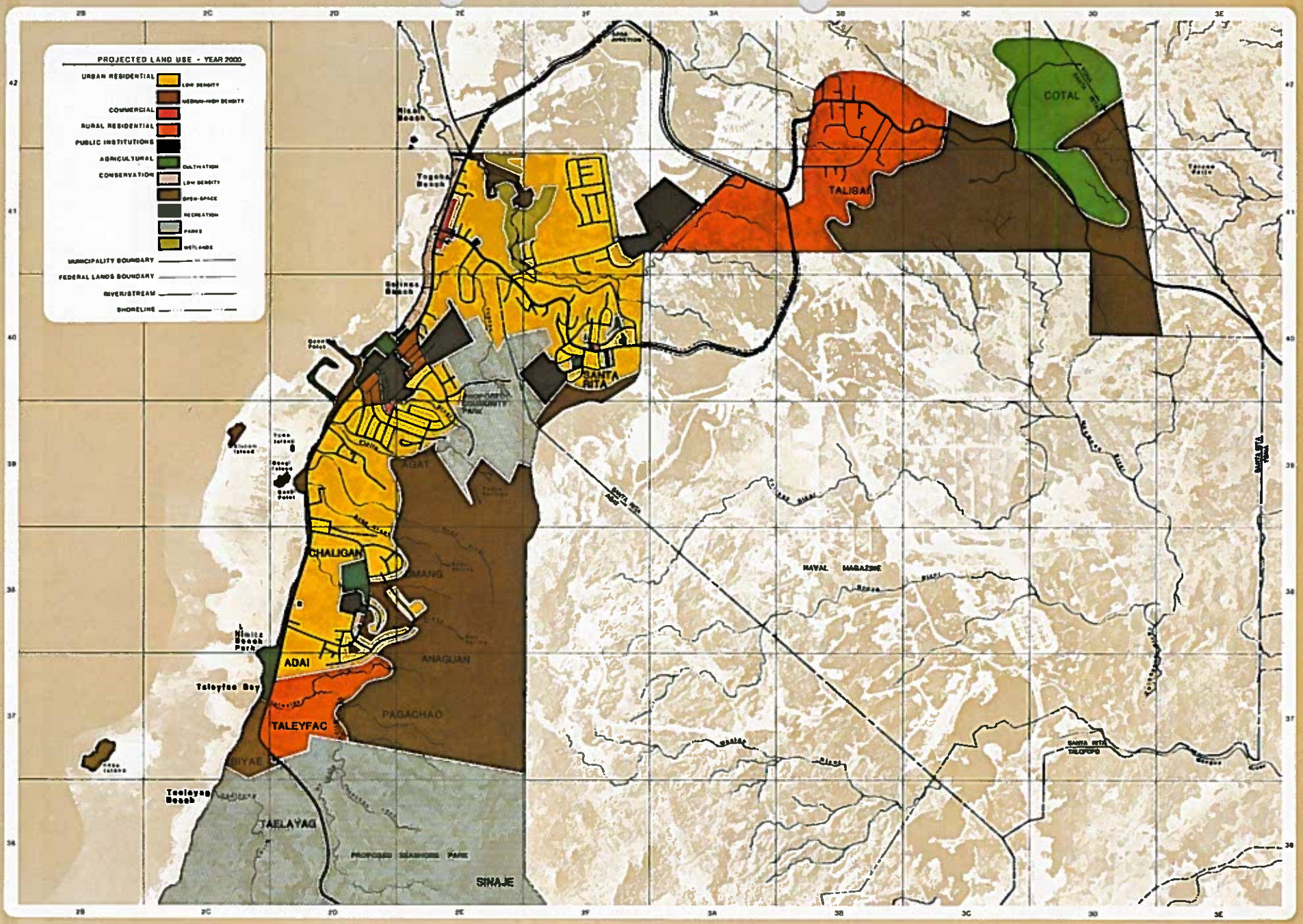
Conservation

1. Open-Space. Undeveloped slope and natural shoreline areas, primary aquifers, and other areas where development is discouraged.
2. Low Density. Heavily restricted residential and agricultural use.
3. Historic Sites. Locations with significant prehistoric, historic or architectural value.
4. Park. Major land areas for active and passive outdoor recreational use such as hiking, camping, and swimming.
5. Recreation. Land for leisure activities such as baseball, basketball, softball, soccer, and playgrounds.
6. Wetlands. Swamps, marshes, rivers, mangroves and other lands constantly covered with water.
7. Lowland Basins and Sinkholes. Low grassy areas and natural openings on the limestone plateau located over primary aquifer recharge areas.
8. Watersheds. Southern volcanic uplands and ravine valleys necessary for uninterrupted and unpolluted surface water drainage.
9. Wildlife Reserve. Areas for preservation of plant and animal life.

D. The Plans

The following maps are reduction of the full-scale Community Design Plans available at the office of the Bureau of Planning.



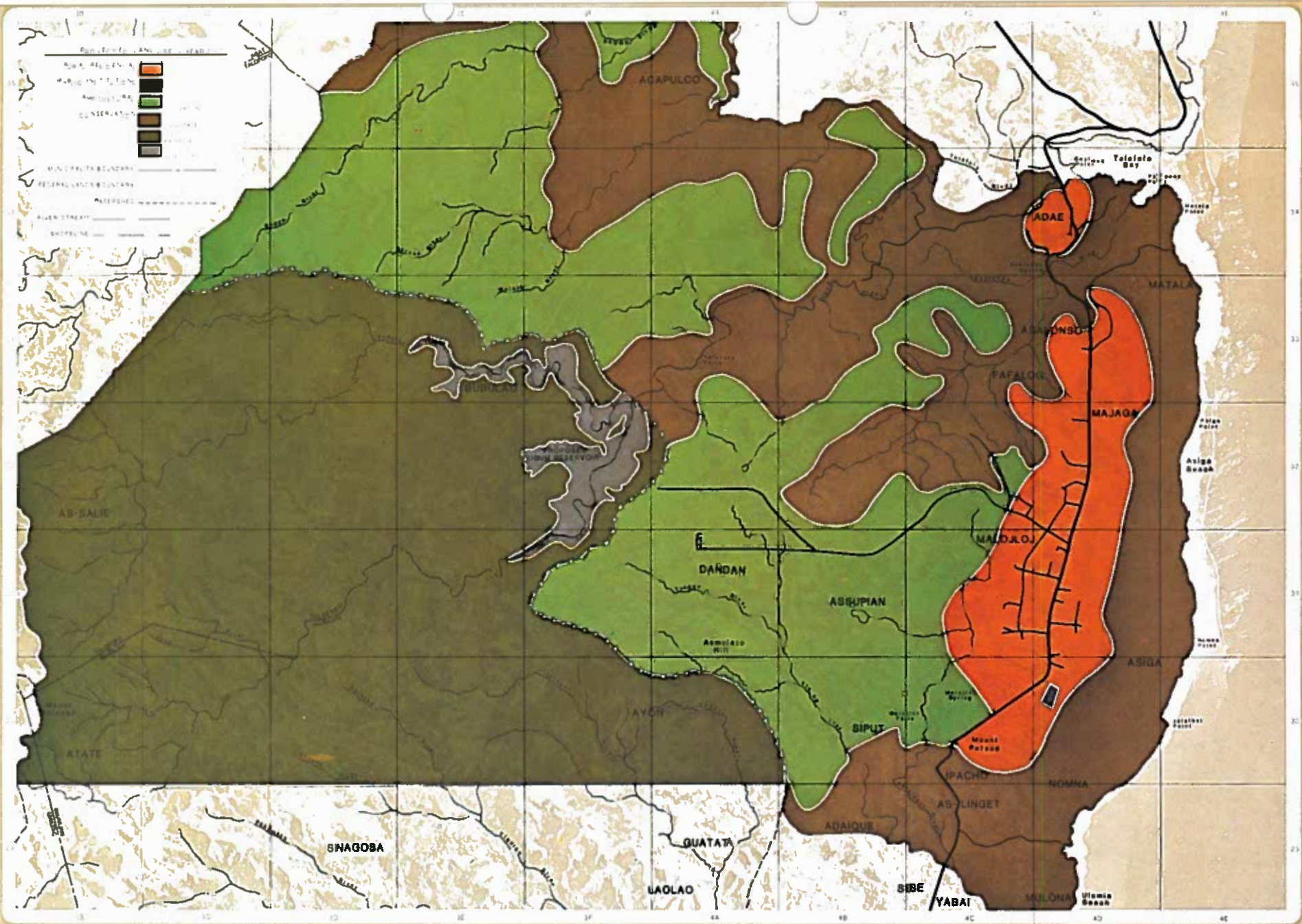


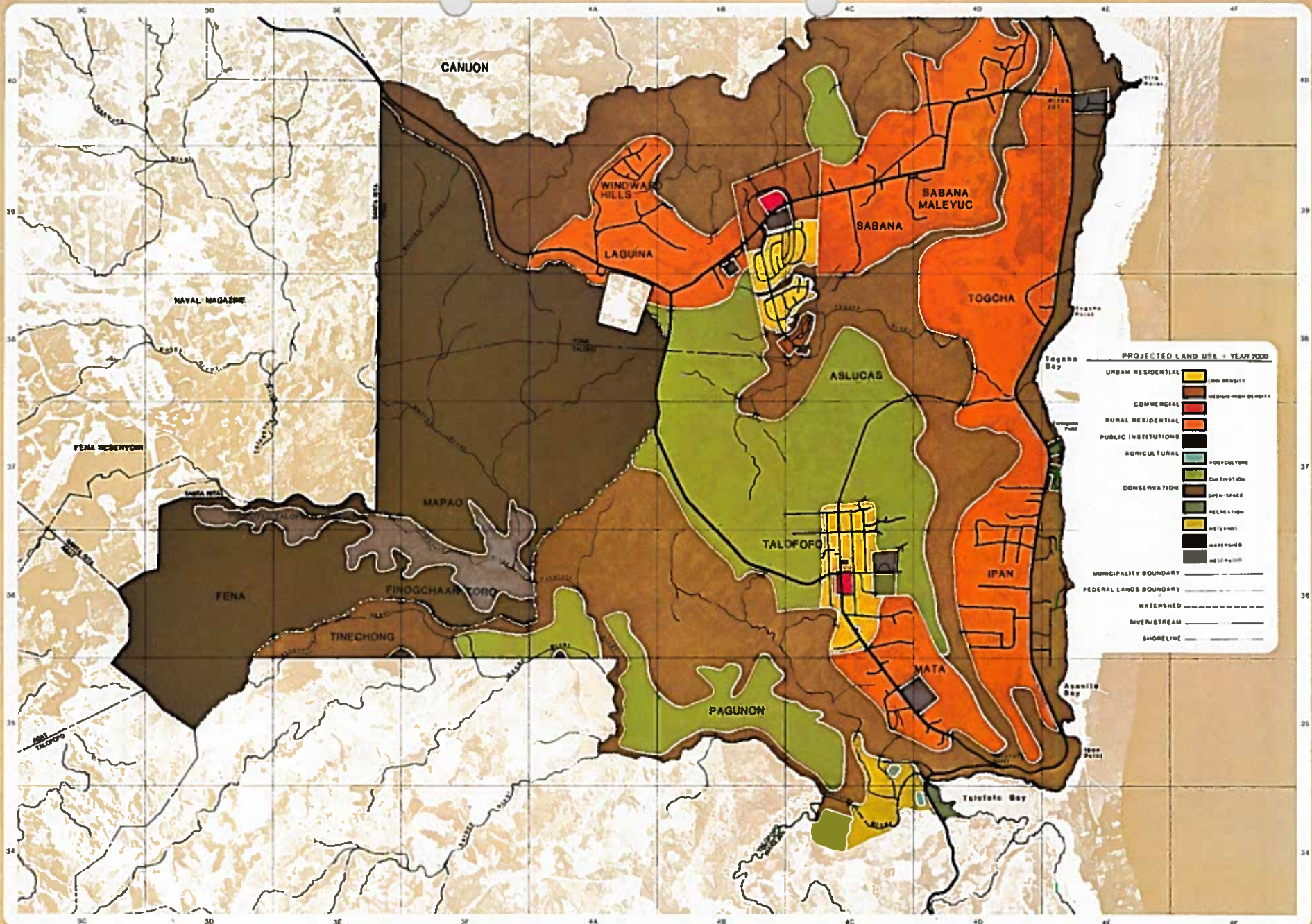


CH 10

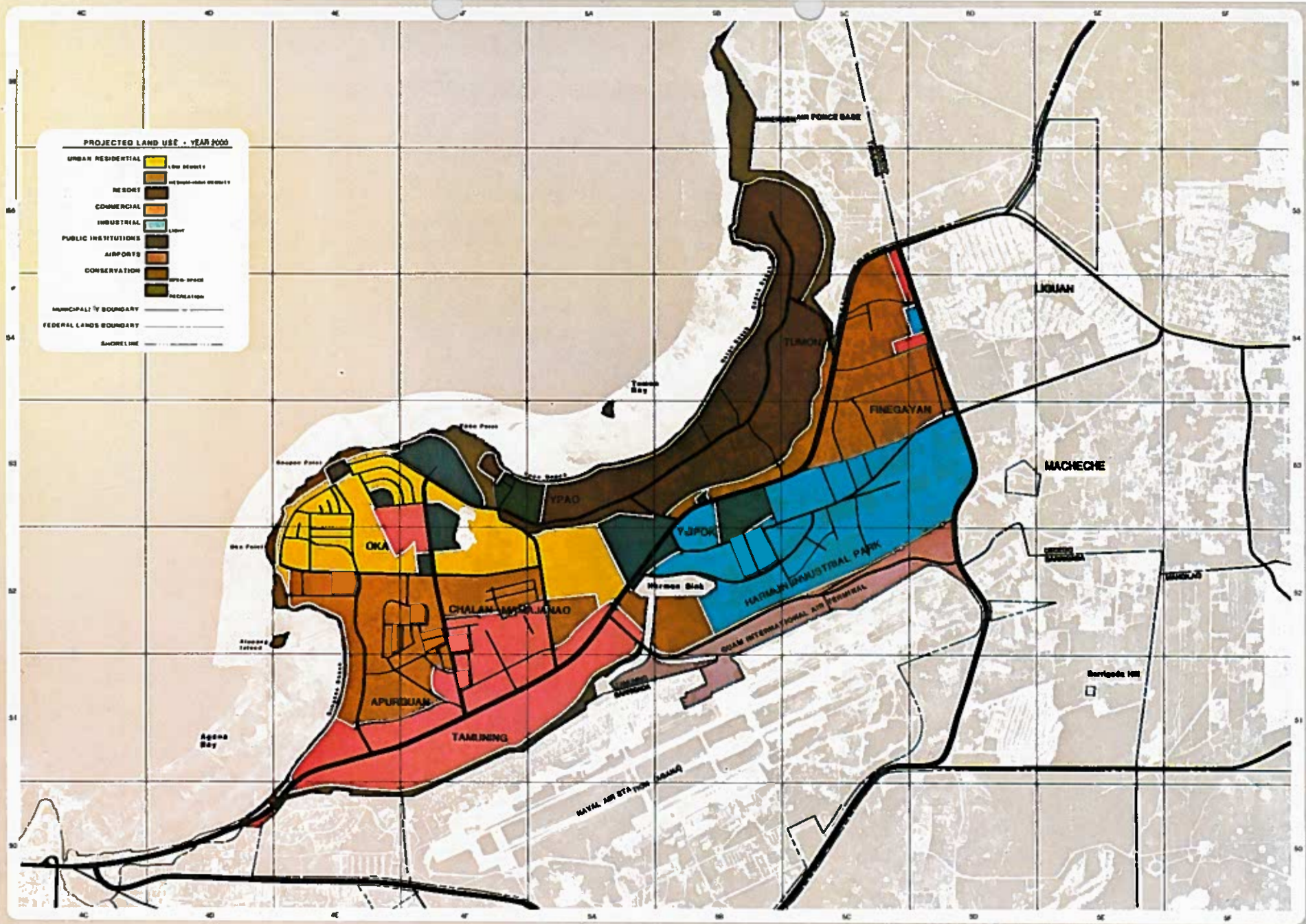
3











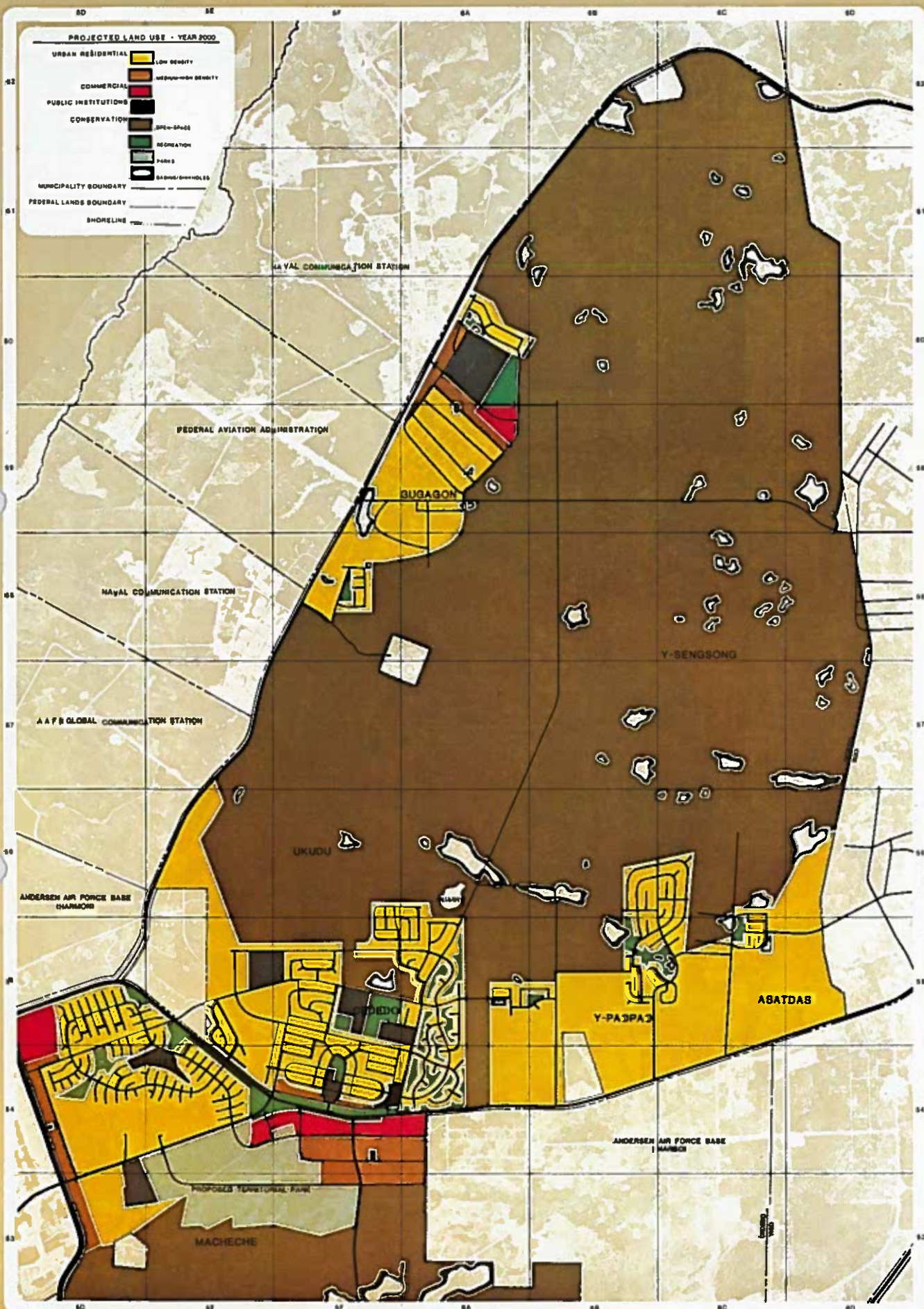
PROJECTED LAND USE - YEAR 2000

URBAN RESIDENTIAL	LOW DENSITY
RESORTS	MID DENSITY
COMMERCIAL	
INDUSTRIAL	
PUBLIC INSTITUTIONS	
AIRPORTS	
CONSERVATION	
	RECREATION

MUNICIPALITY BOUNDARY

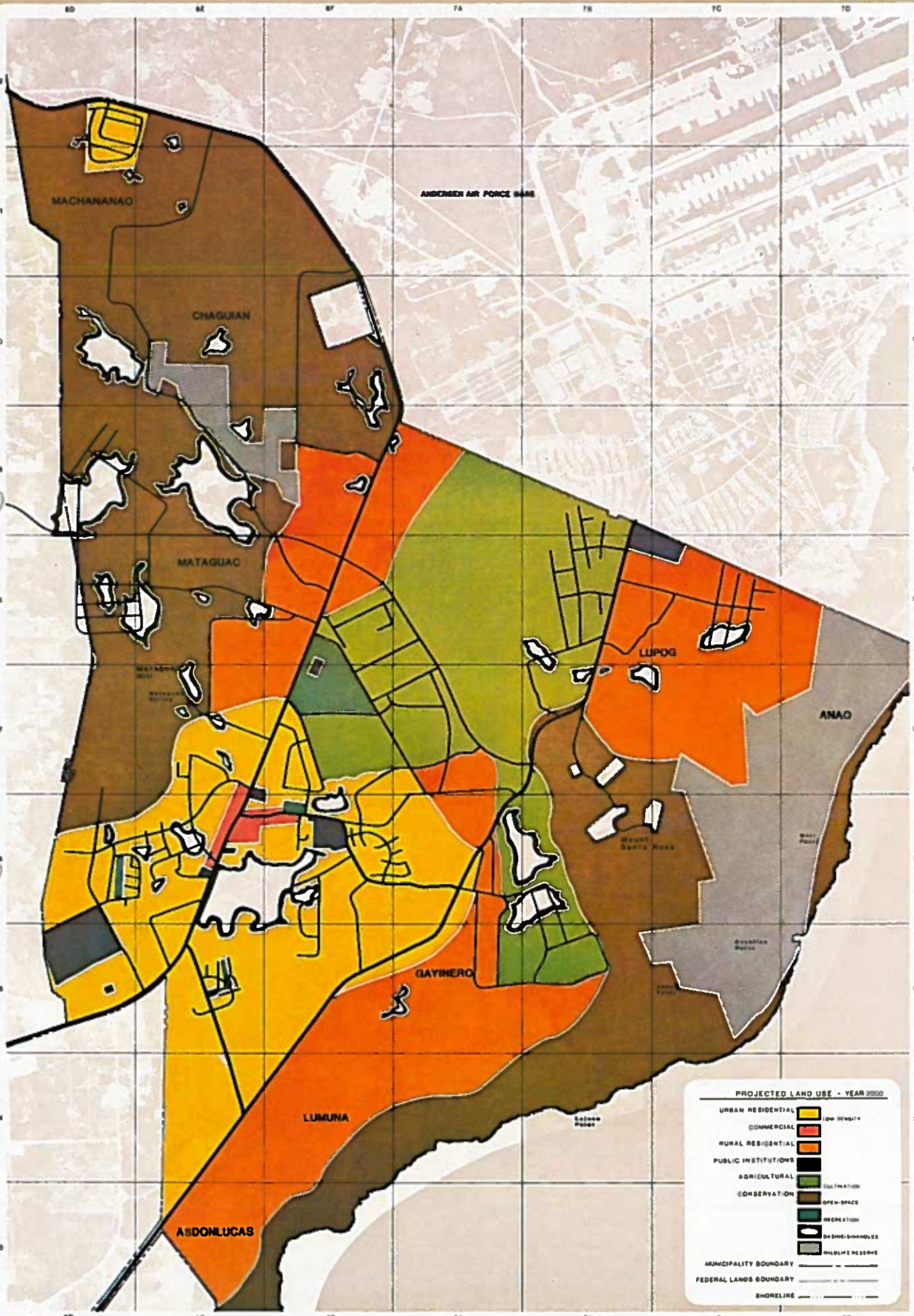
FEDERAL LANDS BOUNDARY

SHORE LINE



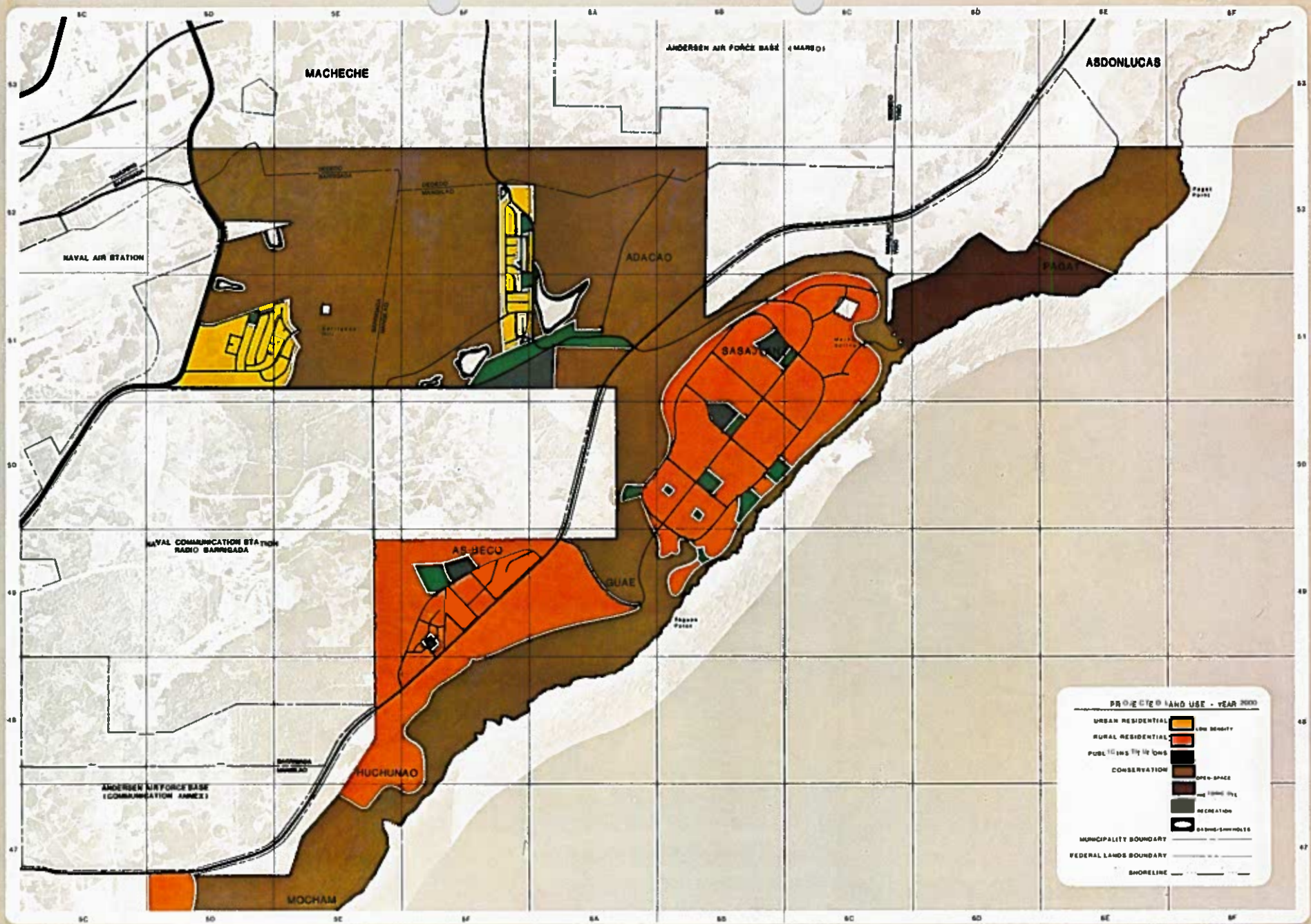
SCALE 1:10000
DATE 1990
BY BUREAU OF PLANNING
REVISION 1





Scale: 1" = 1000'
North Arrow





LAND TRANSPORTATIONA. Background

Guam's land transportation system provides essential infrastructure support for economic development, community life and national interests. Occupying a unique and strategic location in the Pacific, the island's transportation network must fulfill both local and military requirements. Presently, there are 270 miles of roadway on Guam. There are 126 miles of primary and secondary highway, while the remaining mileage is classified as local streets and collector roads.

Since 1970, the number of registered vehicles on Guam has increased from 31,471 to 57,779 in 1977. This upward trend is expected to continue for at least a decade or until prohibitive costs for fuel or provision of mass transit facilities create a major change in an island society currently highly dependent upon automobiles.

The original road system on Guam was mostly destroyed by World War II and rebuilt by the Naval Government. Since these roads were developed in relation to military installations, many which are no longer in use, they often bear little relationship to environmental features, projected needs or responsible community design. The emerging postwar economy has generated a rapid increase in both construction and the use of the motor vehicle, placing heavy pressures on natural resources. The intensity of land use along major routes and prohibitive costs for relocation have insured the permanency of the basic highway system to the Year 2000. However, many problem areas can be alleviated through responsible land-use practices.

The Comprehensive Highway Plan, prepared by DPW in 1975, outlined specific policies relating to land-use and environmental protection.

The plan recognized that:

- . Construction of transportation facilities that would provide access or stimulate further development within environmentally sensitive areas should be avoided.
- . Transportation facilities should be designed to compliment adjacent development and have a distinctive aesthetic identity.
- . Transportation facilities to recreational, historic and scenic resource sites should be avoided until public or private controls and/or regulations are established to protect such sites.

The plan, however, could not go one step further to develop enforceable performance standards in the absence of an updated Land-Use Plan and an improved system of land classification such as the Land-Use Districting system. Thus, this chapter of the revised Land-Use Plan outlines transportation issues related to land use and presents a management strategy in the form of performance guidelines, deservant of regulatory enforcement, to alleviate identified problems. Transportation problems relating to such areas as street lights, traffic signals, paving, speed limits or other needs more related to safety are not addressed in this document. The reader should refer to the Guam Comprehensive Highway Plan and Guam Comprehensive Development Plan for such information.

Where the road system is inadequate to meet the growing needs of the population, highways can either be relocated, modified or reconstructed in their present location. Due to Guam's limited land area, fragile natural resources and existing patterns of urban development, the major emphasis must be on modification and reconstruction of existing routes.

This primarily involves wider or additional lanes, lower degrees of slope, improved curvatures and straighter alignments in some areas, as opposed to extensions and alternate route developments. The amount of modification and reconstruction should even decline in conjunction with provision of alternate modes of transportation.

B. Road Classification

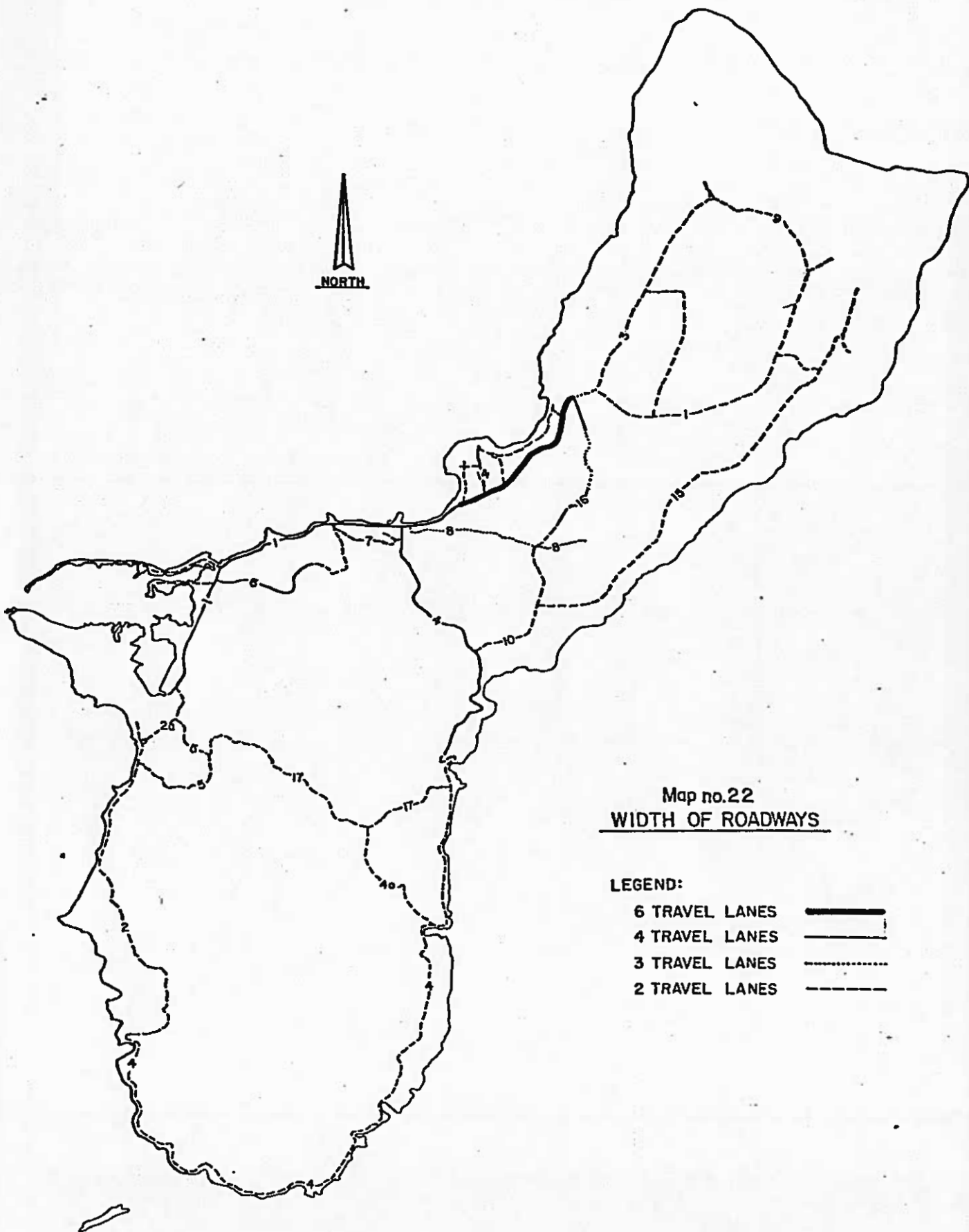
The following classification system provides definitions of major elements of the transportation network as related in the discussion of issues and presentation of guidelines.

1. Primary Highways. These are major trunk or arterial routes which connect areas of intensive urban development and major population centers. They carry high volumes of traffic, greater than 20,000 vehicles per day, including numerous commercial and heavy-duty vehicles. They are comprised of four to six moving lanes and a median divider, with a right-of-way of 100-150 ft.
2. Secondary Highways. These are minor highways which connect communities and carry moderate to high volumes of traffic over relatively long distances. The volume of traffic usually reaches or is greater than 10,000 vehicles per day. Secondary highways should have an average right-of-way of 90 ft. They usually consist of two-four moving lanes with turning bays, but no median divider.
3. Collector Roads. These are critical links in the highway infrastructure as they funnel traffic into higher order highways from surrounding residential, industrial and institutional areas. They average 70 ft. in right-of-way width and consist of two moving lanes. Traffic volumes average about 3,000 vehicles per day.
4. Local Streets. These serve primarily to provide access to individual lots within urban and rural areas or to specific agricultural or recreational areas. Vehicular traffic is less than 3,000 vehicles per day. The inventory of local streets will increase at a rate faster than all other roads as new areas are subdivided or developed. Local streets usually have about 40 ft. of right-of-way and provide for two moving lanes.

C. Issues

1. Urban Sprawl

The major problem associated with road development on Guam has been its contribution toward random urban growth. This problem is actually



Map no.22
WIDTH OF ROADWAYS

LEGEND:

6 TRAVEL LANES	
4 TRAVEL LANES	
3 TRAVEL LANES	
2 TRAVEL LANES	

a composite problem of reduction of: open space, wildlife, scenic quality, water quality and energy efficiency. Accompanying road construction are other infrastructure developments (power, water, sewer, telephone, etc.) which are quickly established within rights-of-way. Provision of these amenities often falsely justifies the directions of urban growth. Thus, a careful analysis of environmental, social and economic impacts, such as required in an EIA, should be an integral part of major transportation route developments. Road construction or extensions, primarily intended to accommodate traffic flow or link land areas, all too often point the direction of urban growth into unsuitable locations. Vehicle transportation developments should now be confined within urban and rural areas as delineated on the Land-Use Districting Map. Any road developments within Conservation Districts should be severely limited to minimal access and parking of recreational purposes within the limits of a defined park area. Access roads within Agricultural Districts should be for agricultural purposes only with no accompanying infrastructure connected to any use other than an agricultural support facility. The argument that residences must accompany farming only promotes further subdivision and urbanlike growth within areas of prime agricultural land, defeating the purpose of delineating Agricultural Districts. Residential growth related to farming is best located within adjacent rural areas.

Linear urban or strip commercial development, along with contributing to environmental problems, from a purely transportation perspective, has resulted in user conflicts and congestion. This problem is most evident along the Agana Bay Urban Waterfront, however, is also increasing in other community areas. The traffic flow is interrupted

by customer and delivery flows from insufficient parking areas and ill-defined entrances and exits. There has been little planned compatibility between the development of the circulation network and the patterns of urban-commercial growth on the island.

Within urban-residential community areas, local streets are in desperate need of restructuring as they have accompanied the random spread of housing in many cases and often traverse privately-owned lands. At this stage of the island's urban growth, existing problems can best be alleviated and prevented through urban renewal efforts and proper review and regulation of subdivision and PUD proposals.

2. Rights-of-Way Ownership and Improvement

The Territory of Guam does not own rights-of-way for much of the existing road network. Ownership of the rights-of-way is divided between the Federal Government, the Government of Guam and private landowners. In many areas, the ownership is undetermined. The problem is most extensive in regards to local streets. Many access roads throughout the island are of private or doubtful ownership. In many cases, open space areas have become public thoroughfares simply through common usage. The excessive use of short-cuts which degrade open space should be discouraged if maintained access to lands is available.

Before many of Guam's roads can be improved, all rights-of-way must be owned by the Government of Guam. Currently, DPW cannot clear the vegetation from the sides of many roads because they do not have the entry rights into private areas which are off paved surfaces. The

capacity of many roads is substantially reduced by the presence of restrictive side clearances or narrow road shoulders. An additionally needed rights-of-way improvement measure is the construction of curbs within urbanized areas of heavy usage. Much of Guam's road system is without curbs. Curbs reduce the degree of nonpoint pollution in stormwater by preventing the erosion of soils along roadsides. Curbs also contain street debris such as soil, glass, tire rubbings, litter and animal wastes that can be partially removed by street cleaning operations and further reduce levels of stormwater pollution as well as enhancing aesthetic quality. Guam lacks a street cleaning program within urbanized areas.

The Government of Guam should conduct an islandwide survey of rights-of-way ownership and deficiencies and exercise the right of eminent domain where needed to improve conditions.

3. Parking

The sharp increase in the number of automobiles on Guam has created a serious lack of parking facilities. Both along-street parking and municipal parking lots are deficient. As the motor vehicle registration grows, there will be a need for even more parking. The problem is most serious within the government and business center of Agana and along the commercial strip that borders Marine Drive through Tamuning and to a lesser extent within Anigua. Parking space requirements can be met through construction of new facilities, but should primarily result from more efficient utilization of existing lots in conjunction with increased centralization of shopping centers and urban renewal efforts. Provision of alternate modes of transportation would also alleviate parking shortages.

The strip commercial development within Agana and Tamuning has crowded along the shoreline on lands insufficient for a proper parking/customer ratio. Often the entire business frontage is utilized for random parking without any defined entrance or exit to the traffic flow on the primary highway, a lack of paving and a total lack of landscaping. The lack of pavement on many parking surfaces often does not comply with Air Quality Standards for dust control.

Within the Central Agana business and government center, parking is insufficient due to the small size of available lots utilized for economic and governmental development. Municipal and private parking facilities must be constructed on larger parcels and open lots must be paved and have sufficient storm drainage. A comprehensive parking plan is needed for the entire Agana-Tamuning business district.

The Zoning Law contains parking regulations in § 17350. Under these regulations, business, professional and public administration offices, such as located within downtown Agana, require one parking space for each 400 sq.ft. of floor area. An individual parking space is required to contain a minimum of 180 sq.ft. When all parking lot areas, including individual spaces, thoroughfares, entrances and exits are totaled, the required ratio is approximately 1 sq.ft. of parking area to 1 sq.ft. of floor space. Many business and shopping centers throughout the United States have found a ratio of up to 4 sq.ft. of parking area to 1 sq.ft. of floor space to be most efficient. It is clearly evident that the required 1 to 1 ratio is extremely insufficient on Guam. Even a 2 to 1 ratio, such

as at the Pacific Daily News Building in Agana, is insufficient for both employees and visitors. A ratio of at least 3 to 1 is needed within Guam's business, governmental and commercial use areas.

The TPC is frequently requested to grant variances for parking requirements under the rationale that lots are too small and provisions for parking would hinder business development. However, issuance of variances on an already deficient requirement, further deteriorates parking conditions. Sufficient parking is good for business and enforcement of requirements will encourage location of businesses into more centralized shopping and service areas where adequate land is available for parking.

A relatively recent, yet growing parking problem on Guam is associated with the Resort-Hotel Zone. Parking regulations require a ratio of parking space to the number of hotel rooms. Surveys have clearly shown that the ratio should rather be determined by the existence of commercial enterprises within hotel complexes. An example is that the Continental Hotel parking lot averages only 46% usage, whereas the Hilton Hotel lot is filled to an average 119% capacity or overflows. Both lots have the same ratio of spaces to number of rooms and nearly the same number of parking spaces. The Continental Hotel, however, offers fewer restaurants and shops than does the Hilton.

Whereas, most parking requirements are insufficient, the Zoning Law requires excessive parking for child care centers. Parents do not park at child care centers. Rather, they pick up and drop off their children. The currently required parking space would be

more efficiently utilized for open space/recreational use and a requirement should be established for a circular drive for off-road pick up of children.

The Zoning Law parking regulations must be reevaluated and amended as a primary step before parking problems can be eased and subsequently, variances to these regulations should not be granted.

4. Bicycle and Pedestrian Paths

A further reflection of our automobile-dependent society, pedestrian and bicycle paths are almost non-existent on Guam. They are needed as an alternative mode of transportation and to safely link commercial enterprises and community areas such as residences, schools and recreational parks. Particularly, school children are in most need of such facilities. Bicycling is also popular amongst Guam's tourists and provision of paths would reduce the problem of uninitiated visitors entering the vehicle traffic stream and would enhance the resort image within the Resort-Hotel Zone. A successful bicycle and pedestrian network must be planned and provided as an integral part of highway reconstruction and modification, rights-of-way improvements and as a requirement along new local streets, particularly within residential areas.

5. Alternate Modes

The Guam Comprehensive Development Plan recognizes that Guam will have to increasingly look toward alternate modes of transportation, particularly mass transit. Presently, public transportation facilities are almost non-existent. Provision for alternate modes, such as a bus system, will directly reduce the net flow of commuter vehicles and the amount of required highways and parking. Secondary impacts

in reducing the volume of traffic are less stormwater and air pollution problems. Public transportation would also support more intensive development within identified urban areas by providing more land for developments other than for roads and parking. If urban densities were to increase within suitable areas, the relative costs of other infrastructure, such as water, sewer and power, would ultimately decrease.

D. Performance Guidelines

- . Primary and secondary highways shall be attractively landscaped on median strips.
- . All reconstruction, modifications or extension of primary and secondary highways, collector roads and new local streets within subdivision and PUDs shall provide a pedestrian/bicycle path within the right-of-way.
- . Primary highways, secondary highways and collector road extension or relocations shall require preparation of and EIA, approved by GEPA.
- . Construction of curbs on all reconstructed, modified or new roads shall be planned to reduce stormwater pollution levels and provide a cleaner, safer road surface.
- . Parking area regulations of the Zoning Law and pavement requirements of Air Quality Standards shall be enforced without variances.
- . New road construction, solely to relieve traffic congestion, shall not be approved if increased public access through a military reservation would relieve the traffic flow problem.
- . Primary and secondary highways and collector roads construction shall be allowed only within Urban Districts as delineated on the Land-Use Districting Map.
- . Access roads within Agricultural Districts shall be for agricultural support only with no accompanying infrastructure connected to a residential or commercial outlet or other urban-type uses.
- . No road developments shall be permitted within Conservation Districts except for recreational access roads within a defined park area which is managed by the Government of Guam or National Park Service.

IX. FEDERAL LANDS

A. Background

Since Guam was first colonized by the Spaniards in the 16th Century, the island has remained a strategic location for military activities. Today, as a U. S. Territory, it is still a vital base for a myriad of defense functions. In meeting defense needs for activities such as fleet support, communications, ammunition handling, flight operations, health services and housing, a vast amount of land area is required. The amount of federal land and the impacts of its use are further magnified by the ratio of federal land holdings to the island's relatively small total land area (See Map No.23). The federal government owns roughly one third of Guam. Most federal lands are owned by the military with ownership nearly equally divided between the U. S. Navy and U. S. Air Force (See Table No. 4).

B. Land-Use Compatability

Management of land and water resources on federal properties has essentially been an insular approach of sole management by the agency owning the land. Recent developments, however, such the preparation of master plans for federal properties, negotiations for releasable lands and federal consistency provisions of the Guam Coastal Management Program have brought forth the need for better coordination in planning for both federal and local land-use. This is only logical considering the fragility of island resources and sizeable ownership of land by the federal government. To assist in long-range planning for compatible land-use, this Plan proposes land-use districting of federal lands such that optimally, the entire island will someday be districted. The proposed districting (See Map No. 24) will not apply to Land-Use

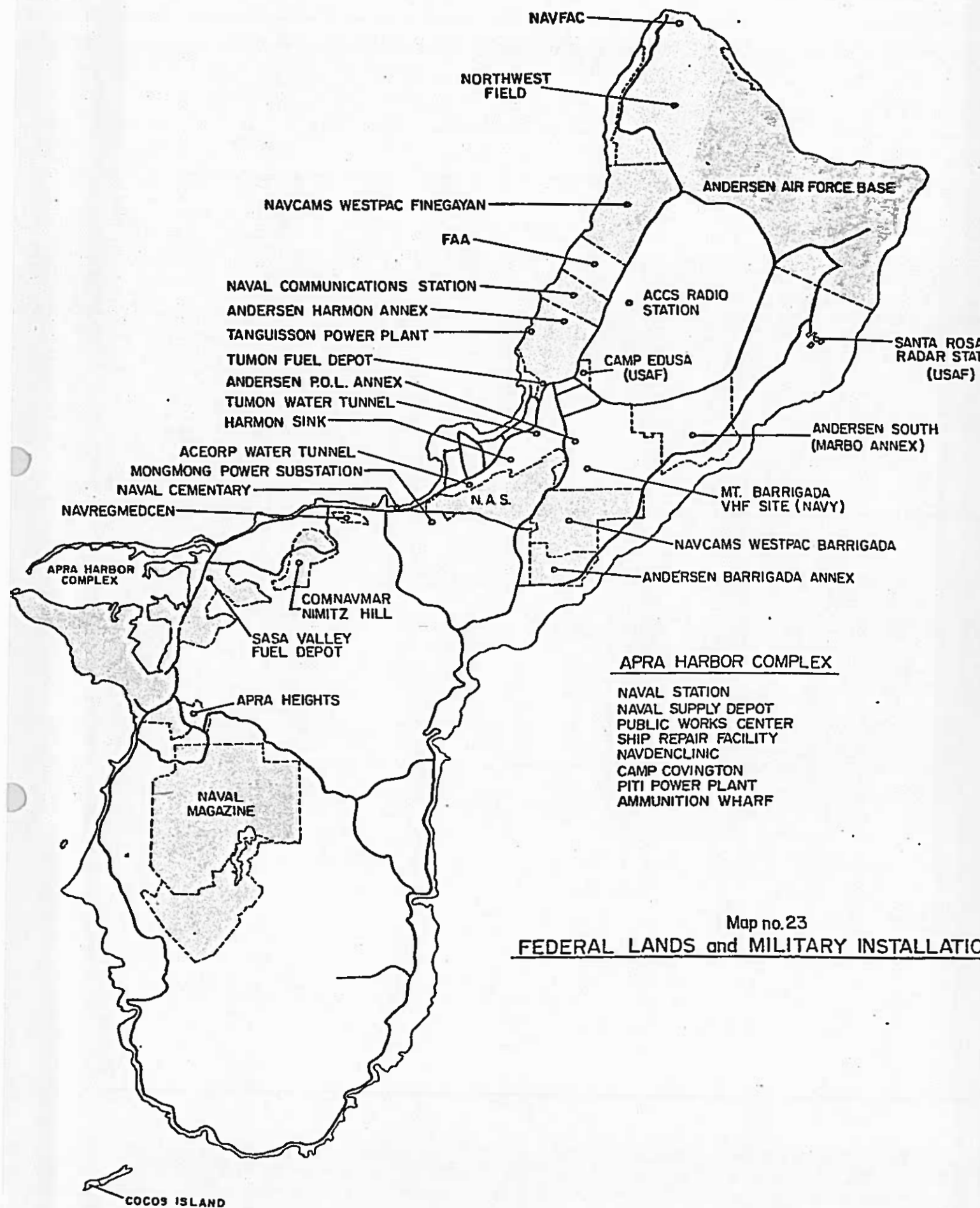


Table No. 4 - PATTERNS OF FEDERAL LAND OWNERSHIP

<u>Agency</u>	<u>Acres</u>	<u>Percent</u>	<u>Percentage of Total Land Area^{1/}</u>
A. Military			
Air Force	20,544.54	46.1	15.1
Navy	22,069.24	49.5	16.3
Coast Guard	71.99	0.2	0.05
Subtotal:	42,685.77	95.8	31.45
B. Non-Military (Federal)			
Federal Aviation Administration	833.18	1.9	0.6
Department of Interior	988.66	2.3	0.7
Subtotal:	1,821.84	4.2	1.3
Grant Total (A&B) ^{2/}	44,507.61	100.0	32.75

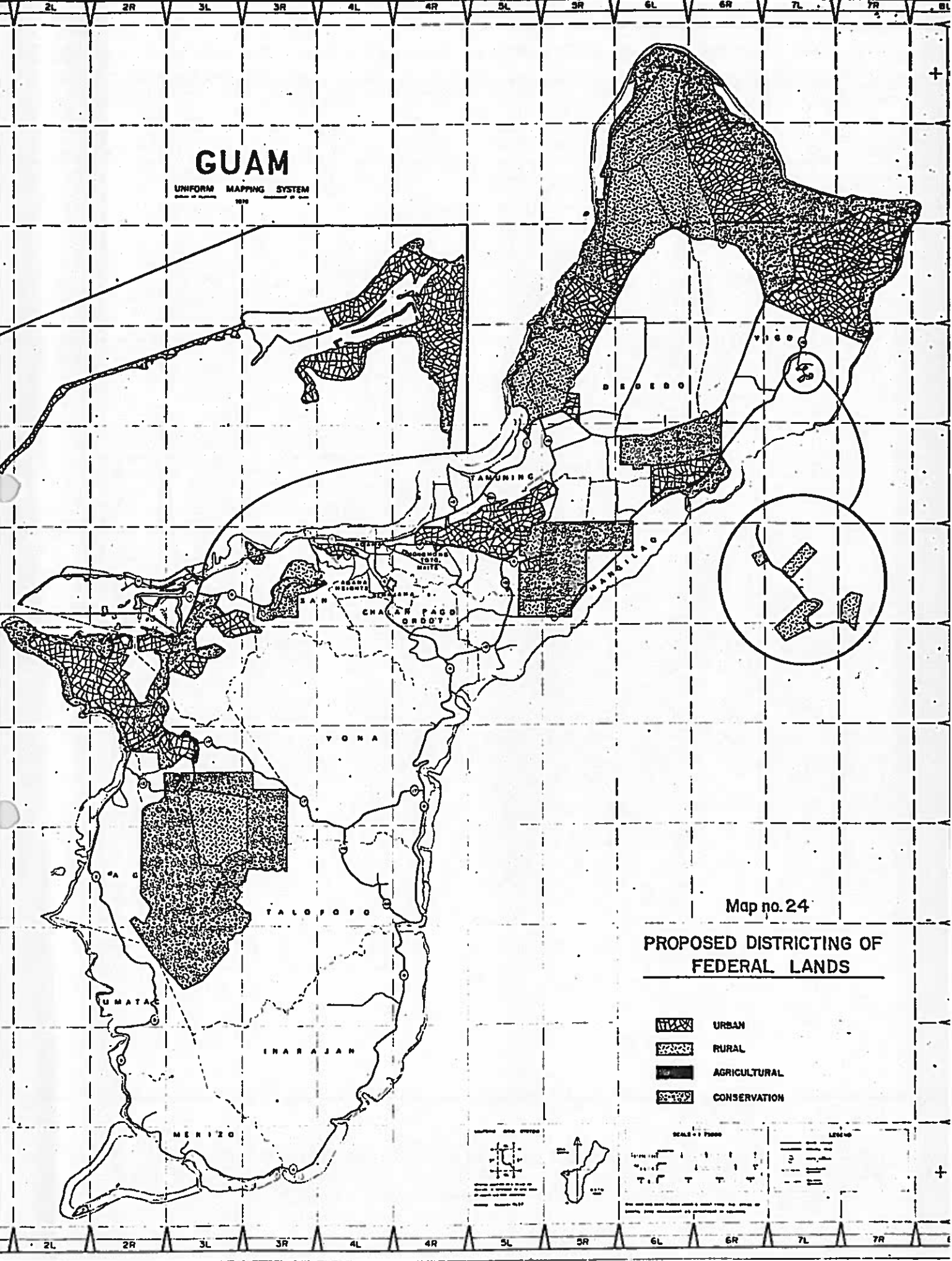
Footnote:

^{1/} Assuming total acreage of approximately 212 square miles x 640 acres per square miles.

^{2/} Differences in conversion factors used account for approximately 5 percent error in acre/square meter comparison. Total areas do not include submerged lands adjacent to property owned by the U. S.

Source: A Summary of Major Federal Agency Land Holdings of the Territory of Guam, Bureau of Planning, Government of Guam, January 1977, p. 3.

Districting Guidelines which are applicable only to Map No. 1, the Land-Use Districting Map and promulgated by Executive Order No. 78-23. Proposed districting of federal lands denotes no management control by local authorities, but expedites districting of lands acquired by the Government of Guam and furthers compatible land-use in future updates of federal lands master plans by military planners.



Appendix No. 1 The Uniform Mapping System

In 1974 an intensive investigation and evaluation of the grid system and mapping system on Guam was begun. Due to the inadequacies of existing maps and dissatisfaction with such maps, various agencies began their own individual grid and mapping system. A policy such as this would have led to more confusion and duplication of mapping efforts. To avoid further problems, the Bureau of Planning consulted all the major map users in the Government of Guam and, with the help of their input, developed and proposed one uniform system for all to use.

The only foundation for a grid and mapping system is the survey data of an area. For Guam, the survey data was established in 1913 which was ideal for grid identification and a map base. This coordinate system, which has negligible distortion for the island of Guam, is the legal basis for all surveying on the island. There have been technical difficulties due to poor survey procedures and war damage, but its basic concepts are as good as the most modern system anywhere in the world.

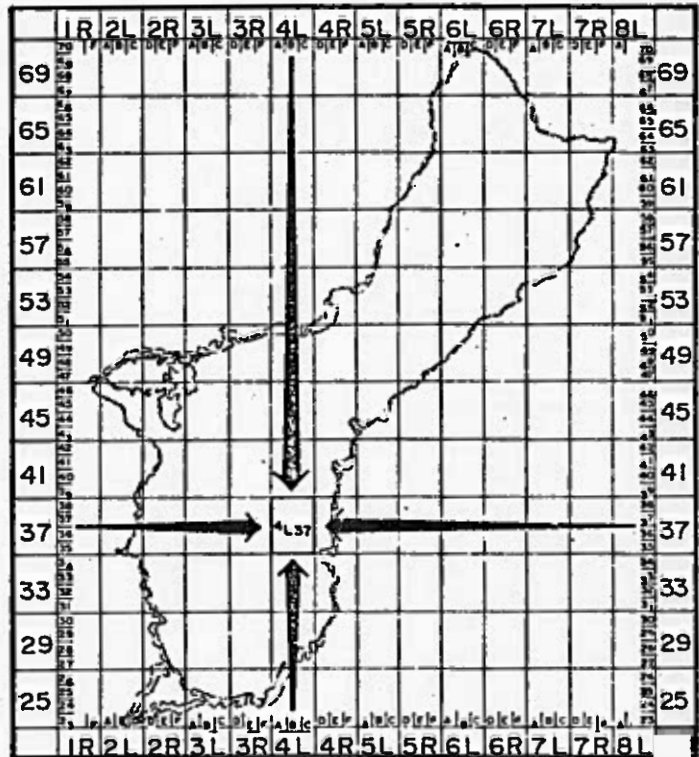
The Guam coordinate system has always been defined in metric units with direct conversion to foot system units often superimposed. Since there is currently a growing, irreversible trend toward use of the metric system, this quality of the Guam Coordinate system is most fortunate. In early 1976, Public Law 13-102 was signed by the Governor which provides for a commission on the Metric System and requires that dual dimensioning begin by February, 1977. Considering these factors, the basis grid for Guam is based on the metric system.

By Executive Order No. 75-16 the Uniform Grid System was established for Guam. In essence, the Uniform Grid System updates the Guam Geodetic Triangulation Net technical procedures common to surveyors, into a more convenient and usable form for planners, engineers, and non-technical map users. The Guam Geodetic Triangulation Net, as noted in the Executive Order, is the technical base for the Uniform Grid System. On the other hand, the Land Square System, as developed in 1913, was good for the state-of-the-art of 1913. The running numbering of squares, the quadrant numbering sections, and the row numbering of units was copied from the American Sectional System common at the time. Such a system is not readily adaptable to computerization but rather dependent on using an individual's working knowledge and memory. Therefore, the simple basis concept of Cartesian coordinates is used in the Uniform Grid System. This provides for divisions in units of ten and is fully described in the specifications provided for the system in Executive Order No. 75-37.

Evolving naturally from the Uniform Grid System was the Uniform Mapping System, and this was effected by Executive Order No. 75-37. The Uniform Mapping System provides guidelines so that all mapping on Guam fits into a systematic pattern based on the Uniform Grid System. This means that, in the case of a series of maps being designed for area coverage of a project, and where regular squares or rectangles constitute each map sheet, then the lines of the Uniform Grid System shall regulate the individual sheet match lines.

Some map series, which are standard, give total island coverage, with some sheets provided to show larger scales. This is regulat-

ed to be consistent for all users. Where only limited project areas are to be mapped the flexibility of the grid allows the use of any grid line, providing it has an even metric value and not a foot system value. In mapping irregular-shaped areas, no grid lines are used for the sheet lines; but the metric grid lines must be shown to allow integration with other maps of the system. Survey maps, engineering site maps, and strip maps are also flexible, with the only requirement that metric grid lines be superimposed and properly labeled.



EXPLANATION OF LOCATION SYSTEM

THE ISLAND OF GUAM IS DIVIDED INTO SQUARE "GRIDS" EACH 1000 METERS BY 1000 METERS. GENERAL LOCATION OF ANY FEATURE IS DEFINED BY THE GRID IN WHICH THE FEATURE IS LOCATED. LOCATION OF A GRID IS DEFINED BY THE "COLUMN" AND "ROW" IT IS IN.

COLUMNS ARE DEFINED BY A NUMBER LETTER COMBINATION. THERE ARE EIGHT COLUMNS (1 THRU 8) EACH DIVIDED INTO SIX (A THRU F) 1000 METER COLUMNS. FOR MAPPING PURPOSES, COLUMNS A, B, C ARE COMBINED TO FORM A "LEFT" HALF (EXAMPLE 4L) AND COLUMNS D, E, F FORM A "RIGHT" HALF (EXAMPLE 4R). THE NUMBER LETTER COMBINATION IS A CODE SYSTEM RELATED DIRECTLY TO THE GUAM GEODETIC TRIANGULATION NET METRIC COORDINATE SYSTEM.

ROWS ARE DEFINED BY TWO NUMBERS (23 THRU 70) DEFINING THE 1000 METER INCREMENTS OF THE GUAM GEODETIC TRIANGULATION NET METRIC COORDINATE SYSTEM. FOR MAPPING PURPOSES, FOUR 1000 METER ROWS ARE COMBINED AND IDENTIFIED BY THE COORDINATE NUMBER OF THE MIDPOINT. FOUR ROWS SUCH AS 35, 36, 37, & 38 ARE INCLUDED IN MAPPING ROW 37 (EXAMPLE 37).

TO DEFINE THE LOCATION OF A MAP WHICH COVERS THREE COLUMNS (4A, 4B, & 4C) AND FOUR ROWS (35, 36, 37, & 38) THE MAP LOCATION IS 4L37. TOTAL ISLAND COVERAGE IS PROVIDED ON 70 SUCH MAPS WHICH INCLUDES 4 SMALL "INSET" AREAS. THE 56 MAPS ARE NUMBERED 1 THRU 70.

APPENDIX NO. 2 - COMMUNITY POPULATION PROJECTIONS

	Uniform Grid Reference	Estimated No. of Existing Dwelling Units	Estimation of Existing Population	Population Projection Year 2000	Location	Municipality
Asan - Piti Community	1. 3E-49	200	1,000	2,000	Asan Village	Asan
	3C-49	157	785	1,400	Piti Village	Piti
	3B-48	50	250	275	Piti Kafer	Piti
	3D-48	127	75	150	Nimitz Hill	Piti
	3C-48	112	460	560	Nimitz Hill Estates	Piti
	3C-48	0	0	260	Nimitz Tower	Piti
	TOTALS	646	2,570	4,645		
Agat - Santa Rita Community	2. 3B-42	94	470	1,000	Apra Hts. North	Santa Rita
	3A-41	84	420	850	Apra Hts. South	Santa Rita
	2F-41	210	840	1,050	Hyundai Santa Rita	Santa Rita
	2F-40	294	1,470	2,150	Santa Rita	Santa Rita
	2E-40	219	1,095	2,650	Old Agat	Agat
	2E-39	443	2,215	4,500	Agat Village Proper	Agat
	2D-39	51	255	350	Agat South	Agat
	2D-38	72	360	600	Agat South to Pagachao	Agat
	2D-38	0	0	1,000	Pagachao	Agat
	2D-37	61	305	450	Taleyfac	Agat
	TOTALS	1,528	7,430	14,500		
Umatac Community	3. 2E-31	20	100	350	Salapigna	Umatac
	2E-30	120	600	900	Umatac Village	Umatac
	2E-29	0	0	350	Machanage-As Paile	Umatac
	TOTALS	140	700	1,600		
Merizo Community	4. 2E-28	26	130	280	Bile Bay	Merizo
	2F-27	183	915	1,500	Merizo Village & Pigua	Merizo
	3A-25	118	590	800	Sagualao	Merizo
	TOTALS	327	1,635	2,580		
Inarajan (Maloljo) Community	5. & 6. 4A-26	39	195	365	Agfayan Bay	Inarajan
	4B-27	104	520	600	Inarajan Village	Inarajan
	4C-28	90	450	800	Ghagamin-Lago	Inarajan
	4D-32	125	625	1,000	Maloljo	Inarajan
	TOTALS	358	1,790	2,765		
Talofofo Community	7. 4C-36	324	1,620	1,975	Talofofo	Talofofo
	4D-37	107	535	700	Ipan	Talofofo
	4B-39	145	573	1,000	Windward Hills	Yona
	4B-39	150	750	1,400	Baza Gardens	Yona
	4B-38	42	250	200	Casa De Sirena	Yona
	4C-39	50	80	600	Sabana Maleyuc	Yona
	4E-41	16	80	100	Togcha	Yona
	TOTALS	834	3,808	5,875		
Yona Community	8. 4E-41	0	0	100	Ylig Bay	Yona
	4E-41	87	435	800	As-Misen	Yona
	4E-42	298	1,500	2,820	Yona	Yona
	4E-43	46	230	600	North Yona	Yona
	4D-42	56	280	1,040	Pulantat	Yona
	TOTALS	487	2,445	5,260		

	<u>Uniform Grid Reference</u>	<u>Estimated No. of Existing Dwelling Units</u>	<u>Estimation of Existing Population</u>	<u>Population Projection Year 2000</u>	<u>Location</u>	<u>Municipality</u>
Central Guam Community	9. 5A-45	336	1,572	5,000	Mangilao West	Chalan Pago- Ordot-
	5B-46	576	1,392	4,080	Mangilao	Mangilao
	5B-48	955	4,691	10,000	Barrigada Village	Barrigada- Mangilao
	4E-49	1,401	5,644	8,000	Mongmong-Toto-Maite	Mongmong- Toto-Maite
	4C-50	166	639	2,550	Agana	Agana
	4A-49	88	440	700	Maina	Asan
	4B-48	905	4,525	8,000	Agana Hts.-Sinajana	Agana Hts.- Sinajana
	4A-48	90	450	750	Afami	Sinajana
	4D-46	446	2,212	4,000	Chalan Pago-Ordot	Chalan Pago- Ordot
	4F-47	85	425	600	Mai-Mai	Chalan Pago- Ordot- Mangilao
	TOTALS	5,048	21,990	43,680		
Tamuning Community	10. 5C-54	537	1,491	4,000	Tumon Village	Tamuning
	5B-53	625	1,559	5,000	Tumon	Tamuning
	4E-52	2,853	8,799	18,500	Tamuning Village	Tamuning
	TOTALS	4,051	11,849	27,500		
Dededo Community	11. 5E-53	406	1,811	3,000	Gugagon	Dededo
	5D-53	1,155	5,775	8,000	Liguan Terrace	Dededo
	5E-55	141	705	750	North Liguan Terrace	Dededo
	5E-56	0	0	5,000	Dededo West	Dededo
	5F-54	473	2,365	2,600	Dededo Village	Dededo
	5F-55	280	1,400	1,500	Wettengel	Dededo
	6B-55	1,034	5,170	5,200	Kaiser Dededo	Dededo
	6B-55	0	0	500	GHURA 500 site 1	Dededo
	6B-55	87	435	800	Ypa-Pao	Dededo
	6B-55	94	376	2,400	Ypa-Pao Estates	Dededo
	6C-56	0	0	500	GHURA 500 site 5	Dededo
	6B-57	253	1,265	1,500	Yseng-song	Dededo
	5F-58	100	500	500	GHURA 500 site 2	Dededo
	6A-59	337	1,685	3,000	South Areas	Dededo
	6A-60	0	0	500	GHURA 500 site 3	Dededo
	6C-60	78	390	500	Yseng-song North	Dededo
	TOTALS	4,438	21,877	36,250		
Yigo Community	12. 6E-55	695	3,361	9,000	Yigo Village	Yigo
	6D-56	0	0	500	GHURA 500 site 6	Yigo
	6E-55	200	336	600	Perez Acres	Yigo
	7A-55	35	175	500	Mt. Santa Rosa	Yigo
	6F-58	253	1,265	1,500	Yseng-song West	Yigo
	6F-59	78	390	500	Chaguan	Yigo
	6D-62	102	520	1,000	Agafa-Gumas	Yigo
	TOTAL	1,363	6,097	13,600		
Pagat Community	13. 5D-52	54	270	540	Barrigada Hill	Barrigada
	5D-52	256	800	1,050	Barrigada Hts.	Barrigada
	5F-52	326	815	1,244	Latte Hts.	Mangilao
	6B-50	0	0	5,000	Sasajyan	Mangilao
	5F-49	125	625	1,500	Pagat Village	Mangilao
	TOTALS	761	2,510	9,334		
	GRAND TOTALS	19,945	84,701	167,589		

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