

**THE SOCIAL-ECONOMIC IMPACT OF MODERN TECHNOLOGY
UPON A DEVELOPING INSULAR REGION: GUAM**

VOLUME III

PART V. ENVIRONMENTAL ISSUES

PART VI. SOCIO-CULTURAL ISSUES



1975

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- PART V. Environmental Issues
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PART V. ENVIRONMENTAL ISSUES

by

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with the cooperation of officials of the
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SUMMARY AND RECOMMENDATIONS

Guam's environment is presently being subjected to a number of man-caused stresses, many of which are quite severe; however, the environment is not yet damaged beyond repair. Man's activities can enhance the quality of the environment in many cases if there is careful planning. Planning that enhances environmental quality can be done only if there is sufficient motivation and environmental concern. Many of Guam's current environmental stresses will eventually lead to a deterioration in the quality of life of the average inhabitant if these stresses are not corrected. If a goal of man's activities is to enhance the quality of the environment rather than degrade it, the time to take corrective action is now. Government must assume a leading role in channeling such activities along corrective and beneficial pathways.

Many of the specific problems discussed in this report have common origins in unplanned or haphazard growth and development.

The most urgent recommendation of this report is that comprehensive planning, or master planning, be adopted and followed.

Comprehensive planning requires a long-range outlook rather than a short-term approach. Moreover, it must be viewed as a dynamic process requiring continual evaluation and updating. It is important not only from the standpoint of environmental considerations, but also from the standpoint of subjects discussed in the other major parts of this report. Comprehensive planning is the common denominator uniting all parts of this report. Its importance cannot be overemphasized.

Guam's environmental resources are capable of supporting a high quality of life for the local populace if these resources are wisely managed; however, the resources cannot support an unlimited population at better than subsistence levels. The question of what the optimum population size for Guam is and how we can avoid exceeding it should receive widespread attention and discussion. Some determination of ideal population size should be incorporated in comprehensive planning. The time for this question to be considered is now.

As part of comprehensive planning, there should be enactment of local legislation to provide a system of environmental review and to require environmental impact statements from all private developers and from federal and local governments. The object would be to insure that environmental considerations would be given appropriate attention in decision making. This is crucial with respect to Guam's freshwater resources and marine environment. Such proposed local legislation would parallel existing federal legislation which already applies in some cases. It should be Government of Guam policy to prohibit new industries and developments that would require a variance from Guam's existing environmental standards and that would contribute significantly to environmental degradation. Industries that do not degrade the environment or that have only a minimal impact should be encouraged. Consideration should be given to restricting hotel and resort developments to specific areas, such as Tumon Bay.

The Navy has an environmental protection plan that guides its activities on Guam. It should be reviewed and updated. The Government of Guam has a de facto plan by virtue of the existence of the Guam Environmental Protection Agency. The GEPA needs to be supported in its efforts to promulgate rules and regulations for the protection of Guam's environment. Existing environmental laws and regulations should be carefully enforced. The Air Force should develop and follow an environmental protection plan to guide its activities on Guam.

Environmental education beyond the existing pilot project currently being conducted by the Department of Education needs to be strengthened. The Department of Education, the University of Guam, and the Environmental Protection Agency should develop more effective educational programs outside of formal classroom teaching so that the general public can be made aware of the various compromises that enter into governmental decision making. The news media should be included in this effort. There is a need for greater environ-

mental awareness among Guam's citizens so that there can be more participation in the public hearings of various agencies; there is presently very little public participation in the many governmental decisions affecting Guam's present and future environment. The Governor and the Legislature should select individuals who have broad and diverse backgrounds to serve on government boards and commissions; political and conflict-of-interest appointments should be avoided.

Environmental research should be encouraged on Guam. Research would promote better-informed decision making by various persons and agencies responsible for planning and management and would help put comprehensive planning on a sound basis. Part of this effort should include the production of accurate maps because the inadequacy of existing maps is a major problem faced by planners and decision makers. Mapping itself should be viewed as a dynamic process that requires continual updating and revision as change occurs. The importance of this process has been overlooked in the past.

LAND RESOURCES

Guam's land resources, although limited, are capable of supporting a high quality of life for the inhabitants if the number of people is not too great. The resources consist of soils, arable lands, historical and public recreational sites, vegetation, and wildlife. The particular nature of most of these is unique to tropical oceanic islands and they are not necessarily amenable to development by using technologies that are applicable in continental temperate-zone areas. The application of an "island ethic" should underlie utilization of Guam's land resources if they are to be available for sustained utilization rather than destroyed or impaired for short-term gains.

The alteration of patterns of land use in recent years has had a significant environmental impact. Guam is changing from rural to urbanized or suburbanized living patterns. There is a tendency for settlements to follow highways and utilities, to stretch in ribbons across the landscape rather than cluster in the compact village patterns of former times. This has fostered a dependence on the automobile that has led to large areas of land being devoted exclusively to auto-related uses. Building designs are generally not geared to the climate or landscape and are not conservative of land resources. Military land use directly affects a third of the area of the island and indirectly affects civilian land use for much of the rest of the island. Increasing land-use conflicts are caused by NAS-International Airport and the ever-increasing problem of solid waste disposal. There is an intensifying dependence on fossil-fuel energy and the growing requirements for power generation have led to additional land-use problems. Clearing and grading of land for construction not only cause damage to the land itself but often lead to undesirable siltation of adjacent reef areas.

Legal controls that affect land use include zoning and subdivision laws; and there are regulations that govern land-use permits, agricultural leases, and the transfer of government lands for private use. Legal controls could potentially include a master plan as well, but an adequate plan has never been prepared. Many laws that directly and indirectly affect land use have such subtle effects that they cannot be thoroughly analyzed. The major laws affecting land use are inadequate and are inadequately enforced.

Basic recommendations with regard to Guam's land resources are:

1. Develop long- and short-range plans that identify basic land uses, classify island lands for their most beneficial use, and set performance standards for the development of those uses.
2. Survey all Government of Guam lands and establish clear title to them.
3. Cease the transfer, sale, and lease of public lands until such processes undergo public scrutiny and are devoid of political influence.
4. Enforce existing building codes, standards, erosion-control regulations, and environmental laws.
5. Begin discussions with the military on civilian needs for locating industrial activities on land near the Commercial Port.

6. Prohibit arbitrary rezoning of agricultural land except in areas where there is a logical need to extend an existing community or increase its population density.
7. Require designation of public land in new subdivisions for open space, recreation, schools, and community facilities.
8. Strictly regulate development in airport noise corridors.
9. Prohibit establishment and continued use of scattered quarries; reclaim existing sites.
10. Establish conservation areas and protect them from encroaching development.
11. Require in-depth assessment of the impacts of highway projects, new sewage collection systems, and the relocation of government buildings.
12. Encourage innovative designs for subdivisions and dwellings.
13. Implement the mass transit system (bus system) proposed by the Department of Public Works.
14. Investigate the feasibility of constructing an elevated fixed-rail mass transit system.
15. Discourage private vehicle use by:
 - a. encouraging centralization of employment and shopping areas;
 - b. imposing higher gasoline taxes and parking fees, and using the income to support mass transit;
 - c. discouraging the paving of large areas for parking lots;
 - d. discouraging construction of new highways.

In general, measures should be taken to minimize the consumption of fossil fuels, both as a means of conserving resources and as a means of minimizing pollution of the air and water. Specifically:

16. Encourage the public to use solar water heaters in place of conventional ones.
17. Encourage occupants of remotely located homes to use wind generators instead of gasoline or diesel-powered generators.
18. Investigate the feasibility of incorporating one or more large wind generators into Guam's power grid.
19. Investigate the feasibility of constructing a geothermal power plant and developing related mariculture and desalination facilities on Guam.
20. Encourage individuals, businesses, and government agencies to reduce power consumption.
21. Set standards of building design to minimize power consumption.

The following are recommended as a means of utilizing solid wastes on Guam:

22. Encourage use of returnable bottles in order to reduce the non-biodegradable fraction of solid waste (and, consequently, the landfill volume required).
23. Set up redemption centers for aluminum cans.
24. Encourage citizens to separate newspaper from garbage; provide special pickup of newspaper for subsequent recycling.
25. Encourage development of a scrap industry for junk cars and large appliances.
26. Compost the solid waste left after separating the recyclable materials. One procedure is to shred the waste, spread it over a land area, and turn it over periodically so that all materials are exposed to the air. This is both simple and effective and appears to be feasible for Guam. The feasibility of adding sewage sludge to this material should also be investigated.
27. Separate the non-biodegradable materials from the compost by means of shaking, followed by further magnetic separation of ferrous components. The ferrous scrap could then be baled and sold along with junk cars and appliances; the compost could be used to reclaim lands stripped by construction projects and as a soil additive in agriculture; and the remaining inorganic portion would be used for landfill. (It is noted that the compost may also be deposited in a landfill without the need for an earth cover because it is biologically stable; also, it might be used as aggregate in concrete.)

These recommendations on the treatment of solid waste can be implemented independently of one another and are each capable of partial alleviation of the problem of solid

waste disposal on Guam. For example, the recycling of aluminum cans will significantly reduce litter and the non-biodegradable portion of landfill material; it may prove to be economically profitable. The composting of municipal waste may be implemented with or without the separation of its components or the addition of sewage sludge. A total recycling system, a composting plant, or a pyrolysis system have not been recommended at the present time because of the large initial expense, although they may become feasible in the future.

In any case:

28. Set standards for solid waste disposal and enforce existing litter laws.
29. Consider prohibiting importation and use of non-returnable beverage containers.

Also:

30. Demand that all construction activities on Guam furnish erosion-control plans for approval by appropriate government agencies prior to issuance of a grading or clearing permit.

FRESHWATER RESOURCES

Guam's freshwater resources consist of an underground lens system in the northern plateau and, in the southern part of the island, surface waters that run off as rivers. The lens system in the northern plateau is a dynamic phenomenon: its volume at any given time depends on the amount of rain-derived recharge flowing into it from above, the amount of water flowing seaward along the margins, and the amount removed by pumping for drinking water. The lens essentially floats in delicate equilibrium on top of the seawater which permeates the porous limestone structure and it is separated from undiluted seawater by a mixing zone, or interface, of brackish water. Extreme fluctuations, or even destruction of part or all of the lens, could be caused by excessive or improper removal of water through pumping.

If the lens is to be preserved as a permanent drinking-water source, it must receive enough recharge water during the rainy season to sustain pumping activities throughout the dry season. This requires that conservation areas be designated above the lens to serve as permanent recharge areas. The conservation areas should consist of zones where no development is allowed and these zones should then be surrounded by areas of low-density habitation (no more than 4 dwellings per acre).

Specific conservation areas have been recommended by consultants to the Public Utility Agency of Guam, but conservation zones have never been set aside by the Government of Guam. Instead, development has encroached upon the areas that were recommended as conservation zones. The effect on the underlying water lens is not yet understood. In any case, it is clear that quick action is needed to preserve what is left of the areas so that a permanent source of drinking water is assured. Some of the rivers in the southern part of the island are developable, primarily for irrigation water.

Water quality in the northern basal lens is generally adequate at the present time, but it does have the quality of hardness, which inhibits sudsing properties when soap is added and which forms troublesome deposits in plumbing and equipment. The groundwaters of the northern limestones also have very high nitrate concentrations, far higher than would be expected in normal groundwaters. Part of this comes from wastewater discharge into the ground, but most of it is probably produced by legume plants (e.g. tangan-tangan) which release nitrate into the ground. The development of mass agriculture on the northern plateau would have a definite negative impact on water quality there because agriculture would involve use of fertilizers and pesticides. The major water-quality problem in southern rivers is contamination by human and animal wastes.

The most important areas recommended for water conservation zones in northern Guam are rapidly being developed for housing tracts and businesses. Agricultural development has also been proposed. The northern water lens may be facing serious threats of

pollution and damage through lack of protection of recharge areas. If serious damage does occur, which seems a distinct possibility, then the cost of providing fresh water will go up dramatically because of the necessity of much more expensive treatment for rendering water useable and the necessity of developing new water sources either by damming certain southern rivers or desalinating seawater. The last alternative is particularly expensive at the present time and will probably remain so for the foreseeable future. It seems much more sensible to protect our existing resources than to think of developing new ones.

Many of the recommendations made under the Land Resources section above apply to the protection of freshwater resources as well. Land use will determine the fate of the northern water lens system in the near future and the eventual fate of the southern river watersheds. Efforts should begin immediately to preserve and protect government lands in northern Guam from intensive development and to acquire private lands for similar protection. This is an urgent recommendation. The Government of Guam also needs to acquire lands in critical southern watersheds.

Programs are needed for investigating means of conserving and recycling water, especially in the case of wastewater (sewage) management. The public should be encouraged to conserve water and be informed of the need for doing so. This matter has received surprisingly little attention in the past, despite the reported problems in Saipan and other islands of the Trust Territory during drought periods. The Water Quality Standards for the Territory of Guam should be strictly followed. The implementation of the Northern District Integrated Sewer System should be accelerated. Finally, there is need for further research on freshwater resources of Guam, particularly with regard to the dynamics of the northern groundwater lens.

MARINE RESOURCES

Guam's marine resources are outstanding. The diversity and numbers of marine organisms, the variety of natural communities, the beaches, and the lagoons all offer attractive opportunities for a variety of recreational activities and aesthetic enjoyment. Traditionally, these resources have been heavily used by the populace. The development of Guam as a popular tourist destination has shown that the marine resources offer important economic benefits as well. The economic potential of such activities as commercial fishing, on the other hand, has not been realized.

The Water Quality Standards developed by the Guam Environmental Protection Agency will become increasingly important in protecting marine resources on Guam. Local and federal laws offer generally good protection against major pollution problems on Guam if the laws are carefully enforced; however, they do not appear to be well enforced at present. The U.S. Army Corps of Engineers has an important role in the protection of marine resources through its authority to issue or deny dredging and filling permits in navigable waters. There is a growing awareness of the need for coastal-zone planning and management, as evidenced by the passage of recent setback laws, laws protecting historic sites, and laws governing the conservation of marine organisms. However, there are a number of actual or potential problems that are significant.

Recent outbreaks of hepatitis in southern Guam, and cases of cholera and typhoid fever, have pointed out the public health aspects of water-related problems, although these diseases are not tied exclusively to the marine environment. The search for solutions to these problems must be given high priority, and it follows that marine waters obviously must not be considered merely as convenient places to dispose of untreated sewage.

Siltation is perhaps the major problem now affecting the quality of the marine environment. Siltation results primarily from land-derived runoff from construction sites where large land areas are often cleared and left bare for extended periods. Siltation has already had a major impact on marine communities in several areas and the number of incidents is increasing. A similar problem is caused by dredging and filling in the marine environment in which there is not only direct destruction of biological communities at the immediate site but also siltation stress on nearby communities. The serious nature of this problem appears to have received insufficient attention.

Pollution of the marine environment by oil and other hazardous materials has been fairly minimal to date, but the potential for a major problem clearly exists and is likely to intensify. With proper precautions, potential marine pollution can be minimized. Discharges of thermal wastes from power plants are having a major destructive impact in one area.

Stormwater runoff is a growing problem in areas undergoing rapid development, such as Tumon Bay. The direct discharge of substantial quantities of freshwater into the marine environment from large drainpipes, such as those constructed by hotels, exerts a stress that could have a significant impact over the long run and drastic, localized effects when heavy rains occur. This is a case in which the hotels are causing stress on the very environment upon which their business depends.

Uncontrolled shell-collecting and fishing is another long-term stress that is increasing. Many species of shelled organisms and other marine forms that were formerly abundant are now rare and possibly extinct on Guam. The use of dynamite and Chlorox as a means of fishing has a significantly destructive effect on Guam's reefs. Coral communities are broken up by souvenir collectors. The lack of effective controls on mesh size of fishing nets results in the disappearance or scarcity of many species of fish. Most of these problems have not yet reached the crisis stage, but there are many types of chronic stress on our reefs that threaten eventual destruction or significantly alter our most attractive marine communities. Outbreaks of the crown-of-thorns starfish, Acanthaster planci, whether natural or man-caused (an issue that is unresolved), have also exerted a major stress on Guam's reefs.

Finally, the problem of litter on beaches and in shallow waters around Guam deserves mention. The biological impact of litter is not very significant when compared with the problems mentioned above, but the aesthetic impact is anything but negligible. The ugliness of litter could have an economic impact as well when the tourist industry is considered.

Specific recommendations are as follows:

1. Protect in every way possible Guam's unique lagoons at Cocos Island and Apra Harbor.
2. Demand that Guam's Water Quality Standards be followed and that all direct discharges into marine waters release effluent below the 60-foot depth contour and at least 1000 feet offshore. Furthermore, place all outfalls at locations that are justified by sound environmental impact surveys.
3. Establish criteria (after appropriate environmental research) for stormwater discharges into the marine environment in terms of depth, mixing zones, and other significant factors.
4. Stop all commercial harvesting of shells and coral.
5. Establish and enforce adequate regulations governing the mesh size of fish nets to assure that juvenile fish are not caught and can remain on the reefs for maintenance of the population.
6. Evaluate the current status of populations of the crown-of-thorns starfish, Acanthaster planci, and the nature and rate of reef recovery from the effects of these starfish.
7. Encourage and support further marine research on Guam.
8. Enforce existing laws to protect the shorelines of Guam from encroachment of man-made structures and destructive activities of man; enact laws to strengthen the existing ones.
9. Establish and maintain natural unique ecological marine preserves.
10. Protect rare and endangered species of marine plants and animals.
11. Encourage industries that will not degrade Guam's marine environment.
12. Encourage fishing, aquaculture, oceanography, and recreation; moreover, encourage them in a manner that fosters compatibility with the environment.
13. Establish marine conservation zones of limited usage.
14. Insure that Guam's Water Quality Standards include and provide protection for marine conservation zones.
15. Demand that all marine discharges receive permits from appropriate government agencies and that the effluent from these discharges be monitored and analyzed regularly.

AIR RESOURCES

Guam's air resources are of generally high quality, but the potential for significant pollution exists even though the island lies in the trade-wind belt. Sources of concern are 1) the increasing number of automobiles because of their direct discharge of pollutants and the dust they generate on unpaved roads; 2) rock quarries because of their dust emissions; and 3) power plants because of their emissions of sulfur oxides, nitrogen oxides, and other pollutants. Although pollution from quarries and power plants is primarily localized, it is nevertheless significant. The recommendations stated previously, particularly those regarding land use, are applicable to the major considerations for preservation of air resources.

INTRODUCTION

Some may believe Guam's environment is ruined already, that many mistakes have been made which could have been avoided, and much that was precious to the residents of Guam has been lost.

Yet Guam in 1975 remains a most attractive island. Its reefs continue to grow and there are beaches, mountains, natural vegetation, and vistas of extraordinary beauty. The island is blessed with a favorable climate. There are examples where man's works have added to Guam's natural beauty. Sensitive construction design and placement, proper land-use planning, and planting can be friends rather than foes of beauty.

Guam's people need to unite in wanting both to enhance the island's beauty and to preserve that trait of Guamanian hospitality which springs in part from a congenial environment. The people of Guam will benefit most when the island's environment is "farmed" rather than "mined." To farm is to use land so that the land will be as good in the future as it is today. To mine is to use resources and exhaust them without replacement. We must not let the latter happen to Guam's exceptionally attractive environment.

It is the responsibility of government to take a leading role in meeting our environmental concerns. Many of the necessary decisions lie beyond the scope of the private sector. Personal concerns commonly come first, and it is difficult to sacrifice immediate personal economic well-being and security for environmental gains that may be long term and seem remote. Legal tools for controlling the environment will not be well accepted if they are viewed as weapons for harassment or devices that serve an elite group at the expense of many. Yet more tools are needed if we are to preserve and enhance what remains of Guam's environment and way of life.

The principal objective of these chapters is to provide the people of Guam with an accurate description of the environmental status of the island. Effort will be made to present an historical perspective, to describe what the environmental conditions were in past years. This information, along with a comprehensive review of the island's present environmental status, hopefully will bring about an understanding of our current and future environmental needs.

A second objective is to provide governmental decision makers with specific information that will aid them in identifying our environmental needs and guide them in finding the best solutions and means of implementing environmental decisions.

In order to establish a foundation for such future environmental decisions, certain basic assumptions about Guam's environment are necessary. The upper-most assumption is that Guam needs to follow the conservation ethic referred to earlier--that of farming rather than mining the environment.

It is assumed that Guam's physical environment is made up of the natural environment and the man-made environment. The natural environment is composed of the island; the ocean around it; and the animals, birds, and fish of the land and sea. These are limited in area, numbers, and quantities. This was the self-maintained natural environment of Guam for thousands of years.

Then man came to the Mariana Islands. Man is an animal too, but he is a different animal. He can organize his efforts; he can build and create. As a human society is organized, man builds structures for housing, commerce, transportation, and other purposes. A man-made environment is created and it is this man-made environment that uses and modifies the natural environment.

The environmental assumptions against which we can evaluate future actions and programs for Guam are these:

- (1) Guam's natural environment is limited in scale and quantity. In many aspects it is unique and fragile.
- (2) Guam's man-made environment consists of social institutions and physical structures that are dependent on the natural environment.
- (3) The man-made environment frequently consumes natural resources and modifies the natural environment, but man has the capacity to enhance the physical environment to reduce the strain on the balance in the natural environment.
- (4) Human beings organize themselves into societies that strive to better the quality of life.
- (5) "Higher" standards of living, currently equated with the higher rates of consumption practiced in developed industrial nations, frequently consume more natural resources and more significantly modify the natural environment than "lower" standards of living.
- (6) Man is an integral part of the total environment and is not separate from it.
- (7) The man-made environment cannot continue indefinitely to take from the natural environment beyond the regenerative capacity of the natural environment. Man must seek a balance with the environment to maximize both the quality of his life and the quality of the environment.

Many important government decisions deal with the interrelationships between man and his physical environment. Further assumptions that should guide the judgments of decision makers in both government and private enterprise follow:

- (8) There is a quality we may refer to as an Island Spirit that is identified with empathy, tolerance, graciousness, friendliness, understanding, and giving. It is also a way of getting along.
- (9) The Island Spirit is fragile and can be shattered by population pressures and a highly competitive society.
- (10) The Island Spirit is worth preserving, and one way to do so is to master the pressures alienating us on our own island.
- (11) This Spirit springs from the natural environment of Guam and the heritage of Guamanian life styles. Our island geography, a favorable climate, and beautiful vistas help create this Spirit. Thus, we have an additional debt to our natural surroundings and a strong self-interest in protecting and enhancing what nature has given us.
- (12) The citizens of Guam expect their government to intercede in order to preserve a harmony between man and nature. The government should use the tools available to it, both positive tools such as incentives, and negative tools such as restrictions and penalties, to achieve and nurture this harmony.
- (13) Where interests conflict, those of residents should take precedence over those of non-residents, without denying fundamental human rights.

The term "environment" has been so widely and indiscriminately used in recent years that its meanings are often contradictory and somewhat confusing. Since this is an environmental report, we want to clarify our interpretation of this word as it pertains to this study.

As previously stated, man exists in a setting which is a product of both natural forces and his own making. We may say then that this setting, or man's surroundings, constitutes what we define as his environment. Our major concerns here are those components of man's surroundings which are becoming increasingly endangered--elements vital not

only to his continuing prosperity and enjoyment of life but to survival itself.

Therefore, we ask, what does man require to continue a healthful and productive existence on Guam? What has he traditionally needed and enjoyed in the past? Will the same needs persist in the future, and more importantly, will the environment be capable of satisfying these requirements? We think the best way to answer these questions is to categorize the basic resources necessary for man's continued existence on Guam and then to examine the status of those resources in terms of both quantity and quality. We must also determine what factors within the natural and man-made environment are adversely affecting the resources and explore the possibilities for preventing further loss or impairment of these resources.

"Resource" is defined by Webster in several ways: "supply of something to take care of a need; a means of accomplishing something; measure or action that can be resorted to, as in an emergency; expedient." Unfortunately, throughout history we have all too often taken the expedient approach to our resources and their use and have sacrificed future needs to realize immediate gain. Resources must be cared for--farmed, not mined--so that they can satisfy our needs. Therefore, a long-range view is necessary.

For the purpose of this report, we shall look at Guam's most basic resources: land, water, and air. Although we often pride ourselves on how far we've progressed as a species, nation, or society, some things today are really not very different from ancient times. A Greek philosopher believed that four basic elements made up all life and similarly supported all existence: land, water, air, and fire. Although we realize today that fire is a combination of other elements, we still consider the other three as basic elements. They lend themselves readily to this study because they are easily understood and categorized, and because they provide a ready format for describing the various conditions present in our environment today.

Prior to a detailed discussion of the basic resources, let us briefly examine the present status of land, water, and air on Guam. We will also look at the changes that have occurred over the centuries and at the historic cultivation and abuse of each resource.

MAJOR RESOURCES

LAND

Other than the few acres added to Guam in construction of port facilities, neither the total land area nor the contours have altered appreciably since the island was first inhabited. Northern Guam is characterized by a relatively flat or rolling landscape with sheer cliffs dropping to the sea; in the South, many streams and rivers flow short routes from the rugged hills to the sea.

The land was bountiful. Written accounts describe the early food and materials of the native population (1):

Coconut palm and the pandanus plant furnished useful leaves and fibers. Houses were thatched with the introduced nipa palm, if available. . . . The Pandanus . . . furnished fiber for lashing together the parts of a house or for making string, hats, mats, and other articles . . . Aprons or breech cloths . . . were made of the inner bark of the breadfruit tree, which also furnished gum for sealing the seams of canoes.

The soils and climate of the island supported the growth of rice, fruits, and plantain. One of Guam's governors, the Honorable W. J. Maxwell, in his 1915 Annual Report to the Secretary of the Interior (2), summarized Guam's land resources:

The arable area of the island, about 130,000 acres, is quite capable of supporting ten times the existing population of over 13,000. Maize, rice, cocoa, beans, coffee, citrus and semi-tropical fruits of commercial value, sugar cane, cotton, kapok, all of high grade . . . can be produced on an area of not less than 100,000 acres, while well watered pasturage of 30,000 acres can be provided for cattle and livestock.

Thompson (3), in an historical description of the eighteenth century, stated:

After the Spanish conquest the surviving natives . . . continued to live off their lands . . . Since the population had been greatly reduced there was plenty of fertile land to go around . . . In 1772, according to Crozet, every family had its property, which was divided into gardens, orchards, and ploughed or spade-worked fields.

Approximately a year later an epidemic took many lives. It was believed by the inhabitants to have been caused in part by, "the crowding in one place of many people heretofore accustomed to life scattered in the open country" (3).

As we begin to see, our environmental problems are not new; rather, they have occurred throughout history and are intensifying now because of the additional demands of a rapidly growing population and a society oriented toward the acquisition and consumption of material goods.

Literature on the precontact culture indicates that societal controls by local chiefs helped to preserve the resources of Guam. According to Thompson (3):

Apparently . . . the islands were divided into districts headed by local chiefs called magas. Each chief controlled the lands of his district, including the hunting, collecting and fishing rights, and no one except the members of his local group was allowed to enter the district without permission . . . property controlled by individuals was regarded to a certain extent as the property of the kinship group and was used, in the case of necessity at least, for the benefit of the members of the group.

Problems intensified however, with the succession of colonial administrations and the destruction of the traditional controls. By the twentieth century, Laura Thompson (3) wrote:

Guam has become progressively denuded in recent years, due to the native habit of burning sword grass in dry weather so that the cattle may feed on new grass and also, as has been stated, so that deer may be hunted more easily.

H. T. Stearns, an early geologist on Guam, was quoted by Thompson (3):

Continued burning and the cultivation of the areas underlain by these rocks (Volcanics) have reduced the humus, soil fertility, and thickness of the soil to such a degree that little else but sword grass can live there now. In some parts of the sword grass country quantities of old Chamorro potsherds are found. These indicate village sites formerly existed where no one can raise crops now.

Former controls provided that:

Any person desiring to cut timber for personal use in the construction of a home must agree to plant, in seedlings, double the number of trees cut, and must care for the seedlings until they are one year old. (4)

Only recently has this practice been reactivated by its application to some subdivision designs by the Government of Guam.

WATER

From the time of Guam's earliest habitation, water resources served a multitude of purposes, from everyday bathing and recreation to the harvesting of fish and shellfish for food. Flying fish, sea crabs, crustaceans, and sea turtles were important items in the local diet until the postwar period (1). Since that time, dependence on imported food products and an increasingly urban society have diminished extensive fishing as a source of food.

Unfortunately, the demands placed on marine resources by recreational activities such as boating, sport fishing, and shell harvesting, as well as increasing pollution, have served to reduce fish populations. Few controls exist to prohibit excessive extraction of aquatic resources. Even in Spanish times, stupifying fish with narcotics was banned (3). Despite legal prohibition, such practices exist today through lack of adequate control.

In the past there seems to have been little regard for the protection of marine waters, especially from human wastes. The waters within the fringing reefs have historically been used as the dumping ground for sewage (1):

Few of the native houses had running water and plumbing, (1938-1939)
The parade of the natives to the sea early in the morning to dump the
buckets of night soil (human) was a feature that bothered some American
residents.

Thompson (3) wrote on the same subject, "Before the introduction of bored hole latrines in 1938, the Guamanians had to carry their night buckets, regardless of tidal conditions, 200 yards beyond the tidal high water mark." Today we dump as much as eight to ten million gallons of raw sewage each day from the Agana outfall, and there are several other discharge points on the island.

Our fresh water resources are plentiful, if somewhat erratic. Early inhabitants relied on springs or rivers for their water supply. Long dry periods often led to a disappearance of both these water sources and the human settlements that depended on them. A manifestation of the effects of a growing population on natural resources was the overuse to the point of exhaustion of springs and wells. In addition, the intermingling of different races and cultures introduced various waterborne diseases, some of which were responsible for decimating the early Chamorros. Illnesses were originally believed to be caused by supernatural means--the work of the taotaomona. In time, however, the population came to realize that human pollution of waters was in fact the real evil. It took still longer for people to realize that overuse itself was a serious form of pollution (5):

Following the liberation of the island (1944), tens of thousands of troops were supplied water from springs and rivers, and wells so numerous that the fresh groundwater was seriously affected by the invading sea.

AIR

Throughout the literature pertaining to the early history of Guam, there is little mention of air resources, or of problems associated with maintaining their high quality. There were no industries that had an impact on air quality, and any air pollution (such as from burning the grasslands) was both minimal and temporary. Yet today several sources of air pollution are beginning to appear, from dust associated with land clearing and quarries to sulfur fumes from power plants. Our air resources deserve special consideration because their quality is only in the beginning stages of deterioration. Damage has not been irreparable, and efforts can be made to preserve the present status instead of attempting only to clean up air that has become polluted.

Guam's resources and thereby its environment are threatened, but not so much because previous generations misused their resources as because of the tremendous demands we now place upon them: growing population, increased per capita consumption, a profit-motivated economic system, and a social system that rewards the accumulation of material wealth. Our hope is that as a society we recognize our impacts on the environment, try to minimize them, and repair and recover whatever we can.

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LAND RESOURCES

CHARACTERISTICS

ORIGIN

Millions of years ago, forces within the earth's crust caused massive movements of rock layers in the southern Pacific basin. The layers of rock derived from the accumulation of the skeletons of a variety of marine organisms. Rock formations many thousands of feet thick and hundreds of miles in length were buckled, broken (faulted), and overturned. Massive ridges and valleys were created beneath the sea. Some of the ridges rose far enough from the sea floor to emerge above sea level and form tiny islets or long, sinewy mountain ridges. Later the original limestone formations underwent additional change, partially through continued earth movement and also because of the rise and fall of sea level, resulting in deposition of additional sediments. Imbedded within these deposits and emerging through them at several points were igneous rocks derived from volcanic eruptions.

During this period, most of the activity that formed southern Guam, as we know it today, took place. There were volcanic explosions and underwater lava flows which were later lifted above sea level. In northern Guam, there are only three places where volcanic rocks are exposed: Mt. Santa Rosa, Mataguac Hill, and Palia Hill. According to Schlanger (1):

The dominant rock-forming processes that built Guam were volcanism and reef growth accompanied by sedimentation in lagoon and forereef areas. Reef complexes tended to evolve along similar patterns through time. The older reef complexes are partially destroyed by volcanic explosions and erosions. The Mariana Limestone, on the other hand, postdates active volcanism and hence retains its original depositional pattern.

These various geologic processes created Guam's topography (Fig. 1). For a more detailed discussion of Guam's topographic regions, see the coastal survey by Randall and Holloman (2). Guam's basic geologic structure as it relates to freshwater resources is discussed in Chapt. 4 of this report.

The oceans around Guam also reveal the characteristics of the geologic forces that created the island and its northern neighbors. Deep trenches, the deepest yet known, bordered by long sinuous ridges (one of which emerges to form the Marianas Islands), indicate an active seismic zone, which is further evidenced by numerous earthquakes and tremors. Guam's coastline was molded by a repetitive rise and fall of sea level, by wave action, growth of coral organisms, and the solution of limestone rocks.

SOILS

The geologic history of Guam created vastly different topographies in the South and the North. Guam's equatorial marine character contributed to the growth of encircling coral reefs and lagoons. The basic structure of the island has created the resources upon which life here exists. Primary among these land resources are soils, the result of thousands of years of weathering of rocks and decomposition of vegetative matter.

Rocks are the parent material of soils. On Guam, the most important feature of the rocks is the almost complete absence of minerals that are resistant to weathering processes. These rocks are generally changed to clays, and weathering frequently extends to 100 feet below the surface.

Numerous soil types were mapped by Carl H. Stensland (3). The principal type is the

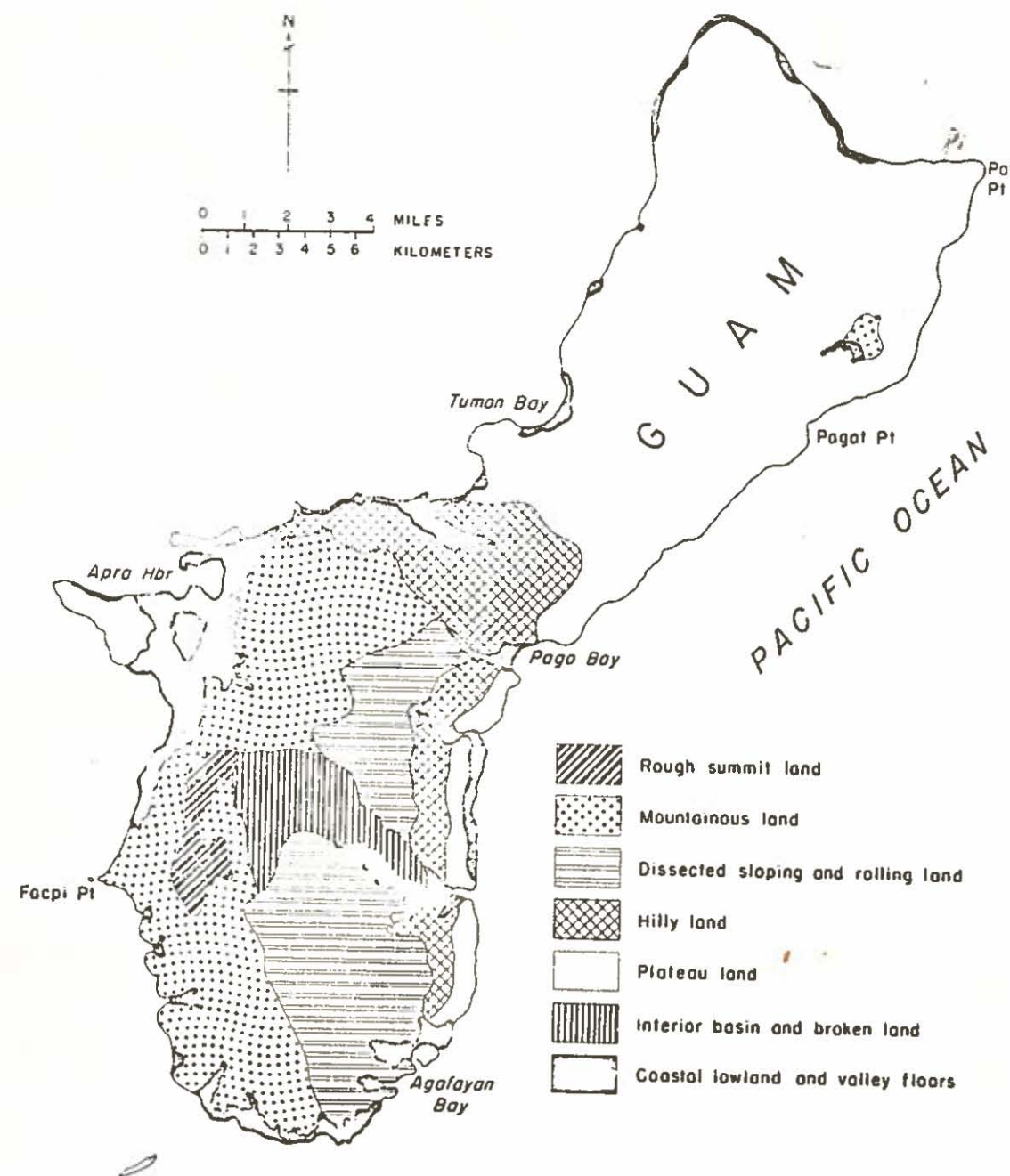


FIGURE 1

Physiographic Divisions of Guam. From (2).

red form known as Guam clay, but brown soils also occur in a few areas. Guam clay, although relatively thin, is more widespread than any of the other soil types on Guam and covers the limestone plateau on the northern half of the island. The Mariana Limestone, on which the Guam clay most commonly occurs, is for the most part highly porous and permeable, and thereby provides good internal drainage for the overlying soil. Other types of limestone soil (Toto, Chacha, Saipan and Yona clays) developed on the northeastern and eastern slopes of the higher southern part of the island where they flank the volcanic material.

The soils that developed on the weathered volcanic rocks of Guam occur principally in the southern half of the island. The weathering of the marine shales and associated rocks and of lava flows extends to an average depth of 50 feet. The volcanic parent materials of these soils have similar chemical composition. Their principal differences can be attributed to topography and age. The soils on the volcanic rocks are very similar in appearance to those on the limestones, but they differ in chemical composition. The most conspicuous difference is the low silica content of the soils on the limestones.

ARABLE LAND RESOURCES

Guam's moist tropical climate is conducive to the cultivation of many types of crops. Guam's soils, although somewhat infertile because of the leaching of minerals, are widespread and varied. Because the island is divided into two major rock types, its soils vary considerably from north to south. Arable land is determined primarily by degree of slope and availability of water; water demand is approximately 1" in 3 days in northern Guam and 1" in 7 days in the South. Most of northern Guam is arable except for areas characterized by steep cliffs or volcanic hills (e.g. Barrigada Hill, Mt. Santa Rosa). No definite figures exist to substantiate the amount of arable land in the North; however, most land not already committed to other uses such as highways and homes could produce a variety of crops.

Because there are steep slopes throughout the South, the amount of arable land is limited. Gilham, Koebig and Koebig, Inc. (4) compiled statistics on the amounts of urban, military, and open land in the eight municipalities of southern Guam (Table 1) and considered the feasibility of an irrigation system. For three of these municipalities (Agat, Asan, and Piti), they concluded that the potential arable land (defined as fertile land which can be physically cultivated) was not of sufficient quantity to warrant consideration for a public irrigation system. They believed that Asan and Piti were destined to become highly urbanized because they are located on the main highway between Agana and the Commercial Port. In Agat 66 percent of the land is under military retention (Table 1). Table 2 shows the land potentially available for agricultural use in the other municipalities of southern Guam.

HISTORICAL AND PUBLIC RECREATION SITES

Guam's history is long and varied. From early Chamorro inhabitants to today's "melting pot" society, the island has experienced changes in racial composition, life styles, and land usages. Fortunately, this heritage is not being lost altogether by wanton destruction of artifacts or indifference to their existence. Guam is studded with historical sites such as locations of early Chamorro villages, remnants of Spanish colonialism, and the battle scars from World War II.

On May 8, 1974, Bill No. 595, An Act to Repeal and Reenact Chapter XIII, Title XIV, of the Government Code of Guam Relative to the Management and Protection of Historical Objects and Sites, was signed by Governor Carlos Camacho and became Public Law 12-126. Its purpose is to "engage in a comprehensive program of historic preservation, undertaken at all levels of the Government of this territory, and to promote the use and conservation of such property for the education, inspiration, pleasure, and enrichment of the residents" of Guam.

Under the Act, the Department of Commerce is authorized to administer historic

TABLE 1
Land Use in Southern Guam^a

Municipality	Urban/Suburban		Military		Agricul. ^b & Open		Total
	Acres	%Total	Acres	%Total	Acres	%Total	
Yona	276	2.1	57	0.4	12,579	97.5	12,902
Talofofo	286	2.6	1,291	11.8	9,401	85.6	10,982
Inarajan	165	1.3	-	-	12,102	98.7	12,262
Merizo	433	11.3	19.1	0.5	3,476	88.2	3,942
Umatac	39	1.0	12.5	0.3	3,890	98.7	3,942
Agat	344	4.8	11,491	66.0	5,105	29.2	17,484
Piti	109	2.4	2,053	45.0	1,952	42.6	4,582
Asan	380	8.4	1,048	26.0	2,586	65.6	3,942

^aFrom (4).

^b"Agriculture" in current zoning terminology is understood to mean rural areas. All land within this group is not necessarily suitable for agricultural use.

TABLE 2
Arable Land Available for Agricultural Use in Southern Guam^a

District	Class	Gross Area (Acres)	Percent Arable	Net Arable (Acres)	% Available for Agricultural Use ^b	Available for Agricultural Use (Acres)
Yona	River Bottoms	400	100	400	50	200
	Coastal Uplands	650	100	650	-	-
	Inland Plateaus and Hills	6950	30	2085	50	1042
						1242 Total
Talofofo	River Bottoms	400	100	400	90	360
	Coastal Uplands	450	100	450	50	225
	Inland Plateaus and Hills	7900	30	2370	50	1185
						1770 Total
Inarajan	River Bottoms	1025	100	1025	40	410
	Coastal Uplands	575	100	575	60	345
	Inland Plateaus and Hills	5400	30	1620	50	810
						1565 Total
Merizo	River Bottoms	300	100	300	50	150
	Coastal Uplands	16	100	16	-	-
	Inland Plateaus and Hills	1134	30	340	50	170
						366 Total
Umatac	River Bottoms	125	100	125	50	62
	Coastal Uplands	-	-	-	-	-
	Inland Plateaus and Hills	800	30	240	80	192
						254 Total
						5197 TOTAL

^aFrom (4).

^bBased on existing zoning, discussions with Government of Guam planning staff, and current trends in development in southern Guam.

preservation programs including designation of historic sites, to control all government construction projects affecting these sites, to negotiate for the acquisition of sites, to establish penalties for the destruction or removal of historical objects, and to regulate development of underwater historical remains.

As of this writing, 34 historical sites have been registered since the law was enacted. Reliable sources within the Department of Commerce estimate that more than one hundred sites will be added over the next few years. There is no doubt that this process will affect the use of land on Guam. One instance has already occurred: a portion of the designated quarry at Lujuna Point has been restricted in order to protect the remains of an ancient Chamorro village.

In addition to the designation of historical sites, the Department of Commerce administers island parks and recreational areas. Major parks exist throughout the island, primarily in and around centers of population (Fig. 2). They are usually associated with natural landmarks and beautiful vistas (e.g. Inarajan Pool, Two Lovers Point), or points of historical interest such as Fort San Jose, Umatac. In 1968, an Outdoor Recreation Plan for Guam (5) was prepared with recommendations for specific types of recreational centers and their locations. This was updated in 1973 (6). The updated version, known as the "Paradise Plan," outlined Guam's recreational needs once again and established a five-year implementation schedule. This plan is currently being carried out with the assistance of both local and federal funding. Major improvements to date include projects at Ypan, Talofofo, Talofofo Bay, Two Lovers Leap, and the Landeran Overlook along Marine Drive in Upper Tumon.

For several years a national seashore park has been recommended for Guam. Concerned citizens, the Dept. of Interior (7), and Friends of the Earth (8) have all worked for the creation of the 13,000+ acre site along Guam's southwestern coast, stretching from Nimitz Beach to Ajayan Bay (Fig. 3). Unfortunately, the seashore park has never been implemented and private development continues to erode its boundaries.

VEGETATION

General (9):

The greater part of Guam is forested, but substantial areas, especially in the southern half of the island, are covered by coarse grass, and smaller parts are in pasture or under various kinds of cultivation. There are few large stretches of uniform vegetation; most of the island is covered by a mosaic of small patches of extremely varied appearance. The forests are mostly second growth, many of them thickets, generally dense, tangled, and often with spiny undergrowth.

Limestone areas are usually wooded except for some vertical cliffs and some clearings. The original forest on limestone was of large trees with a thick canopy. A long history of disturbance by the Guamanians, by frequent typhoons, and by the destructive effects of World War II and subsequent military activities, has left little undisturbed primary forest on the island. Weed patches, partially revegetated clearings, thickets of fast-growing soft-wooded weedy trees, and scattered bare skeletons of dead forest giants are more characteristic than in undisturbed forest. Scattered patches of the latter remain here and there on the northern plateau, especially on cliffs and relatively inaccessible terraces around the steep coasts of the northern half of the island.

Much of the plateau has been cleared for military establishments, either active or abandoned. Some clearings are relatively bare of vegetation, others are grown up to tall grasses, thickets, and larger areas of *Leucaena* (a tall, feathery-leaved shrub or small tree which has increased enormously in number since the war). Coconut groves are in many parts of the island, both on the plateau and along the coast. The lower central part of the island has been subjected to disturbance much longer than have other parts. Much of it is under cultivation (mostly in small

FIGURE 2

Island Parks and Recreation Areas, as of 1968. From (5).

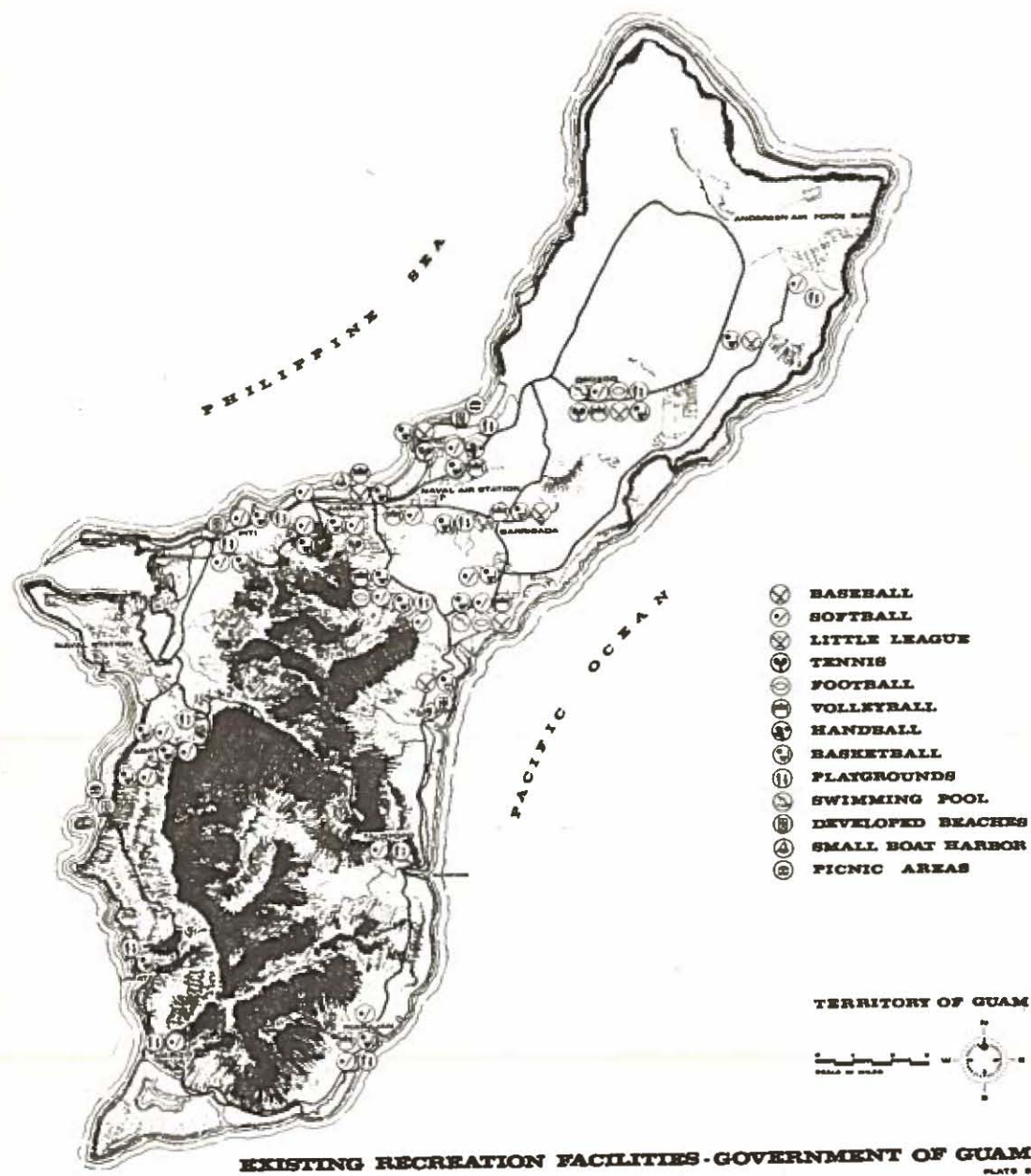
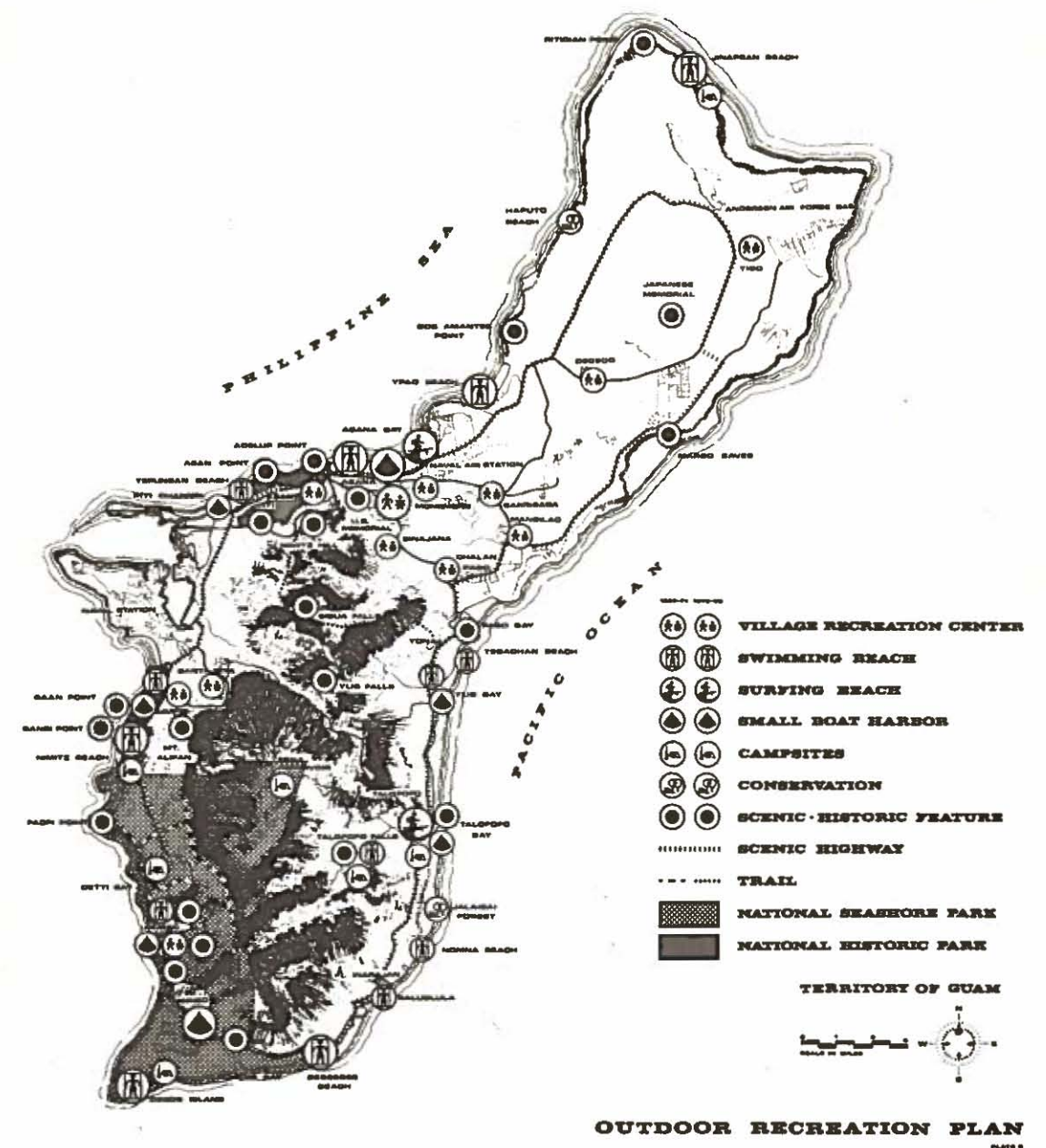


FIGURE 3

Sites Proposed for Development as Recreation Areas in 1968 in the Outdoor Recreation Plan for Guam (5). Note the areas of the proposed National Seashore Park and National Historic Park.



patches) or is in larger areas of pasture, with diverse thickets, *Leucaena*, bamboo clumps, and small coconut groves. A large reed marsh, Agana Swamp, is just east and north of Agana. Other marshes are along the west coast from Piti to south of Agat, with small mangrove swamps interspersed.

The southern, volcanic half of the island is a complex mosaic of grassland and patches of forest. Lowlands in the valleys of the Talofofo River drainage and of some of the other rivers are occupied by extensive swamp forests and occasional cultivated clearings. In these valleys, as well as on uplands along the east coast, are large coconut plantations. Patches of mangrove occur at the mouths of the river.

Vegetation Communities

The Limestone Forest Community comprises over 90 percent of the natural vegetation found on the northern half of Guam. Banyan and wild breadfruit, called "dugdug" in Chamorro, make up the upper layer of the forest. Shorter trees, along with various vines, ferns, and orchids growing on the trees, make up most of the middle-height growth in undisturbed areas. Such "pure," or "undisturbed," plant communities are not commonly encountered now and can generally be found only in more inaccessible areas. In areas of recent disturbance there is a succession of plant types following each other in a predictable pattern. On bare ground the first plant to invade is wild papaya (a good source of wild pig food), followed by a daisy-like flower (known scientifically as *Bidens*), followed by a bitter melon (*Momordica charantia*) in areas exposed to full sunlight. The endpoint of this sequence is usually tanga-tanga (*Leucaena*), a widespread weedy legume that may grow 15 to 20 feet tall. The seeds of this tree were sown throughout the Mariana Islands by the military after World War II in an effort to check rapid erosion.

The savanna Community is one of our largest plant communities and covers almost all of the southern highlands. The two dominant grasses are the swordgrass (*Miscanthus*) and a soft, hairy, tufted grass (*Dimeria*) that appears silvery from a distance. Ironwood, or Australian pine, is scattered throughout the Savanna. Other associated plants are mint, the Philippine ground orchid, ferns, and several members of the myrtle family.

The Ravine Community dissects the savanna and grows in the various valleys and gullies into which water drains and moisture accumulates. The vegetation consists of dense stands of "nunu," or banyan trees; "pabon" (*Pandanus*) trees; and a number of smaller woody plants, including "fadang," or federico palm; lemon de China; and "pago" (*Hibiscus*). The "pugua," or betel nut palm, is characteristic of the Ravine Community. With the exception of the betel nut palm, all the above vegetation can also be found in the Limestone Forest Community; but the percentages of the various trees differ. Such a plant community covers the large interior limestone basin surrounding Fena Reservoir. The presence of potsherds and artifacts in the upper reaches of the rivers, and the fact that a number of plants typical of cultivated areas downstream can be found in the ravines, led Stearns (10) to speculate that these areas once supported large numbers of people and that the present ravine vegetation communities are secondary growth. In the past, the upland forests covered much of the adjoining ridge-line and hillsides now dominated by swordgrass.

Marsh and Freshwater Vegetation Communities are discussed in Chapt. 4. See (11) for a more extensive discussion of all vegetation communities.

Low limestone areas called terraces are found along the northern and eastern coasts of Guam. Harsh conditions prevail due to rapid water drainage, high evaporation rate, and exposure to salt spray. A shrub known scientifically as *Pemphis acidula* is the most abundant and grows nearest to the water. This is followed by *Scaevola*, often called half-flower, and *Tounefortia*, a small tree. Farther back, *Pandanus* and *Hibiscus* can be found. *Bikbia*, with glossy green leaves and a square white tubular flower, will often be found on the steep cliffs.

A large stand of *Barringtonia aciatica*, beach zone vegetation, existed along Tumon Bay until recently. The only place where these trees remain is in the vicinity of the Hilton Hotel, where the management has retained them. Large numbers of the trees were removed from the Okura Hotel site in 1973 because they were considered ugly. Their removal caused a localized siltation incident in the bay. Coconut trees were substituted.

Of the varieties of plants that grow "wild" on Guam, several are useful for their fruits, nuts, leaves or trunks. Among these the breadfruit, papaya, betel nut, and coconut palm are notable.

Even though Guam is dependent on imports to sustain her people, local agriculture still plays a valuable role in helping to meet local demands for fresh fruits and vegetables. As pointed out earlier, there are thousands of acres of arable land on Guam, and the warm humid climate allows year-round crop production. Table 3 indicates the major crops grown commercially and their relative importance.

WILDLIFE

Guam's terrestrial wildlife is very limited, due both to our isolated island nature and to the destruction of habitats by war and construction. Most of the animals were introduced by man, including the carabao, or water buffalo, and the giant African snail.

Most often the animals serve man and should be considered a valuable resource. They perform work, provide food, destroy harmful insects, or (in the case of birds) contribute to the quality of our environment with their beauty and song.

Some of the more notable animals which help control harmful pests are the giant toad, or Guam toad, introduced from Hawaii to control the black garden slug; the Philippine rat snake, introduced into Guam around 1946 and now helping to control the rodent population without posing any danger to man; and the gecko, or "gualiig," a small house lizard that feeds on insects. Other animals, which may not contribute directly to our welfare but nonetheless add to the variety of our environment, are the coconut crab; the monitor lizard; the fruit bat, or "fanihi"; and the Guam deer, or "benado." Several of these animals provide a source of food for people of the island although their numbers, particularly in the case of the fruit bat, have decreased in recent years through over-hunting and habitat destruction. The Guam deer, introduced by the Spanish in the latter part of the 18th century, grows to an adult weight of 200-300 lbs. Their number has been drastically reduced (partly by poaching) even though the deer is legally protected by limited hunting seasons. Wild pigs can be found occasionally, but they are also affected by high hunting pressures. Animal pests now found on Guam include several species of rats, particularly the Norway rat, which are known to destroy several thousands of dollars worth of property each year as well as being disease vectors; the giant African snail previously mentioned; and the musk shrew.

Last, there are several varieties of birds on Guam, including four types of seabirds: the fairy tern, the noddy tern, the Pacific Man-O-War (a large black bird only appearing on land when tropical storms are nearby), and the wedge-tailed shearwater. The reef heron, plumed egret, Pacific golden plover, and whimbrel are all land birds which are either resident on the island or visit it as a stop in their migratory patterns between islands of the Trust Territory or Australia. See (11) for additional information on Guam's wildlife.

LAND USE AND ITS ENVIRONMENTAL IMPACT

Of the many dramatic changes that have taken place on Guam within the past five to ten years, the alteration in the patterns of land use is one of the most dramatic. During the early 1960's, and particularly until Typhoon Karen in 1962, the island was predominantly rural. Small villages were scattered along the coastline, most roads and highways were unpaved, land values were low, and the construction industry, along with the rest of the commercial sector, was relatively small and inactive. By 1969 however, everything had changed. Guam had entered its second era of discovery, this time by

TABLE 3

Cultivated Crops Ranked According to
Their Share in the Total Annual
Volume of Production
(In Pounds)^a

Commodity	1969-1971 Annual Average	Percent of Annual Average Production
1. Bananas, eating & cooking	346,097	16.1
2. Watermelons	220,577	10.3
3. Tomatoes	210,587	9.8
4. Cucumbers	159,245	7.4
5. Tangerines	134,036	6.2
6. Melons, cantaloupe, etc.	128,959	6.0
7. Yams	103,313	4.8
8. Taro, including tips	101,339	4.7
9. Beans, green (all types)	96,876	4.5
10. Eggplant, long & round	63,051	2.9
11. Potatoes, sweet	50,634	2.4
12. Peppers, hot & sweet	49,809	2.3
13. Corn, sweet & local var.	49,284	2.3
14. Cabbage, Chinese & head	48,302	2.2
15. Oranges	42,384	2.0
16. Okra	39,164	1.8
17. Papayas	38,246	1.8
18. Onions, green (bunch)	33,077	1.5
19. All other crops	236,870	11.0
TOTAL	2,151,850	100.0

^aFrom (12).

Japanese tourists. The island's climate, culture, and nearness to Japan encourage an influx of tourists that is still growing despite today's worldwide economic woes. In addition, the Vietnam War located military personnel and their dependents here while America waged its frustrating struggle in the East. Guam's strategic location became increasingly apparent not only to military strategists, but also to airline executives who began to see a potential in transporting thousands of passengers on their once- (or maybe twice-) in-a-lifetime trip to exotic Micronesia.

Suddenly there were many more people than anyone had planned for; they demanded schools, housing, entertainment, food, and clothing. As fast as possible, industry responded. By the beginning of 1973 there were 54 percent more new buildings constructed than there were at the beginning of 1969. These were primarily tract houses in Santa Rita, Dededo, and Barrigada. Within approximately four years, the value of these new buildings had increased some 300 percent (13). Not only were new homes being built, but their value far exceeded existing structures. The number of landowners increased as incoming residents sought homes in the new subdivisions. As a result the patterns of land use changed dramatically.

In 1966, when the first Master Plan was completed, over 59 percent of Guam was rural; 1.5 percent was residential; and 0.23 percent commercial. Even in the more developed communities of Agana and Tamuning, respectively 70 percent and 62 percent of the land was zoned as agricultural. The communities of Dededo (96 percent), Mangilao (87.3 percent), Agat (95.4 percent), and Yigo (88.7 percent) were almost entirely agricultural (military land excluded) in 1966 (14). However, by 1975 Agana and Tamuning are expected to have, respectively, only 4.4 percent and 0 percent agriculturally zoned land (Guam Department of Public Works estimate). Major increases over the last eight years have occurred in the multi-family (R-2), commercial (C), and light industrial (M-1) classifications. For example, Tamuning had no land zoned R-2 in 1965, whereas by 1975 it is expected that over 1450 acres will be zoned for this use. Dededo is expected to have a 32 percent decrease in agriculturally zoned land and nearly a 100 percent increase in land zoned as single family (R-1). The municipality of Barrigada, in central Guam, experienced a 50 percent decrease in agriculturally zoned land and a corresponding 333 percent increase in residential land (R-1, and Planned Unit Development), and it completely lost land allocated for conservation (Barrigada Hill, 225 acres) between 1965 and 1974 (Guam Department of Public Works estimates).

The various demands on land and changes in land use from 1966 to mid-1974 can be exemplified by events concerning Barrigada Hill and Sella Bay. In both locations, proposed or actual development impacted on land that had been, at least in the traditional sense, reserved for public purposes.

1. Barrigada Hill is an out-cropping of white even-grained chalky limestone which is finely porous and permeable. It has therefore been considered a major source of recharge to the water system of northern and central Guam. Additionally, many people have felt that its commanding view should be preserved as public open space. In a 1970 water resources report done by Austin, Smith and Associates (15), a recommendation was made that the hill be kept as a conservation area, primarily for water recharge. This seemed to be compatible with other needs, such as the expansion of the Guam International Airport. Since jet noise was an increasing problem, and Barrigada Hill was seriously affected, it seemed logical to keep this land undeveloped.

However, in 1971 the Hyundai America Corporation, a Korean-controlled company, secured much of the area of the hill and formally applied to the Government of Guam for the construction of a 266-unit subdivision. The response of public agencies was almost unanimous: no subdivision. By the time the request came before the Territorial Planning Commission, a solid case had been assembled which recommended disapproval of the subdivision. The TPC agreed with the recommendation and the subdivision was turned down.

Shortly thereafter, the Governor's office interceded on behalf of the developer. The TPC was called into a special session, resulting in approval of the project and loss of the conservation area.

2. In the case of Sella Bay, the National Park Service conducted several studies in 1967 at the request of the Government of Guam. The recommendations called for the

establishment of a seashore park in the southwestern portion of the island (7). It came to be known as the Territorial Seashore Park, encompassing an area of some 13,000 acres of terrestrial wilderness and 4,600 acres of coral reefs (Fig. 3). It stretched from Nimitz Beach south to Ajayan Bay, including a very scenic unspoiled area known as Sella Bay. Very little was done, and the area continued to develop slowly along traditional lines.

During the late 1960's the Vietnam War reached its height, particularly with the renewed bombing of North Vietnam. This necessitated the importation and off-loading at Apra Harbor of thousands of tons of bombs which then were transported by truck to Andersen Air Force Base. In 1969 the U. S. Navy became increasingly concerned with the problems of off-loading bombs in a commercial port area and began to seek an alternative site. The Navy selected Sella Bay for location of an ammunition wharf. Feasibility studies and soil analyses were undertaken, and negotiations to acquire the site began with the owner, the Government of Guam.

However, several citizens, appalled with the prospect of destruction of the unspoiled nature of the bay, sought to stop the project. Major opposition began to crystallize by August of 1970. Nevertheless, the Governor approved the plan with the provision that federal land elsewhere on the island would be exchanged for the land surrounding Sella Bay. Some 4,400 acres of land would have been acquired by the U. S. Navy, which at that time already controlled some 17.7 percent of the land on the island (16). Public comment and opposition from the legislature were two of the forces that eventually stalled the project. There was also a lawsuit brought by a legislator acting as a private citizen.

In 1974 the Navy finally abandoned the project. Thus, the bay remains basically as it was then, unspoiled yet coveted for its development potential.

These two cases exemplify competitive forces in the nature of land-use demands on Guam. One force is conservative of the land and water resources on the island, and the other is more speculative, with fixed goals concerning development of much of the island. Of the two forces, by far the more dominant is the one that favors development. Low living standards and rising expectations, the influx of large sums of capital, the lack of government controls, and ever-present special interests have all combined to foster an ethic of expansion and physical development throughout the island. Whether this ethic continues to prevail, without regard for the fragile nature of the island's resources, will have an important effect on the quality of life on Guam throughout future generations.

Guam's present land-use and physical development trends do not reflect the "island beautiful" image advertised by government and the tourist industry. Guam started ahead of the game in that the island was blessed with a warm climate, rugged and scenic hills and cliffs, fringing coral reefs, and beaches washed by clean ocean waters. Today's land-use trends, however, are responsible for much of the destruction or misuse of these natural resources.

LAND OWNERSHIP

When Guam was under naval rule much land was acquired from private owners by purchase, condemnation, or "cession." When local government came into existence it took over thousands of acres of public land previously administered by naval forces. Within the past ten years the amount of private land has increased through the purchase of excess government lands, land grants, and litigation.

Our present pattern of land ownership, therefore, was derived from historical happenstance and is not the product of thoughtful planning. Major environmental problems have resulted because of this. For example, the U. S. Navy controls large amounts of land in southern Guam, land which is better suited for the disposal of solid wastes (because of the impermeability of the volcanic soils) than is land in northern Guam. However, the civilian sector produces the majority of solid waste on the island. Because the sector producing the most solid waste does not own the land most appropriate for waste disposal, development of suitable islandwide disposal sites has been inhibited.

Industries such as asphalt and cement plants and quarries are required to locate on private lands zoned for industrial usage. Unfortunately, the pattern of industrial zoning has been the result of who the owner was and where he happened to have developable land, rather than the result of a rational assessment of lands most suitable for industry. Therefore many areas developed for heavy industry are located in close proximity to residences and schools.

When developers present construction plans an immediate problem arises as to air pollution because of the nearness of downwind receptors (adjacent developed land areas). This problem was pointed out by Dr. O. V. Natarajan, Administrator of the Guam Environmental Protection Agency, speaking at an air pollution hearing in 1973:

Many of you know about the zoning regulations of the Government of Guam. Unfortunately it is not an exclusive type of zoning. When I say exclusive type, there is residential zoning, commercial zoning, and industrial zoning (M-1 and M-2, light and heavy). Anyone can live anywhere. A guy can build a house and reside in an industrial zone. This is the problem. If we had exclusive zoning, if our zoning law says there should not be anyone living in an industrial zone, then we would not have that problem. I am not talking about a theoretical case. There is such a case in which there is an industrial operation and on the same lot an apartment building is being rented and people live there.

Local air pollution regulations must often prevent construction because industry is not able to achieve the necessary control efficiencies. From an air pollution standpoint, locating industry near the shipping facilities and major distribution centers (retail and wholesale outlets) in central-western Guam would be ideal. Unfortunately, these lands are primarily owned by the military (Navy) which presently shows no intention of relinquishing them.

Another environmental problem caused by our land ownership patterns concerns areas of groundwater recharge (northern Guam) or river watersheds (southern Guam). Presently almost the entire civilian water supply comes from groundwater extracted from the northern basal water lens (the lens-shaped form assumed by freshwater in porous limestone). Continued reliance on this as a source of potable water depends on recharging the lens to maintain its quantity and protecting it from pollutants to safeguard its quality. Development trends in the North (overlying the lens system) indicate steady consumption of natural areas for streets, homes, businesses, and parking lots. This development can not only deny rain to replenish groundwater, but also more often introduces pollutants such as dissolved solids, coliform bacteria, and heavy metals contained in urban runoff which percolates to the lens system. Since government ownership of the land overlying the water lens is limited, development is difficult to regulate. The Government of Guam is not financially able to purchase lands to protect the water supply, nor is there an established program of land transfer for this specific purpose.

In the South the problem is similar. Several studies have been done recommending areas most feasible for water supply development through the impoundment of river waters. Unfortunately, much of the needed land is privately owned and is increasingly being subdivided for speculative purposes. Thus, future land purchase and transfers will be more difficult and costly. When physical development begins in earnest in southern Guam, problems will accelerate because of the danger of erosion and resultant siltation of rivers.

An additional problem of ownership that deserves mention is the lack of public easements. This has hindered development of highways, water supply systems, and sewage collection systems. Often the government must purchase easements. In some instances, land cannot be procured at all and the government must forego development or radically change the design of improvements. When the cost of materials inflates daily, a few weeks' delay because of difficulty in gaining easements can also increase the cost of public improvements by thousands of dollars.

THE IMPACT OF LOCAL LIVING PATTERNS ON LAND RESOURCES

In earlier times the people of Guam tended to group in small compact villages, primarily for reasons of defense and inability to transport food and water over great distances. Roadways between villages were simply lines of travel and communication and did not have the effect of stretching settlement out in narrow ribbons across the landscape. Much of the land within villages was held in common, to be used either as gathering points or as areas of food production. Today, due to the adoption of American culture and patterns of land development, the settlement of land on Guam has changed dramatically.

Villages are no longer compact; rather, they spread over the landscape, often linearly along major highways. Only in those areas where topography or the provision of utilities is restrictive do villages remain compact and densely settled, e.g. Inarajan and Umatac. Since the society has become less cohesive and less interdependent, individuals have left the traditional pattern of communal life within villages to build homes throughout the island. Developers have created large subdivisions, often guided by lower land costs, availability of large tracts of land for purchase, or other factors unrelated to the nearness of village centers and the distances from major work areas. New subdivisions in Yigo, Kaiser Dededo, Windward Hills, Santa Rita, Pigua (Merizo), Latte Heights, and Nimitz Hill have created residential islands, lengthened service lines, and necessitated elongated travel patterns.

The preponderance of detached single-family homes has also had severe impact on land use. When living units are spatially segregated from each other, the cost of development rises as much as 40-60 percent over high-density development (17). The paving of additional streets, sidewalks, and driveway areas becomes necessary, thereby removing more green space and having an adverse impact on natural water systems. This single-family housing pattern further consumes land because of government regulations regarding minimum street setbacks and side and rear yard requirements. For example, homes in Kaiser Dededo have 8-foot side yards, creating virtually useless strips of land between dwelling units. The American pattern of street setbacks forces the development of front yards having little purpose other than the growing of lawns or placement of decorative shrubs. Rear yards, the areas most commonly used by families, are shortened as a result. Detached single-family housing is a major user of land, consuming available areas for house pads, yards, streets, and parking that might otherwise be left undeveloped or used as public open space. In addition the units cost much more to develop, and consequently purchase and maintenance costs are higher. Nationally, the environmental impact of detached single-family housing patterns is estimated to add 45 percent more air pollutants (from automobiles) and 73 percent more water-related pollutants (17).

In Guam, the present land-use pattern has fostered a dependence on the automobile that few other U. S. areas can match, with an auto ownership rate of more than two cars per household. Places of residence are not spatially related to work areas or shopping centers in most instances. Several new subdivision developments have included small commercial centers, but often this has been done more to maximize the value of the land and to increase the selling price than to serve as a planned center providing necessary services and employment to residents. Usually only neighborhood stores and small amounts of office space are developed, and homeowners must then travel several miles to work or shop. Increasingly the Agana-Tamuning area is becoming a center of commercial and governmental activity, and thus Guam's employment center. At the same time, the major places of residence are moving north toward Yigo, south toward Windward Hills, and east toward Mangilao.

The automobile not only becomes necessary for home-to-work and shopping trips, but it also becomes the major force encouraging land-use dispersion itself. Without the auto individuals would not be able to live great distances from work, schools, and stores. Reliance on private automobiles has resulted in the paving of a considerable portion of the island for streets and highways, carports, parking lots, and driveways. New subdivisions approved within the past twelve months devote 25-40 percent of their total land area to auto-related uses (writer's observation and review of subdivision plans). In Los Angeles County in Southern California, 70 percent of the total land area is devoted to the automobile and a similar land development pattern could evolve here.

Providing dispersed developments (e.g. Perez Acres in Yigo) and scattered agricultural subdivisions with utilities causes excessive costs to government and helps to foster a continued pattern of scattered growth. For example, the Northern District Sewer System proposed by the Government of Guam would connect Andersen Air Force Base, NCS Housing, Perez Acres, and other smaller subdivisions with the village of Dededo. This project, if completed, will cost between 10 and 20 million dollars, yet most land along the route of the sewer lines is still undeveloped. As a result, the sewage system will invite growth in these areas, help subsidize it, and promote the far-flung linear growth patterns that already dominate the landscape.

Proposed sewage systems for Merizo and Umatac, where basic planning assumptions seem to have different bases, are more compact and have capacities designed to serve primarily existing populations. Government planners seem to prefer the quiet, more rural nature of these villages and design systems that do not foster immediate growth. The Northern District Sewer System, however, assumes growth and sizes collection and treatment facilities accordingly. Whether the planning concepts are right or wrong is not the point; rather, the use of public facilities as a planning tool, or even an assessment of their impact on land use, has never really been fully considered.

BUILDING DESIGN

The design of living places on Guam is unimaginative, and is geared neither to the climate and terrain, nor to conservation of land resources. This is particularly apparent in new subdivisions such as Kaiser Dededo, where monotonous housing design is mixed with a terrain devoid of trees and relief. Federal Housing Administration (FHA) requirements on drainage and house construction, along with local setback requirements, tend to diminish the design options available, or at least put additional demands on architects to be innovative. The particular orientation of dwellings on lots and modes of interior partitioning do not consider solar exposures or take advantage of prevailing winds. Low roof lines without insulation create thousands of "hothouses" throughout the island, requiring expensive energy-consuming air conditioning. In fact, more and more designers seem to assume air conditioning and then create buildings that require it. For example, the Central Public Health and Social Services Facility in Mangilao was built without windows and relies entirely on artificial cooling. It is not uncommon for this cooling system to fail, either because of internal breakdown or power outages. When this happens, temperatures in the building often exceed 90°F and, since there is no ventilation, the air becomes extremely stale. Several working days were lost in 1974 because of this situation. Windows that admit a minimum of light and cannot be opened are also becoming commonplace in modern commercial office buildings.

Decorative planting and the conservation of existing trees would alleviate the visual impact of sterility created by concrete row houses, cut down local temperature extremes, and reduce the transmission of noise and air pollutants. However, few developers have seen the advantages of retaining vegetation. Usually the land is stripped bare for ease in housing layout and slab construction. The Planned Unit Development Regulations of the Guam Department of Land Management state the following design principles:

VISUAL CONSIDERATIONS:

1. Careful attention must be given to the quality of design of all buildings, land uses, street furniture (such as street lighting, outdoor equipment and signs), community facilities: parks and landscape. The nature, size, shape, lighting, style of all outdoor signs must be found to be in harmony with the purpose of zoning ordinance.
2. To improve the quality of environment and to reduce the possibility of damage and inconvenience during bad weather conditions, the underground installation of electrical and telephone equipment is considered very desirable.
3. To create identity and interest in the layout of housing fronting streets, variations in set-backs shall be encouraged.
4. Adequate lighting must be provided to the outdoor areas used by occupants after dark. Appropriate lighting fixtures must be provided

for walk-ways and to identify steps, ramps, directional changes and signs. Lighting shall be located to avoid shining directly into habitable room windows in the project or into private outdoor open space which is associated with dwelling units.

These principles are just that, principles and not requirements. Their degree of implementation within any project is dependent on the aesthetic conscience of the developer or the amount of "coaxing" by government planners.

Subdivision layout, usually grid patterns or cul-de-sacs, creates an unimaginative landscape, unnecessarily lengthens utility lines (sewers, water, power) and increases their costs, necessitates additional paving for streets and parking, and affects the cost of subsequent government services such as solid waste collection. Commercial buildings, although more money is invested in their design, often display the same lack of attractiveness because of the unplanned disconnected nature of their development and their location in strip commercial zones. Marine Drive between Airport Road and Route 4 is an example of the type of strip development that occurs when an integrated land-use plan is lacking and existing controls are not rigidly enforced. The Twelfth Guam Legislature perpetuated and added to this type of development when it passed rezoning bills over the Governor's veto: Marine Drive between its intersections with Tumon Loop Road was rezoned for commercial use to a depth of 200 feet along both sides of the highway; similar actions were applied to sections of land adjacent to Route 4.

One design and aesthetic consideration, notable because it has been enforced, is the sign law. The Territorial Planning Commission and also the Department of Public Works have attempted to prevent the ubiquitous growth of billboards and other large signs along roadways. There are many current violations with which the Department of Public Works must deal, but without the TPC's relatively strong stand, Guam would suffer from the ugliness of commercial outdoor advertising that exists in most mainland communities.

MILITARY LAND USE

There are three basic categories of land ownership on Guam: private, comprising 62,000 acres or 45 percent; Government of Guam, 29,800 acres or 22 percent; and military, 46,900 acres or 33 percent. As these figures indicate, military land use is one of the more obvious demands on Guam's land resources. Various pressures on land use have evolved because of Guam's strategic location, its past history, growing population, and changing economy. The United States Air Force controls 15.3 percent of the island's land, with its command situated at Andersen Air Force Base (occupying much of northern Guam). The Navy controls 17.7 percent of the land, with its commands located at several points throughout Guam: the Naval Station (Orote Peninsula and Apra Harbor area), Naval Air Station (central Guam), Naval Communication Station (Finegayan), Polaris Point, the Naval Hospital (Agana Heights), and the Naval Magazine (Apra Heights). See Fig. 4 for military holdings.

In 1973, the combined military and military-dependent population on Guam was estimated to be 31,000, with an 8 percent growth rate projected until 1977. This population is subject to great fluctuations, depending on world conditions and the status of the United States' international commitments. Recent studies of U. S. Military Far Eastern policy indicate that the major thrust over the next decade will be gradual withdrawal from the Asian mainland and a corresponding build-up in more politically stable areas such as the Marianas. This view seems justified by the announced withdrawals over the past two years from Vietnam, Thailand, Korea, and Japan. In addition to this, there have been U. S. military maneuvers for land on Guam and Tinian. It thus becomes clear why the military commands on Guam are reluctant to discuss proposals with the civilian government for the joint use or transfer of excess military lands.

The military is the largest single land user on Guam; this role is not likely to change for some time. The withdrawal of personnel from Asia and the resultant centralization of the U. S. Pacific Forces in the Marianas mean that existing military lands will be developed more extensively for both military operations and support facilities. Thus, even though the respective commands operate autonomously as closed systems whenever possible, their activities will continue to have numerous joint islandwide environmental impacts.

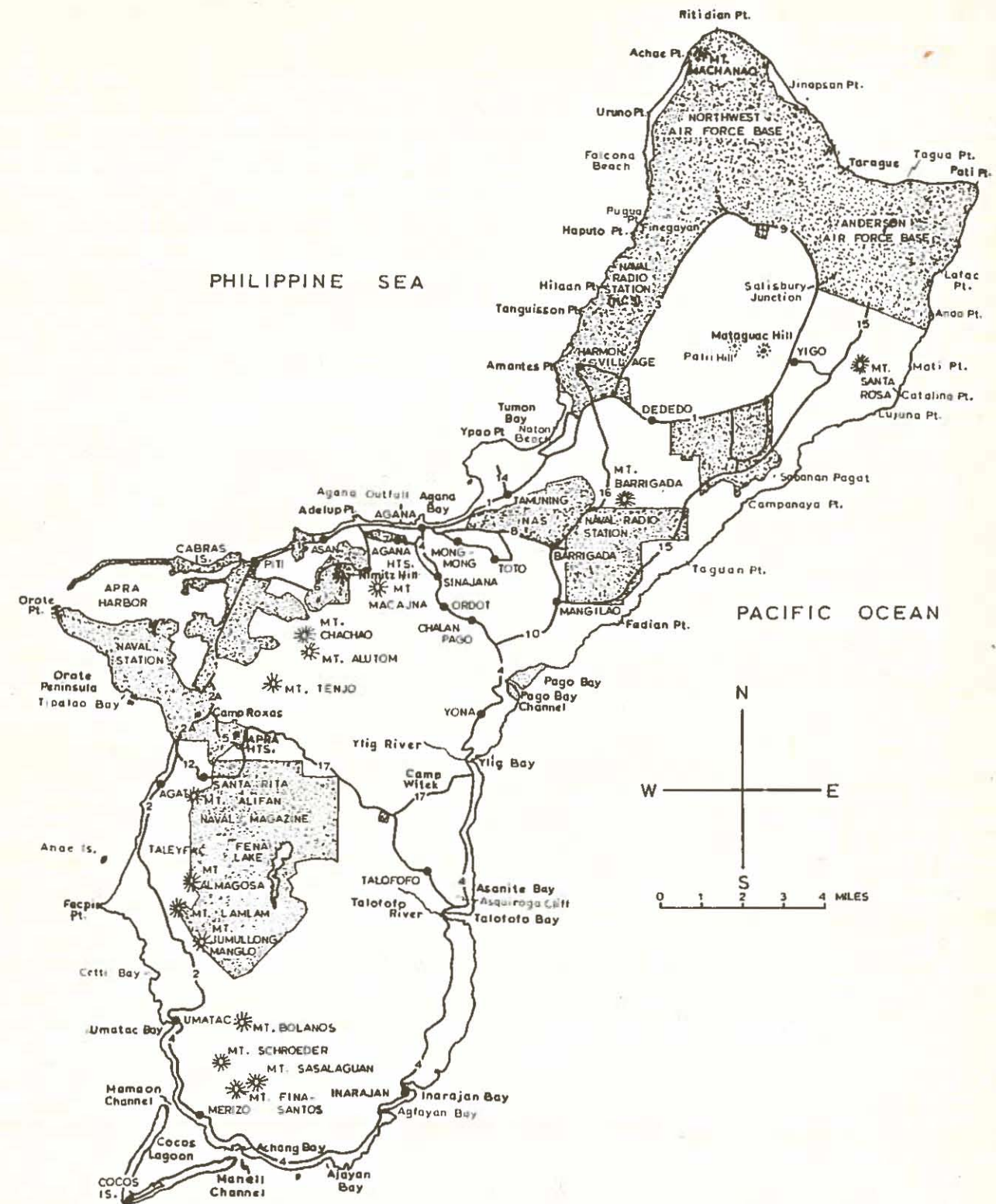


FIGURE 4

General Locator Map of Guam, Showing Military Reservation Boundaries, Major Highways, Villages, Mountains, and other Place Names. From (2).

THE NAS-INTERNATIONAL AIRPORT

Because of Guam's strategic location, both as a commercial transportation hub and military focal point, the development of a major airfield was inevitable. The Guam International Airport, located in the west-central portion of the island (Fig. 5), was originally built to serve the U. S. Naval commands but now accommodates the civilian community as well. The runways, flight control tower, and fire station are still owned and operated by the Navy (18). The civilian air terminal was built on land transferred to the Government of Guam by the Navy. The runways and land devoted to airport use have been expanded continuously, either because of changing technology (e.g. larger aircraft) or increased passenger loads. Table 4 indicates the tremendous growth in the number of aircraft arrivals between 1964 and 1973; commercial arrivals have increased by more than six and one-half times.

The entire airport area and related facilities comprise some 1,980 acres including the commercial airport and the surrounding Naval Air Station lands (Fig. 6). Private lands lie to the north of the airport toward Marine Drive, to the south and east in the village of Barrigada, and to the west along Route 8 in the Mongmong-Toto area. Major commercial and residential development has occurred in the Tamuning area to the northwest and along Route 8 in Mongmong-Toto. In addition, a large subdivision has been constructed directly east of the airport on Barrigada Hill.

One of the recommendations of the Master Plan (18) for the International Air Terminal in 1971 was:

... that the Government of Guam immediately undertake steps to develop a land use and transportation plan in the vicinity of the airport Proposals may be made to change the pattern of development in areas surrounding the airport, and these must be carefully evaluated in light of airport usage. Failure to control land uses in the entire airport vicinity . . . could jeopardize the public investment in Guam International Airport.

Though the Master Plan was accepted and adopted by the Governor, this essential portion of the plan was not implemented. As a result, the airport is increasingly in conflict with its neighboring land uses. (Refer to the Barrigada Hill example discussed earlier in this chapter.)

Although most people will concede its necessity, airport land usage creates severe environmental problems. Surface run-off from paved areas such as runways carries oils, heavy metals, and other contaminants. The underlying porous limestone readily absorbs surface run-off and transmits it to ground waters. Air pollution from jet engine exhausts is also a major problem, contributing thousands of pounds of nitrogen oxide, sulfur dioxide, particulates, and hydro-carbons to the atmosphere each year.

While these pollution problems are serious, the major environmental irritant generated by Guam's airport is excessive noise. Humans can tolerate noise levels up to 120-140 decibels without physical pain and/or hearing impairment. However, for reasonable comfort, and to communicate and avoid annoyance, maximum levels should not exceed 85 decibels. In the vicinity of jet aircraft, noise levels commonly exceed 120 decibels. (By comparison, homes and business offices outside of typing areas, generally are in the 35-60 decibel range.) The total annoyance factor for aircraft is related not only to the decibel level but also to the number of occurrences during a given time interval. A weighting of both these factors yields the Composite Noise Rating considered in Tables 5 and 6 and the Noise Exposure Forecasts considered in Fig. 7.

The U. S. Department of Housing and Urban Development's "Noise Assessment Guidelines" contain land-use compatibility guidelines for areas in the vicinity of airport take-off and landing patterns (Tables 5 and 6).

Fig. 7 indicates noise contours in excess of acceptable levels that emanate from the airport. Even though these contours do not include excessive levels caused by the testing of jet engines at the Naval Air Station (a persistent complaint), excessive noise levels exist for most types of land uses within a several-mile radius of the

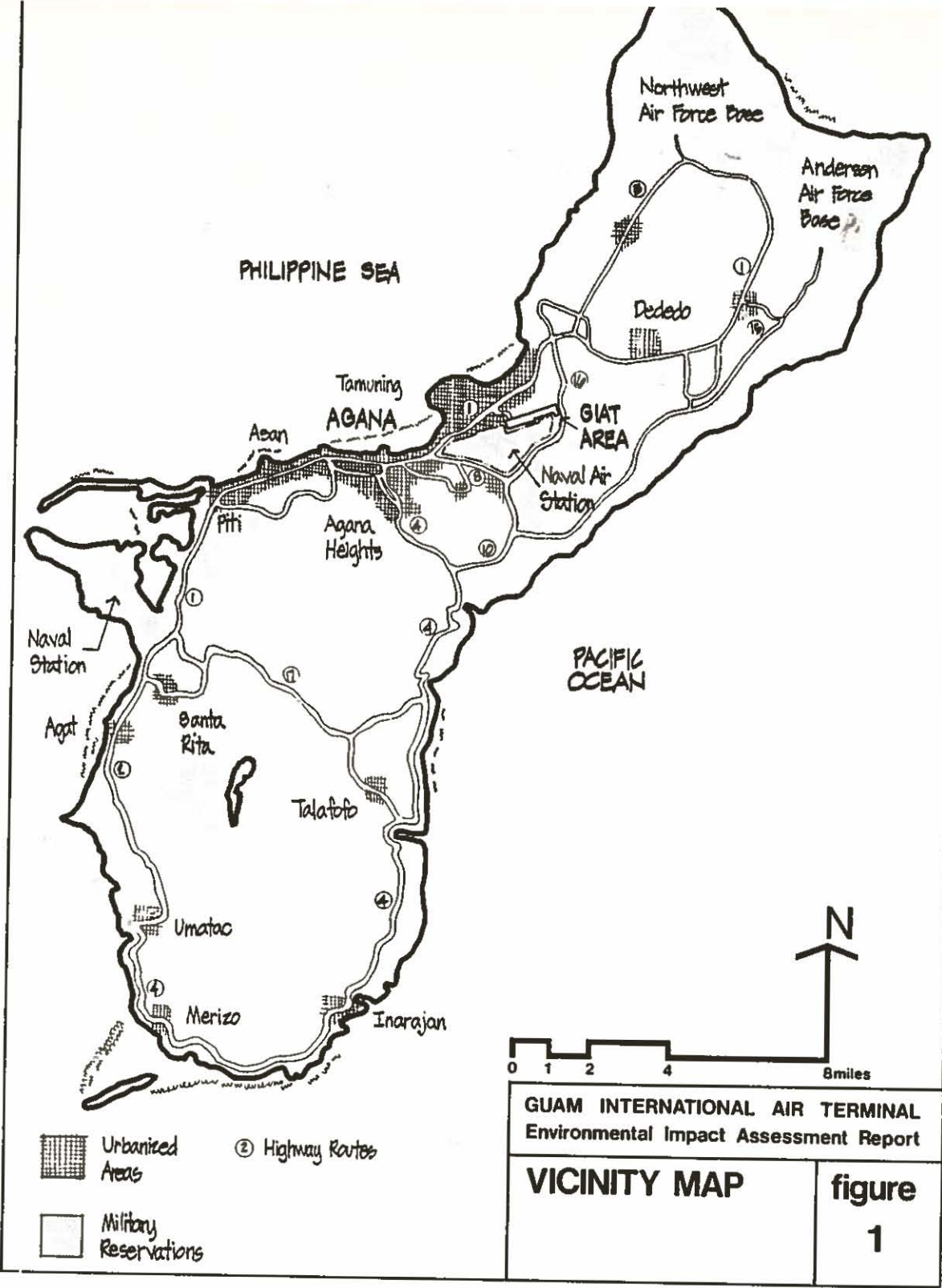


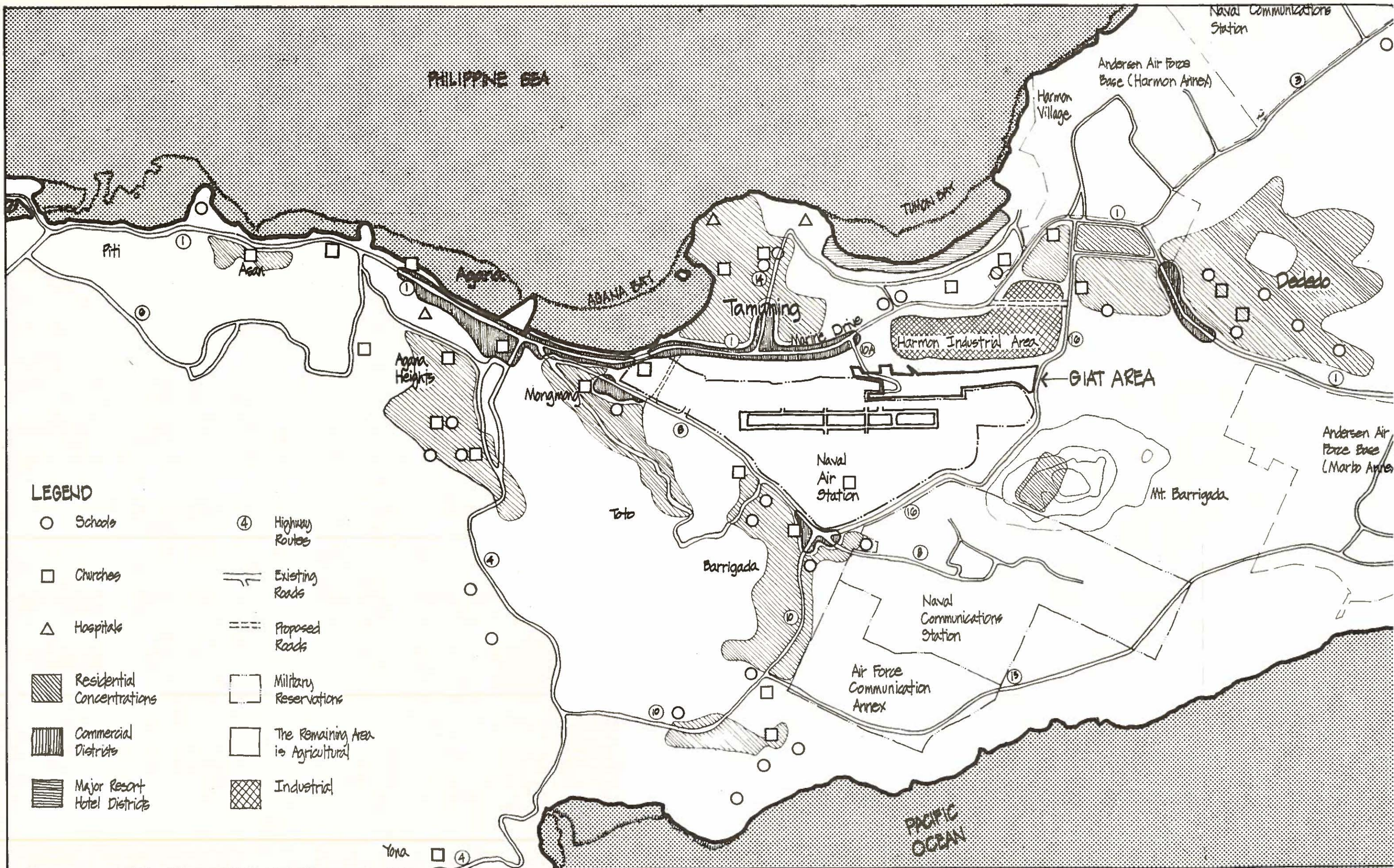
FIGURE 5

Locator Map for Guam International Air Terminal (GIAT). (From Guam Dept. of Commerce. 1975. Environmental Impact Assessment Report, Guam International Airport Terminal.)

TABLE 4
Aircraft Arrivals, Guam NAS-International Airport

Fiscal Year	Commercial	Non-Commercial	Total
1964	894	2,155	3,049
1965	1,053	1,478	2,531
1966	1,784	1,471	3,255
1967	2,020	1,554	3,574
1968	2,313	1,140	3,453
1969	2,528	1,240	3,763
1970	3,651	1,146	4,797
1971	4,301	1,025	5,326
1972	5,439	1,224	6,663
1973	5,844	1,250	7,094

Source: Customs and Quarantine Division, Department of Commerce,
Government of Guam.



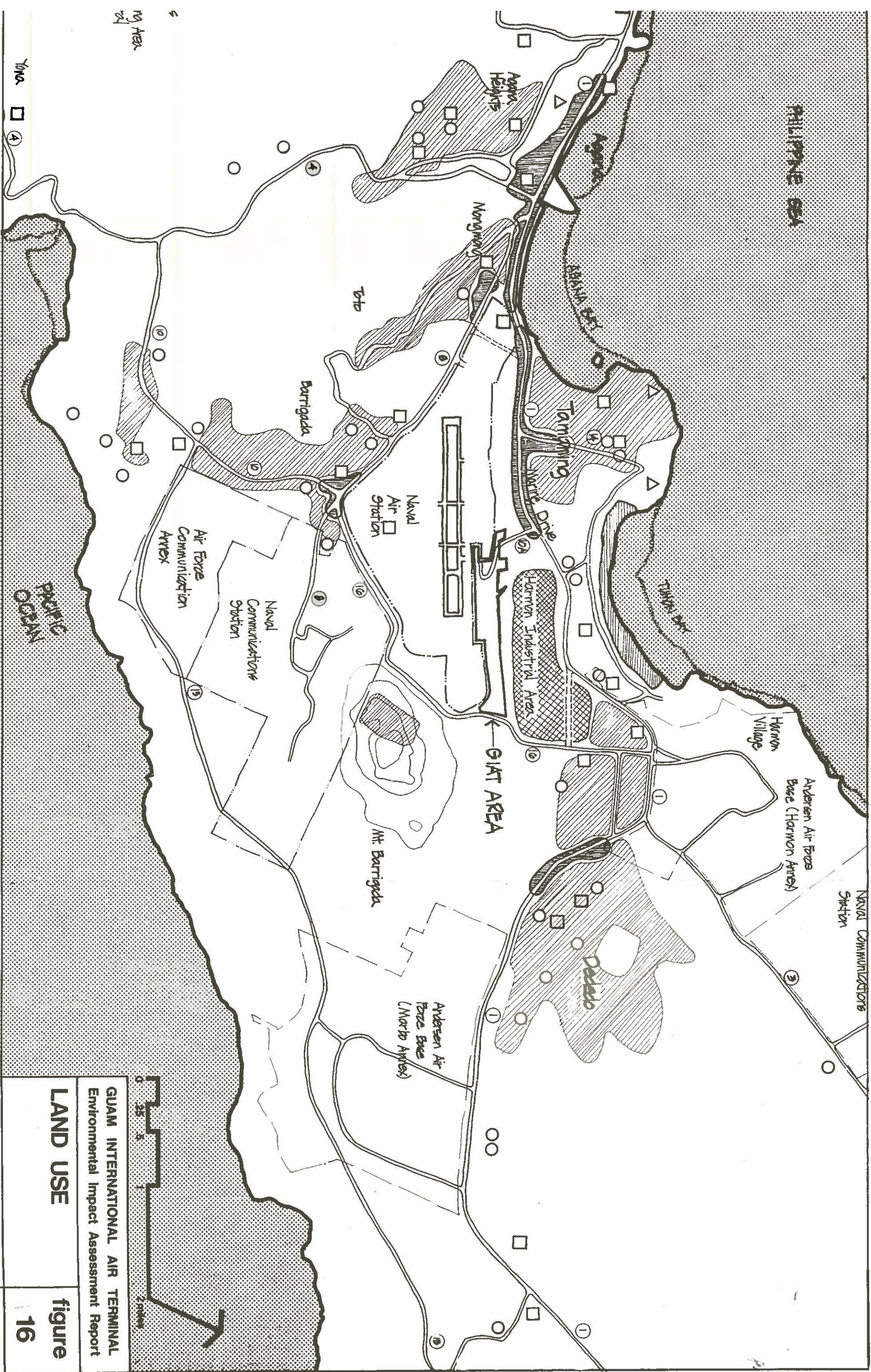


FIGURE 6

Land Use at Guam International Air Terminal and in Surrounding Areas. (From Dept. of Commerce. 1975. Environmental Impact Assessment Report, Guam International Airport Terminal.)

TABLE 5

Expected Community Response for Specified
Composite Noise Rating (CNR) Caused by Aircraft^a

CNR	Expected Community Response
120	Serious noise problems are likely. Individual reactions would likely include repeated, vigorous complaints. Concerted group action might be expected.
115	
110	
105	Individuals may complain, perhaps vigorously. Concerted group action is possible.
100	
95	
	Essentially no complaints would be expected. Noise may interfere with some activities.

^aFrom (19).

TABLE 6

Land Use Categories Compatible with Various
Composite Noise Ratings Caused by Aircraft^a

Land Use Category	Composite Noise Rating							
	90	95	100	105	110	115	120	125
Auditoriums, Music Shells	-----xx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Playgrounds, neighborhood parks	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Residential, Schools, Libraries, Churches, Hospitals, Nursing Homes, Outdoor spectator sports	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Manufacturing, Communications (Noise Sensitive)	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Golf courses, Riding stables, Water Rec., Cemeteries	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Transient Lodging	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Livestock farming, Animal Breeding	-----	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Extensive Natural Recreation Areas	-----	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Office Buildings (Commercial-Retail), Movie theaters, Restaurants	-----	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx	xxxxxxxxxxxx
Wholesale, Some Retail, Manufacturing, Industrial	-----	-----	-----	-----	-----	-----	xxxxxx	xxxxxxxxxxxx
Public Right of Way, Agriculture (except livestock), Mining, Fishing	-----	-----	-----	-----	-----	-----	-----	-----

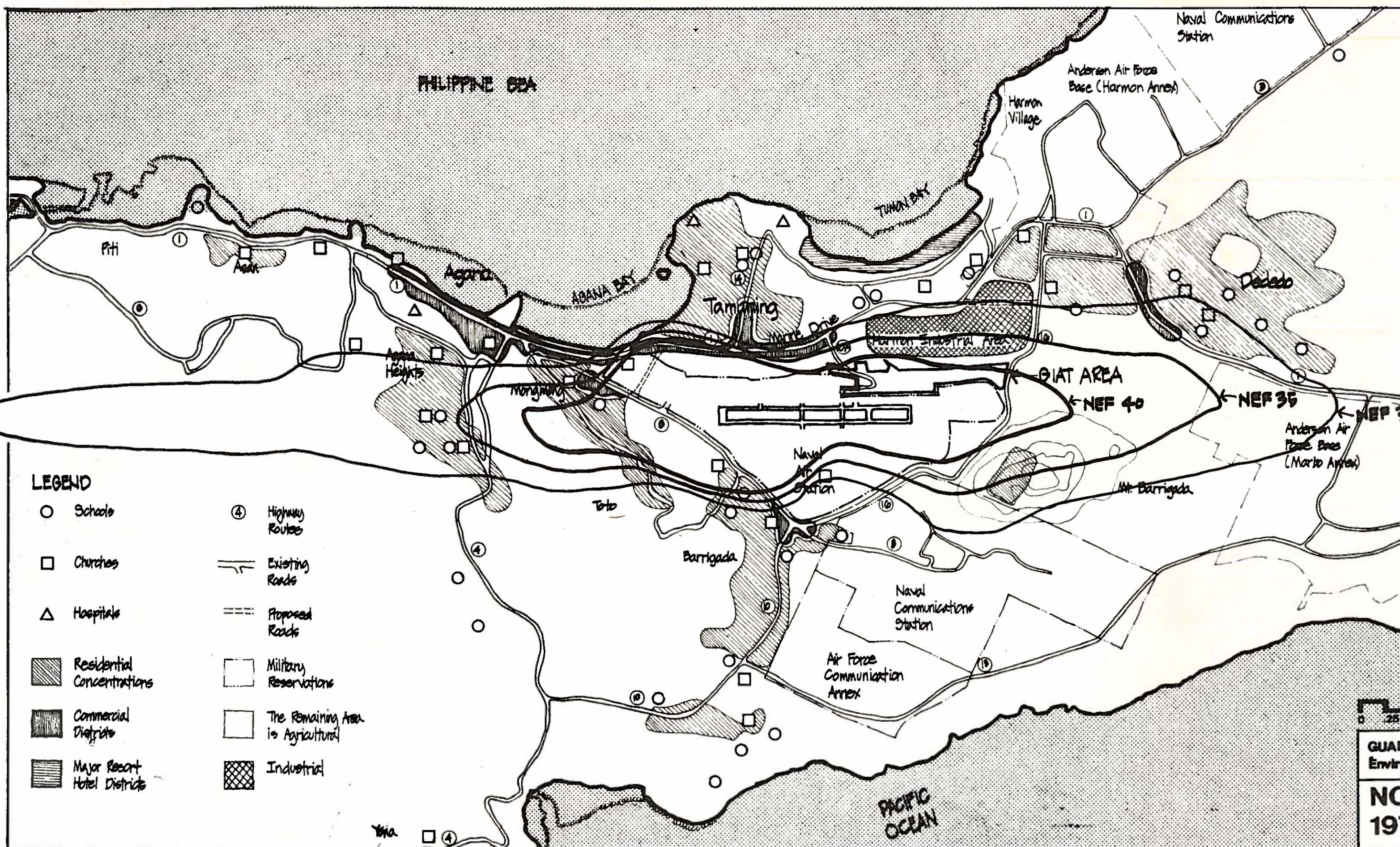
..... ^aFrom (19).

----- clearly acceptable

----- normally acceptable

xxxxxxx normally unacceptable

oooooooo clearly unacceptable



LEGEND

- | | |
|--------------------------------|--------------------------------------|
| ○ Schools | ④ Highway Routes |
| □ Churches | — Existing Roads |
| △ Hospitals | === Proposed Roads |
| ▨ Residential Concentrations | □ Military Reservations |
| ▩ Commercial Districts | □ The Remaining Area is Agricultural |
| ▧ Major Resort Hotel Districts | ▣ Industrial |

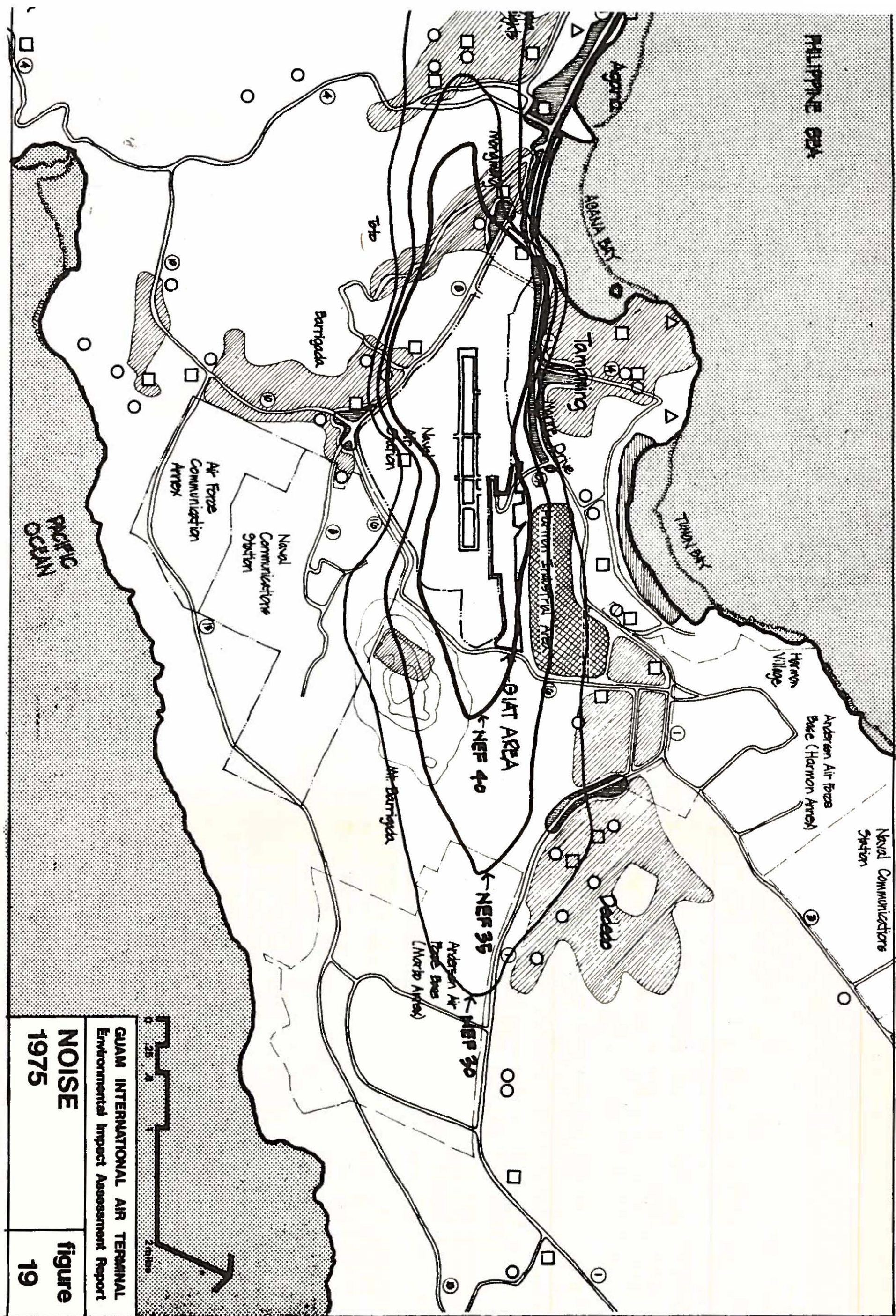


FIGURE 7

Noise Contours Around Guam International Air Terminal. The Noise Exposure Forecasts (NEF) levels are based on such factors as aircraft type, aircraft mix, number of operations, runway utilization, flight path, airport operating procedures, and time of day. (From Guam Dept. of Commerce, 1975. Environmental Impact Assessment Report, Guam International Airport Terminal.)

airport. Particularly affected are the communities of Barrigada, Tamuning, and Dededo, which contain approximately one-third of the island's population. Mr. George P. Harris, Area Manager, Federal Aviation Administration (FAA), in a speech before the 1972 Environmental Awareness Conference (20) commented that:

. . . Dededo is a source of increasing noise complaints because many N.A.S./Agana departures turn out seaward over this area and most Andersen Air Force Base arrivals are descending to Andersen directly over the same location There is a development contemplated in the currently vacant land adjacent to the departure end of runway 6R/24L There is no question that this development will create a severe source of complaints of noise problems simply by the placement of people within this area Further development in such areas, or the control of these developments, is a local government responsibility.

The contemplated development to which Mr. Harris referred is the Barrigada Hill development.

Thus, even though the airport itself is confined to approximately 2,000 acres, its impact spreads in wide fingers, encompassing large portions of the island. The local government has no noise pollution laws or nuisance laws which would help to alleviate the noise problem caused by aircraft. Court cases on the U. S. mainland have established the precedent that only the FAA may regulate air traffic and aircraft design. The FAA, however, can regulate only civilian air traffic (Civil Regulations-PAR 36 of the Federal Aviation Regulations); while military aircraft, perhaps the major contributor to noise problems on Guam, remain uncontrolled.

Several types of control measures can be instituted to minimize the impact of aircraft noise: the use of quieter engines, modification of take-off procedures through power reduction, and discrete departure patterns. It has also been suggested that the airport be moved away from population centers (e.g. to Northwest Field), but this would be prohibitively expensive. Nothing works quite as well as controlling the land use in and around airports.

In several communities on the mainland, notably Cleveland, Seattle-Tacoma, and Los Angeles, citizens have successfully sued airport authorities for actual physical damage to their homes and loss of value because of decreased liveability. Although such suits have not occurred on Guam, it is possible that citizens may some day seek relief through legal action.

In summary, there is little doubt that the physical size and use of the airport will continue to expand. The Government of Guam is not equipped to control growth in the airport environs and does not always exercise regulations it does have. At some point in time, the environmental impact of this land use will no longer be tolerable or tolerated. At that time it will be impossible to move people.

SOLID WASTE DISPOSAL

People have been generating and disposing of solid waste on Guam since the first human habitation. Until recently, however, solid waste disposal was not much of a problem. There were few or no manufactured goods; even imported foods and wares came in reusable bulk containers, or ones which were easily degraded by heat and humidity. Population was small and scattered. Personal income was limited to expenditures for basic items such as food and clothing, with little available for luxury goods. Conditions have changed considerably: the population has increased many times over since 1900; current economic policy is predicated on obsolescence and conspicuous consumption; our goods are over-packaged in wrappings designed to be thrown away once the contents are consumed; and our leisure time and expendable income have grown. No figures exist on the amount of solid waste generated on Guam during the early part of the 20th century, perhaps because so little waste was actually generated and much more space was available for its disposal. In fact both the ocean and the land served as the island's garbage dump. In the ocean, the wastes settled to the bottom, were carried away by

currents or eaten by sharks; on land, vegetation rapidly covered the unsightly dumps: out of sight, out of mind.

Today these simple solutions are no longer possible, and the Federal Government first recognized this in 1969. Two individuals from the U. S. Department of Health, Education, and Welfare did the first solid waste study on Guam. Weighing and sampling refuse and categorizing the producers, they deduced that approximately 115,470 tons of solid waste were generated on Guam in 1969, including that from the military commands. The 1970 Territorial Solid Waste Management Plan, done by the Department of Public Works (21), estimated that the amount would grow to 167,400 tons in 1975 and to 283,200 tons by 1990. Unfortunately, these projections may be understated. The 1970 figures assume a generation rate of 2.06 lbs. per person per day; 1975, 1.74 lbs. per person per day; and 1990, 1.59 lbs. per person per day. However, actual field samples done by U. S. Department of Health, Education, and Welfare in 1969 indicated a generation rate of 2.1 lbs. per person per day. The study also pointed out that if open burning by homeowners and widespread feeding of food wastes to poultry and swine were eliminated, the figure would jump to 3.3 lbs. per person per day. In 1974, these practices subsided to a point where the civilian community probably generated close to 4 lbs. per person per day. The influx of nonreturnable beverage containers, use of paper plates and cups, and excess packaging for merchandise may increase this figure even more (22). The Hawaii State Plan for Solid Waste Management (23), done in 1971, projected that Hawaii's per capita waste generation would increase by 4 percent per year. For example, Oahu's per capita waste generation in 1968 was 3.3 lbs. per day; by 1978 it was predicted to be 4.88 lbs. per day; and by 1988, 7.23 lbs. per day. There is little to indicate that Guam's per capita waste generation will be any different. (The trend is also similar on the Mainland.) Therefore, if we assume a similar 4 percent growth rate in per capita waste generation and a 7 percent yearly population growth rate, the civilian community alone would generate 196,800 tons in 1990. This figure corresponds very closely with the projection of the 1970 Plan for Guam (21) of 195,200 tons per year.

How does one imagine the dimensions of 195,000 tons of solid waste? It may be more understandable to think in terms of the land area that must be set aside for waste disposal of this magnitude. For example, if the 1975 projected islandwide figure of 167,400 tons per year is converted to volume, it becomes 2,012,840 cu. yds. (assuming 166 lbs. per cu. yd.); converted again to an area measurement, it would be equal to 1,248 uncompacted acre-feet per year. This means that if you own 1,248 acres of land on Guam, the amount of solid waste generated by the civilian and military communities by 1975 would cover all your land to a depth of one foot. If you own one acre of land, to dispose of all the waste you'd have to pile it 1,248 feet into the air. By 1990 this figure will increase to 1,762 acre-ft. per year.

With Guam's limited land resources, we should begin to wonder where we will put all this waste. It can't be put just anywhere. Landfills containing municipal solid waste produce dangerous pollutants in the form of leachate (liquid wastes produced by the percolation of surface water through the fill, with the resultant absorption of decomposing wastes) and methane gas, produced by the decomposition of organic wastes. Leachate contains heavy metals and high counts of coliform bacteria, and has high demands for oxygen as it undergoes further decomposition. Methane gas is explosive and poses a serious hazard if allowed to collect in pockets. Because of the porous nature of the underlying limestone in northern Guam, landfilling in this area is not advisable since there is a high probability that leachate from the fill may contaminate groundwater supplies. Thus, landfills are limited primarily to southern Guam with its volcanic-origin soils, an area of roughly 100 sq. miles or 640,000 acres. If our average waste generation between 1975 and 1990 were 1,500 acre-ft. per year, we would need 225,000 acres to spread the waste one foot deep, or 35 percent of the entire area of Guam. By the year 2,000, this figure could jump to 66 percent. These projections are simplistic of course, but they do serve to present a picture of the magnitude of the problem and the potential impact on our land resources.

There are presently four operating landfills on Guam: two operated by the Navy at the Naval Station and Naval Air Station (NAS), one operated by the Air Force at Andersen Air Force Base (AAFB), and the civilian landfill operated by the Department of Public Works at Ordot. Each of these operations is an area fill where waste is spread on the surface of the site, compacted to a depth of eight to ten feet, and covered with dirt.

All of the sites have potential water pollution problems: NAS and AAFB sites because they are situated in limestone areas; the Ordot landfill because of its poor operation, inadequate cover, and resultant leachate which enters a branch of the Lonfit River; and the NAS because the landfilling is being done in a swamp area. Other than the Ordot landfill, all of the sites should be closed due to water pollution problems; Ordot would not pose a serious problem in this respect if it were operated properly. All of the landfills have short life expectancies: NAS, 5 yrs; Ordot, 5-7 yrs; Naval Station, 2 yrs; and AAFB, 1+ yr. In 1973 AAFB finished construction of a solid waste transfer station to bulk-haul its waste south and to enable the Air Force to close their landfill. Equipment delays and the lack of a receiving point stopped implementation of the plan. Both the Air Force and Navy commands have expressed interest in utilizing civilian landfills for disposal; however, the only one available, Ordot, would be exhausted much sooner if it were to receive military wastes. A distressing proportion of Guam's solid waste simply appears as litter discarded on public and private lands (22).

The question that must be asked of decision makers now is where our waste will go in the future. Assuming that we will need or use some 100-200 acres per year (with 10-ft. layers of waste), where will this land be found? Landfills must have adequate access, a nearby or on-site source of cover material, and soils of low permeability. Precautions to guard against water pollution will have to be taken, and no doubt there will have to be government ownership of the land. When all these factors are taken into account there are few choices, and no matter how the problem is ultimately settled it will be costly. The most suitable land is located in the South, far removed from population concentrations; this means long haul distances and correspondingly high collection costs.

Another point also comes to mind: what will land disposal sites be used for once the fill operation is completed? This question will soon arise in regard to the Naval Station and AAFB landfills. Because of the problems of settlement and methane gas production, precautions must be taken if any construction is planned. Large structures usually cannot be built on completed fill areas. These areas can be used for open space (active and passive), parking, or left to revert to growth of secondary vegetation.

Sites for solid waste disposal should receive major consideration in our land-use decisions over the next 5-10 yrs. Solid waste disposal will have a major impact on our land resources not only because of necessary precautions and environmental problems, but also because of the large area that will be needed. In 1974 agricultural land in southern Guam with adequate access sold for \$3-10 per square meter. What the price will be by 1990 is beyond reasonable guess, but it will probably be several times current prices. Between 1964 and 1973 the assessed value of land increased 2.5 times; with increasing demand for land and rising inflation, future increases may even be greater. Even today, assuming we need approximately 13 acres per year to dispose of solid wastes (in 10-ft. compacted layers), the value of the land so used will be close to half a million dollars. This negative investment will only increase in the future as land prices rise and waste generation increases. Should we make such decisions about the use of our limited land resources simply because we are not willing to act positively to find alternative solution to our solid waste problems?

Guam has experienced enormous growth over the past ten years, most of it occurring since 1969. It has been a difficult adjustment. Society has had to deal with the pressures of a crowded, more materialistic population. There has been an ever-increasing demand upon land and water resources. We must assess the island's resources and determine the extent to which they can survive under the pressures of urbanization.

EROSION

The clay soils, steep slopes, and heavy rains have always posed erosion problems for southern and central Guam. Early inhabitants often lit fires to flush wildlife from their places of hiding, facilitating the animal's capture but denuding the land and making it susceptible to erosion. Such burning is still practiced by present-day hunters and poachers. Massive bombing during World War II decimated thousands of acres, resulting in rapid erosion of many areas. Shortly after re-occupation by the Americans, seeding of tangan-tangan was carried out, with the resultant greening of the island.

It was the policy of Naval Governors to foster forestry and to conserve soil resources. In 1969 the U. S. Navy Public Works Center, in cooperation with the Guam Department of Agriculture and the U. S. Forest Service, undertook a program of planting 21 species of trees, including teak, eucalyptus, and Formosan sweetgum (24):

According to Mr. Nelson, Research Forester, Guam has an alarming erosion problem. Each year, vast portions of grass and brush are destroyed by brush fires, and then the torrential, tropical rains fall on the burned areas eroding the soil and filling in the area of streams and reefs. Not only does this loss of soil create ugly scars on the hillsides but the silt smothers the reefs and drives out the reef fish. Therefore, erosion control is one of the chief reasons for the tree experiments. Some of the other goals the forestry team hope to achieve are: decrease wild fires and reduce fire damage; improve watershed cover; and develop and improve forests for scenery, recreation, wildlife, timber, and timber-related products.

Despite these efforts, erosion has progressed and is now being spread by another mechanism: construction of subdivisions. With the availability of water and approval of individual package sewage treatment plants, major development has for the first time crossed into southern Guam. In the area south of Adelup-Pago fault line, Nimitz Hill, Windward Hills, Pulantat, and Pigua (Merizo), construction of major new subdivisions has begun within the past two years. In the case of Nimitz Hill, massive cut and fill operations resulted in large-scale site erosion, transport to the Matgue River, and ultimate deposition in Piti Bay. This case is discussed more extensively in Chapt. 5.

Fortunately, some officials within the Government of Guam realized the impact of erosion. On June 7, 1974, Mr. Joe Diego, Director of the Department of Commerce, warned of similar dangers at government subdivisions in Umatac and Merizo and called for preventive controls. Later, in August, the Guam Environmental Protection Agency did an in-depth investigation of sediment sources of the Tarzan River at the request of the Department of Commerce. This investigation revealed yet another contributor to the problem: a motorcycle track at Route 17 that crosses private and government land. Eliminating this source of sediment means curtailing a popular sport in this location, but continued use of the track will ultimately despoil the planned recreational improvements at Tarzan Falls.

An analysis of the government procedure for issuance of clearing and grading permits explains why many problems are occurring and seem to be intensifying. The Director of the Department of Public Works, pursuant to Sections 31014 and 31015 of Title XXXII, Chapter 1, of the Government Code of Guam and Section 24200 of the Administrative Adjudication Act, promulgated regulations stating that "all construction work within the jurisdiction of the Department of Public Works shall be governed by the Uniform Building Code." The Uniform Building Code, Chapter 70, "Excavation and Grading," sets forth requirements for grading permits (Section 7008), and Erosion Control (Section 7013).

In practice, these regulations have not been adequately enforced, primarily because of the lack of sufficient manpower to monitor clearing and grading operations. An analysis of Grading Permits issued in 1973 substantiates this. Of more than 150 permits issued, 20 lacked either acreage or period-of-work information and several others had only partial information; no site inspection was performed by Public Works on any application. For large projects (such as subdivisions) grading plans are submitted by the developer and reviewed carefully by several agencies. However, the issuance of many permits without plans or the uncontrolled clearing of land without government supervision still creates problems. It is noteworthy that of the 1,562 acres (plus an unknown amount not listed by several applicants) cleared and graded during 1973, 72.47 percent of the land was cleared between June and November (the months of heaviest rain). In other words, over 70 percent of the land was cleared during the five months of the year when the impact of that work would be most severe. Nearly half of all grading permits issued were for those same five months.

According to these figures 1,562 acres represents 1.15 percent of all Guam's land. When we include the unknown acreage from the additional applications, land cleared and graded

by the Government of Guam (e.g. for highway construction), and similar operations by the military, we can assume that probably more than 2 percent of all Guam's land resources underwent some clearing and grading in 1973.

A similar analysis of permits issued in 1974 indicates that this pattern did not change substantially. Fifty-five clearing permits and 55 grading permits were issued by the Department of Public Works between January 1 and August 1, 1974 (Tables 7, and 8). Seven clearing permits had no fixed date by which work had to be completed, four others had time limits in excess of one month. For grading, seven permits had no date and seven others had time limits of over a month. Again, there did not appear to be definite attempts to do grading during the dry season. By far the greatest amount of land affected by either clearing or grading was in northern Guam:

	North	South
Clearing	449.8	40.9
Grading	546.2 acres	17 acres

Should this trend remain unchecked, serious land erosion problems will undoubtedly occur throughout most of Guam, particularly in southern Guam. Although manufactured soil can be trucked in by developers and ultimate project residents can stabilize lawns and rights of way, the damage to the land, rivers, and reef areas will have already occurred and in most cases will be irreparable. If reservoirs are constructed on southern rivers to develop public water supplies and there is a continuance of inadequate control over the grading activities of developers within the watersheds, we can expect the lives of these reservoirs to be short and the quality of their water poor.

The scenic blight of mass-graded subdivisions is subjective; it depends on the point of view of the observer. However, the sterility of Kaiser Dededo and Barrigada Heights has not been lost on many of our decision makers and potential homeowners; already these areas are less preferred and may ultimately face problems of occupancy or inability to sustain competitive land values.

THE POWER INDUSTRY

Between 1970 and 1973, Guam's population increased from approximately 85,000 to more than 105,000, an increase of 23.5 percent. During the same period of time, however, the island's power consumption increased 67 percent, with most of that growth occurring during the latter 24 months. Residential usage increased 61 percent and commercial and governmental consumption, over 71 percent. The increased demand on power is attributed not only to Guam's population growth but also to a higher per capita usage. The tourist industry has expanded, necessitating the supply of power to 240,000 visitors annually. The establishment of new businesses is still another contributing factor. In response to this surge in power consumption, a corresponding increase in power output has been achieved by the Guam Power Authority (GPA). Enlargement of the existing physical plant (i.e. a diesel plant in Dededo, Tanguisson Power Plants #1 and #2, and the Cabras Island Power Plant) has been necessary to handle the increased demands. The impact of these new facilities on air and water quality is discussed in later sections.

One of the largest single impacts of increased power consumption, however, was on the use of land. Because of the expansion of power facilities, between 550 and 600 acres (including GORCO's 500 acres in Tenjo Vista) were permanently committed to power-related usage. Other than the smaller substations and diesel plants, the complexes are located along the western coast of Guam, stretching from Agat to Tanguisson Point. The largest of the facilities are located in and around the Commercial Port: the Piti Power Plant, Cabras #1 and the Power Barge "Inductance." Cabras #2 is now under construction within the same area. In 1975, additional complementary fuel storage facilities and pipelines and Cabras #3 will begin construction. Significant amounts of land are also required for transmission lines, and land use in adjacent areas is affected by air pollutants resulting from power plant operations.

TABLE 7

Clearing Permits Issued Between January 1 and August 1, 1974^a

TOTAL PERMITS ISSUED	PERMITS FOR NORTH	PERMITS FOR SOUTH	TOTAL ACRES	ACRES NORTH	ACRES SOUTH	DAYS PERMIT ISSUED FOR	MONTH
11	10	1	167.51	166.28	1.23	2-4-8-30 - open	January
10	8	2	36.78	24.43	12.35	3 hours - 3-7 18-60 - open	February
10	7	3	87.83	86.27	1.56	1-2-8-14 - open	March
6	3	3	19.26	3.65	15.62	2-11-23-30 - open	April
9	7	2	8.61	1.5	7.1	2 hours - 1-7 60 - open	May
6	4	2	167.32 +1.68	165.32	3	4-5-14 - open	June
3	3	0	2.33	2.33	0	2 - open	July
55				449.78	40.86		

^aCompiled from records of the Guam Department of Public Works.

TABLE 8

Grading Permits Issued Between January 1 and August 1, 1974^a

TOTAL PERMITS ISSUED	PERMITS FOR NORTH	PERMITS FOR SOUTH	TOTAL ACRES	TOTAL ACRES FOR NORTH	TOTAL ACRES FOR SOUTH	DAYS	MONTH
19	16	3	34.12	33.53	.79	1-2-4-6 13-30-66 120-235- 300 - open	January
5	3	2	6.18	5.61	.57	1-17 - open	February
7	5	2	15.81	12.127	3.709	3-6-8 26-45 - open	March
9	7	2	320.31	319.39	.92	1-5-12-13-15 21 - open	April
6	5	1	8.61	7.70	.918	2-12-18 - open	May
5	4	1	172.02	161.92	10.10	3-6 - open	June
4	4	0	5.90	5.90	0	60 - open	July
55				546.17	16.99		

^aCompiled from records of the Guam Department of Public Works.

And yet we cannot realistically expect the demands of the power industry on Guam's land resources to end here. Based on an increase in annual power consumption at a rate of 10-15 percent per year, the estimated power demand by the year 2000 (with 1972 as the base year) would be 479.50 to 650.75 megawatts; these figures represent an increase of 37 percent and 86 percent respectively over the 1975 capacity of 350 megawatts (Fig. 8). Within the next 25 years, therefore, the generating capacity of GPA will have to increase anywhere from 33 percent to 85 percent in order to meet the growing power demands. Plants will have to be expanded and complementary fuel storage and loading facilities constructed, placing still more burden on Guam's limited land resources. The need to be near the Commercial Port and a source of water will dictate that power plants will be located along our coastline, impacting not only on the usability of the coast but also on the quality of the surrounding air and water resources.

The expansion of Guam Power Authority, like other businesses on the island, has been accompanied by a growth in the number of employees and the physical plant necessary to house their functions. Because Guam's land resources are finite, however, even areas that cannot environmentally bear the burden of construction and industry eventually become "desirable" locales. As an example, Guam Power Authority recently applied to the Government of Guam for land to construct a centralized office and maintenance building. This proposed facility was not in the vicinity of their power generation plants but was projected for Route #3, north of Wettengel Junction near NCS. This site is 41 acres of undeveloped land overlying the northern water lens, an area that was once identified for low-density use because of the need for water conservation.

The present method of power generation places an inordinate strain on Guam's land resources. The large demands for land because of the massive nature of the plants themselves and because of the need for fuel storage facilities and transmission lines cannot be accommodated forever. Special consideration and priority must be given to the development of alternate power sources (see Chapt. 7) and the recycling of waste waters if this growing industry is not to degrade the quality of our environment. The production of power should be associated with the disposal of our waste and be compatible with our surroundings. Rather than mining resources to exhaustion, we should use them in a manner that incorporates and magnifies their inherent qualities.

LEGAL CONTROLS ON LAND USE

ZONING

As discussed by Leary (26), the legal basis of zoning legislation is to protect the public health, safety, morals, and general welfare of citizens. Zoning ordinances are unique in that they may differ from district to district within an area covered by legislative jurisdiction. Hence, different requirements might be set for residential areas than for commercial or industrial areas. However, this unique feature also introduces the danger of local legislative bodies giving special treatment to particular individual property owners, and this has led to court decisions imposing the following restrictions on local legislative power:

- (1) while zoning regulations may differ from district to district, they must be the same for each type of building in each type of zone throughout the legislative jurisdiction;
- (2) there must be a reasonable basis for classifying particular areas differently from others;
- (3) an ordinance must cover the entire jurisdictional area and not single out a sub-area for regulation while leaving the rest of the area unregulated;
- (4) the regulations must be reasonable in their application to particular properties so that they are compatible with physical restraints on those properties.

According to Leary (26),

The most effective way of meeting all of these requirements is to base

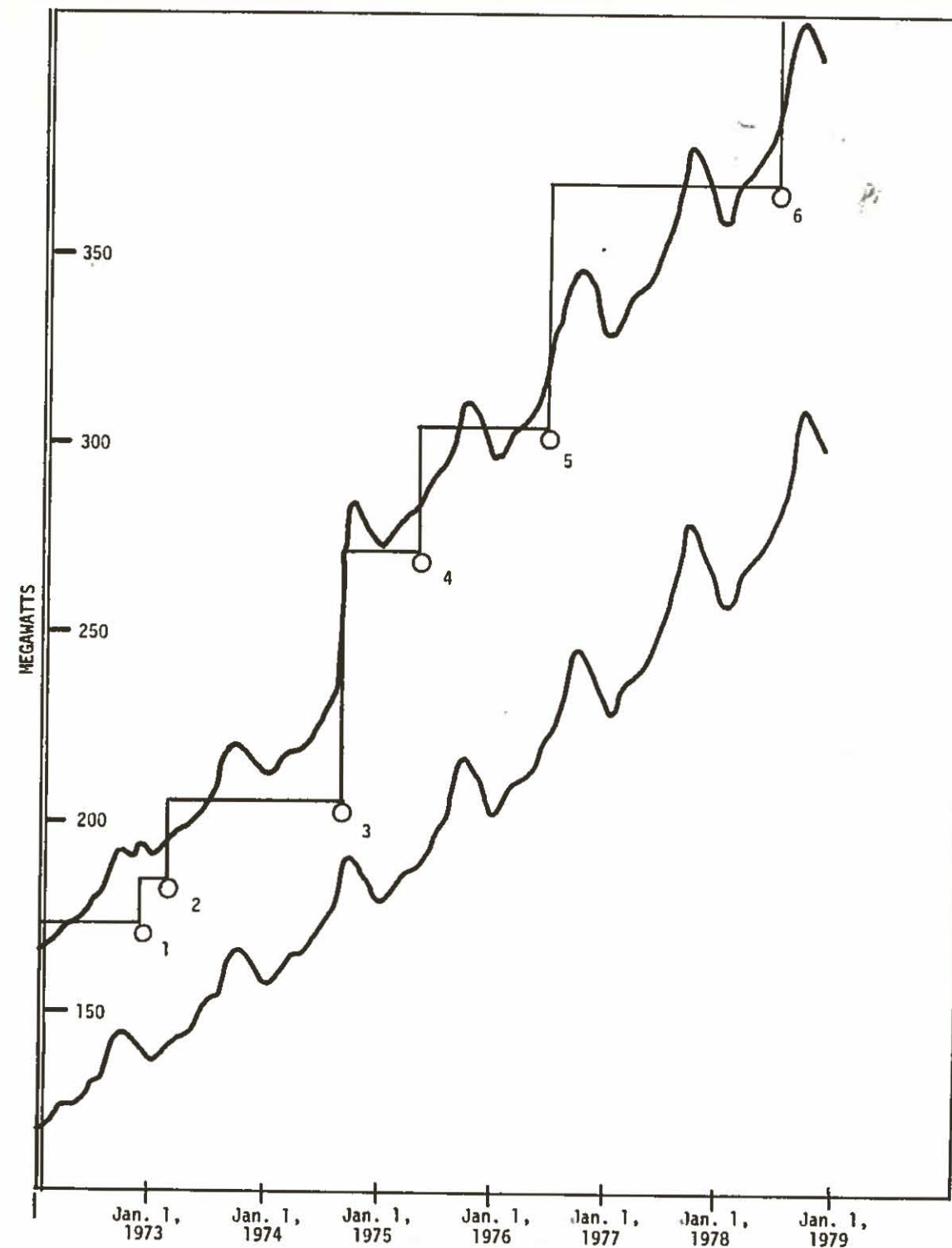


FIGURE 8

Electrical Power Demand and Production on Guam. Code: (1) INDUCTANCE in service, 28 MW capacity; (2) TANGUISSON #2 in service, 26 MW; (3) CABRAS #1 in service, 66 MW; (4) CABRAS #2 in service, 66 MW; retire YFP10 (20 MW) and 13 MW of old Navy diesel; (5) CABRAS #3 in service, 75MW; retire 10 MW diesel; (6) CABRAS #4 in service, 85 MW; retire INDUCTANCE. Figure from (25).

the ordinance on a carefully conceived land-use plan (or 'comprehensive plan') for this tends to minimize distinctions based on the ownership of a particular piece of land and to magnify considerations of general application.

Guam enacted a zoning law (Title XVIII, Government Code of Guam) through its power to protect the public health, welfare, and safety. The first zoning bill was passed in 1952; it has been amended several times since then.

Basically, the zoning allows the classification of the island's land according to various uses [rural (agricultural), residential, industrial, commercial, and parking] on the premise that the public welfare is served by segregating land uses which are not compatible with each other. Each zone is defined by the uses which are permitted therein; in addition, height, side yard, and setback limits are included to regulate the size, density, and placement of structures on lots. Nonconforming uses (those which exist in an area before enactment of the law), prohibitions against encroachment on public beaches and waterfronts, and procedures for variances and zone changes are also included in the law.

The zoning law is the primary regulator of land-use activities on Guam. It controls the spread of development and, in large part, the particular nature the development may take. Processing, staff review, and analysis are performed by the Department of Land Management. The Territorial Planning Commission (TPC), appointed by the Governor, reviews zone changes, and hears appeals and requests for variance. Its major enforcement tool is the denial of building permits by the building official if the proposed project is not in conformity with the zoning law.

A current zoning map is maintained by the Department of Land Management; incoming requests for subdivisions, variances, and zone changes are checked against it. At present, the major land-use zones on the island consist of agricultural (A-1), Residential (R-1 and R-2), Commercial (C), and Industrial (M-1 and M-2).

SUBDIVISION LAWS

A subdivision law (Title XIX) was also enacted in 1952, and later amended by P.L. 6-134 in 1962. Its purpose is to:

. . . control and regulate the subdivision of any land for any purpose whatsoever.

This control was deemed:

. . . necessary to provide for the orderly growth and harmonious development of the territory; to insure adequate traffic circulation through coordinated street, road, and highway systems; to achieve individual property lots of maximum utility and liveability; to secure adequate provision for water supply, drainage, sanitary sewerage, and other health requirements; to permit the conveyance of land by accurate legal description; and to provide logical procedures for the achievement of this purpose.

More specifically, the law gives authority to the Territorial Planning Commission for the review and approval of new subdivisions, creates various kinds of subdivisions (agricultural, lot parcelling, planned unit development), requires submission of detailed plans, establishes criteria for adequate improvements, and procedures for variances, appeals and recordation. Zoning establishes allowable uses of land; the subdivision law states how the land can be legally developed, divided, and sold.

MASTER PLANNING

A master plan is a rational, researched document which is a guide for the long-term

development of a community. Master plans have been done for hundreds, perhaps thousands of years. Washington, D. C. was laid out along the recommendations of a master plan, as were several other cities in the United States. Chapter III, Title XIV, Government Code of Guam, establishes the Territorial Planning Commission and sets as one of its major responsibilities the development of a master plan consisting of land use, public buildings, community design, and housing elements. Such a plan is to be adopted by the TPC after public hearing, then submitted to the Governor for his approval, and transmission to the Legislature.

In 1966, an initial Master Plan for Guam (14) established various land-use zones within each community and attempted to define developmental goals for the island as a whole; however, it served to guide growth to a very limited degree. A revision of this plan was begun in 1972, but later was abandoned (27).

LAND TRANSFER

Chapter VI, Title XIV, Government Code of Guam, provides for the Land Transfer Board to preside over and make decisions concerning the disposition of government land on Guam. Its provisions include requirements for the lease and purchase of government land, priorities for the recipients of such land, and prohibitions on its resale. Chapters VII and VIII go further and give the Director of Land Management control over the issuance of land-use permits and agricultural leases.

As indicated earlier, it has been estimated that the Government of Guam owns 22 percent of the land on Guam (14). No precise figures are available because much of the land has never been surveyed and registered. What the government does with its land (e.g. roads, schools, granting of leases) affects the surrounding land; as such, governmental actions are prime determinants of island land use.

OTHER LAWS INDIRECTLY AFFECTING LAND USE

There are many laws directly and indirectly affecting land use on Guam--so many, and their effects so subtle, that only an extensive legal analysis could adequately describe their scope. The following is an abbreviated listing of legislation affecting land use:

- (1) Public Law 12-126, Preservation of Historical Sites has been discussed previously.
- (2) The Water Conservation Resources Act gives the Administrator of the Guam Environmental Protection Agency (GEPA) authority to regulate the development of water resources, thereby indirectly regulating developments that must rely on the new water supplies.
- (3) The Air Pollution Control Regulations, Section 19 and 3.4(a)(3), give the GEPA authority to review and approve "complex sources" such as shopping centers, subdivisions, civic centers, and municipal parking lots, with consideration for their impact on air quality through the increase in auto emission pollutants. If it is found that automobile traffic generated by the facility would violate ambient air standards, then a construction permit would be denied. In addition, Sections 9960 (p) (q) and 9960.8 provide authority to prevent construction or modification of new sources of air pollution such as cement and asphalt plants and quarries.
- (4) Chapter IV, Conservation, Title XLV of the Government Code of Guam authorizes the Director of Land Management, with the approval of the Governor, to set aside government-owned land for forest reservations.
- (5) The Water Pollution Control Act, Section 9950.6(d) authorizes the GEPA Administrator to review and approve plans for all sewage collection and disposal systems with consideration for their impact on public sewerage systems and to require the provision of adequate sewage treatment and disposal. Water Quality Standards developed pursuant to the act prohibit the discharge of toxic materials and classify the waters of Guam for their most productive use. These standards indirectly

control land in that potential dischargers may not be able to meet applicable standards and therefore must forego development or alter its nature.

DISCUSSION

The major laws affecting the use of land on Guam are in large part inadequate. An enforceable master plan for Guam does not exist. The 1966 Plan (14) was superficial; it did not allow for such land uses as parks, conservation areas, open space, or schools, and has never been updated. At the beginning of Governor Bordallo's administration, a Bureau of Planning was created within the Governor's office to establish a new, updated master planning effort. In the absence of an accepted master plan, special interests have channeled development for their own purposes.

Government regulations and laws have been so dispersed that they affect only portions of land-use development without assessing the long-term comprehensive impact of their application.

For example, highway planning exists within the Department of Public Works, funded largely by the Federal Government. The review and approval of waste water disposal planning is the responsibility of the GEPA, without whose approval necessary federal funds cannot be acquired. The extension and development of water supplies has largely been the responsibility of the Public Utility Agency of Guam (PUAG). Guam Power Authority plans for and provides power to the island. These essential services--highways, sewage collection and disposal, power, and water--necessarily guide development, yet each is being planned and carried out by separate agencies, often in isolation from the others.

Without a central review agency, sufficiently staffed to determine the interrelationships of various plans and their respective impacts, we can expect confusion, overlapping efforts, and conflicting government policies.

The zoning and subdivision laws, while helpful in regulating growth, are outdated and geared toward helping land speculators. For example, installation of sewers and other similar improvements on agriculturally zoned land is not required by law, although residential development up to 4 units (2 duplexes) per acre is allowed. This permits development of the land, thus increasing its value without the corresponding provision for improvements such as storm drains, paved streets and sewage facilities.

The zoning law does not recognize open space, school, or conservation zones; similarly, the subdivision law does not require the setting aside of areas for these land uses within new developments. This has led to densely settled subdivisions, without adequate recreational areas, which have been superimposed on the landscape without utilizing the natural features of the site. School sites within new subdivisions are not required, so that the government is placed in a position of exchanging government land for school sites, or directly providing them.

Both laws suffer from lack of enforcement. Variance provisions are included within laws to accommodate cases that cannot be solved within general guidelines or because unforeseen circumstances were not anticipated by the original lawmakers. These provisions have been used to permit greater density than the law normally allows. Much of the problem lies with the interrelated nature of the Guamanian community and the composition of the regulatory boards, such as the TPC, whose membership is primarily composed of construction contractors and individuals with indirect interests in real estate development.

Another problem is the protection of government land. There is no uniformity in how and to whom government land-use permits, leases, or sales occur. Special interests may be involved since procedures for the transfer of government land are not uniformly applied. Most of the government lands have not been surveyed or registered and are subject to private claims. It has been "... estimated that the Government of Guam has lost somewhere between five and eight percent of land once thought to be public land in the past years" (intra-agency memo to Director of TPC from Barbara Webb,

August 8, 1974). Whether or not these figures are exact is unknown, but it is certain that government land is being slowly eroded by the conflicting claims of private individuals. Many proposals and laws have been made in the past 22 years to rectify this, but none has been implemented.

The lack of a coordinated program for land-use classification, survey, and registration has led to the growth of substandard lots, and a deficiency of both adequate access easements and proper storm drainage systems. A shocking fact is that the Government of Guam does not own 30-40 miles of the land that public highways utilize. For example, Route 4 from Nimitz Beach to the intersection with Route 17 consists entirely of private easements that have never been granted to the government.

The lack of necessary land-use controls is accentuated by inadequate manpower to enforce provisions of building permits, restrictive covenants, or the demolition of cesspools as sewers become available. In order to perform these functions a trained staff of inspectors would have to be in the field continuously, monitoring activities for compliance. More often, a project is reviewed just once, often at the desk of an inspector. If an individual chooses to bypass the system and build his own home, he can probably do so without discovery.

A coordinated approach to land-use control is necessary, primarily through the establishment of a central planning authority and the adoption of an islandwide development plan. It is also essential that this system, once established, be adhered to and respected by the executive and legislative branches of government. To subvert plans and laws to accommodate the special interests of a few will only lead to more problems in the future.

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FRESHWATER RESOURCES

GEOLOGY OF GUAM AS RELATED TO WATER RESOURCES

In order to understand the extent and dynamics of the freshwater resources of the island, an analysis of its basic geologic structure is necessary (Fig. 1). A more detailed discussion may be found in General Geology of Guam (1).

The island is made up of three basic compartments--the northern plateau, the central mountains, and the southern mountains. The central and southern mountains, the products of volcanic activity, are mixed beds of pillow basalts and andesites (products of volcanic extrusions beneath the sea's surface), and tuffaceous shales (fine-grained rocks formed by a continuous rain of volcanic ash). The central mountains are thought to be the oldest rock system of the island, as evidenced by extensive faulting and folding. The highly contorted nature of the subsurface rock layers in this area can be imagined by observing the rugged surface relief. The southern third of the island is dominated by a high ridge (made up of Mounts Jumullong Manglo, Balanos and Sasalaguon) averaging 1200 feet in altitude and running north and south near the west coast of the island. The west side of this "cuesta" falls away rapidly to the sea, while the eastern flank slopes gently to the east.

The northern plateau is made up of limestone rock overlying volcanic basement material which is continuous with the central mountain system. This volcanic material surfaces at the northeastern-most end of the island (Mt. Santa Rosa). The limestone cap is composed of four relatively flat-lying beds formed by the growth of corals and calcareous algae. (Any calcareous organism is one that deposits calcium carbonate, or limestone.) The most recent, and therefore uppermost, layer was deposited during the Pleistocene age, about one million years ago, when the sea level was much higher than it is now. During the Pleistocene time Guam probably appeared as two islands connected by a huge barrier reef, similar to the present Cocos Lagoon. The recrystallized reef deposits are visible around the perimeter of the northern plateau. The interior of the plateau is made up of the remains of corals, algae, bivalves such as clams and oysters, and other calcareous organisms that were washed over the reef. Limestone rock was also laid down along the southeast and the north-facing central coastline. The northern plateau has been secondarily uplifted and tilted, and several faults have created long scarps, or cliffs, such as the one stretching from East Agana northeastward past Barrigada Hill. The well-defined break between the flat northern plateau and the sharp relief of the central mountains is due to a fault that crosses the island from Adelup Point to Pago Bay.

Several major limestone types make up a system that caps the southern mountains from Mt. Lamlam north to Mt. Alifan. These formations, which make up the upper Talofofu River drainage basin (including Fena Reservoir), are older than the limestone that makes up the surface of the northern plateau, as evidenced by the rugged relief, the many scarps, and fault planes of the former. The limestone structure has been "formed by solution and recrystallization of a greatly jointed and faulted limestone formation" (2).

RAINFALL

Guam has two distinct climatic periods--a rainy season (from July through November) and a dry season (from January through May). The mean annual rainfall ranges from 80 inches on the western side of the central mountains near Apra Harbor to about 100 inches on the uppermost slopes of the southern mountains (Fig. 9). Of the total rainfall, 15-20 percent falls during the dry season and 68-73 percent during the wet. The remainder falls during the two transitional months--December and June (3).

The greatest extremes of rainfall occur during typhoons and tropical storms. According to Blumenstock (4), major storms are five times more likely to occur in the rainy than in the dry season. The rainfall in periods of heavy rain is not uniform, however. During the typhoon of October 1953 the 48-hour total rainfall at Umatac was 48 inches. Since the winds were northwesterly at the time, the rain clouds were pushed over the

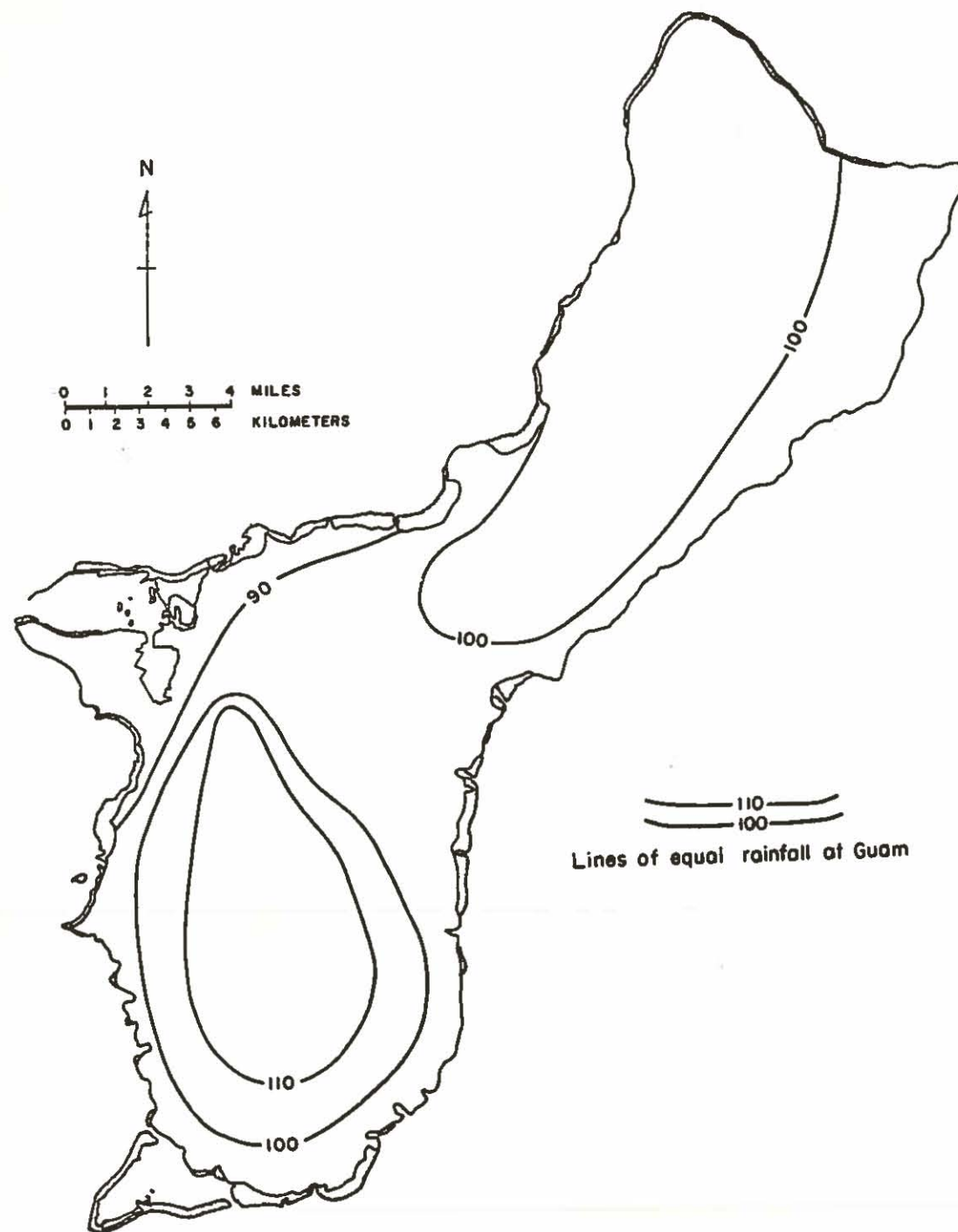


FIGURE 9

Mean Annual Rainfall on Guam. Numbers given are in inches. From (4).

southern ridge, dropping moisture as they went. On the leeward side of the island at Inarajan during the same period, the total was only 5 inches. Because of the high probability of major weather systems passing close to the island, extreme rainfall intensities are very high. Blumenstock (4) noted that the highest 24-hour rainfall recorded during a hundred years of record-keeping in the continental U. S. was 26.12 inches at Hoegess Camp, California, in January 1943. The maximum 24-hour rainfall for New Orleans on the hurricane-exposed Gulf Coast was 14.01 inches during the period from 1889-1950. This can be compared with Umatac's figure of 26 inches in 24 hours in October 1953 in only nine years of record-keeping at that station. The potential for high rain intensity underscores the likelihood of the weathering of the soils in the southern end of Guam and also their very high erosion susceptibility, which was discussed in the previous chapter.

Ironical as it may seem, drought is a normal feature of Guam's climate. According to Blumenstock (4), as far as surface water supplies and crops are concerned, any month with less than 4 inches of rain is a drought month. He calculated a probability of 60 percent that at least two consecutive months during the period February through April would have less than 4 inches and a probability of 40 percent that all three months would be drought months. Further, since less than 0.1 inch of rain in a day could not contribute significantly to either groundwater or surface water sources, Blumenstock provides us with a means of analyzing the probability of experiencing a severe drought based on the number of consecutive days (N) with less than 0.1 inch of rain (Fig. 10).

HYDROGRAPHY

It has been estimated that an average of nearly a billion gallons of rain falls on Guam each day. Part of this water evaporates and another part is taken out of the soil and incorporated into plant tissue or is returned to the atmosphere as transpiration. Depending upon the geology of an area, a fraction of rainwater may percolate downward to a groundwater aquifer, or lens. Another fraction may run into ravines and join flows that are fed by seeps and springs on a journey to the sea.

In northern Guam, an average of 400 million gallons of rainfall reaches the surface of the limestone plateau each day. Fifty percent of this amount begins its vertical journey to the groundwater reservoir below. The rest is lost to the atmosphere through evaporation and transpiration, or is incorporated into plant tissue. There is no surface runoff to the sea nor are there any perennial streams in the northern plateau because of the excellent percolation properties of the rock.

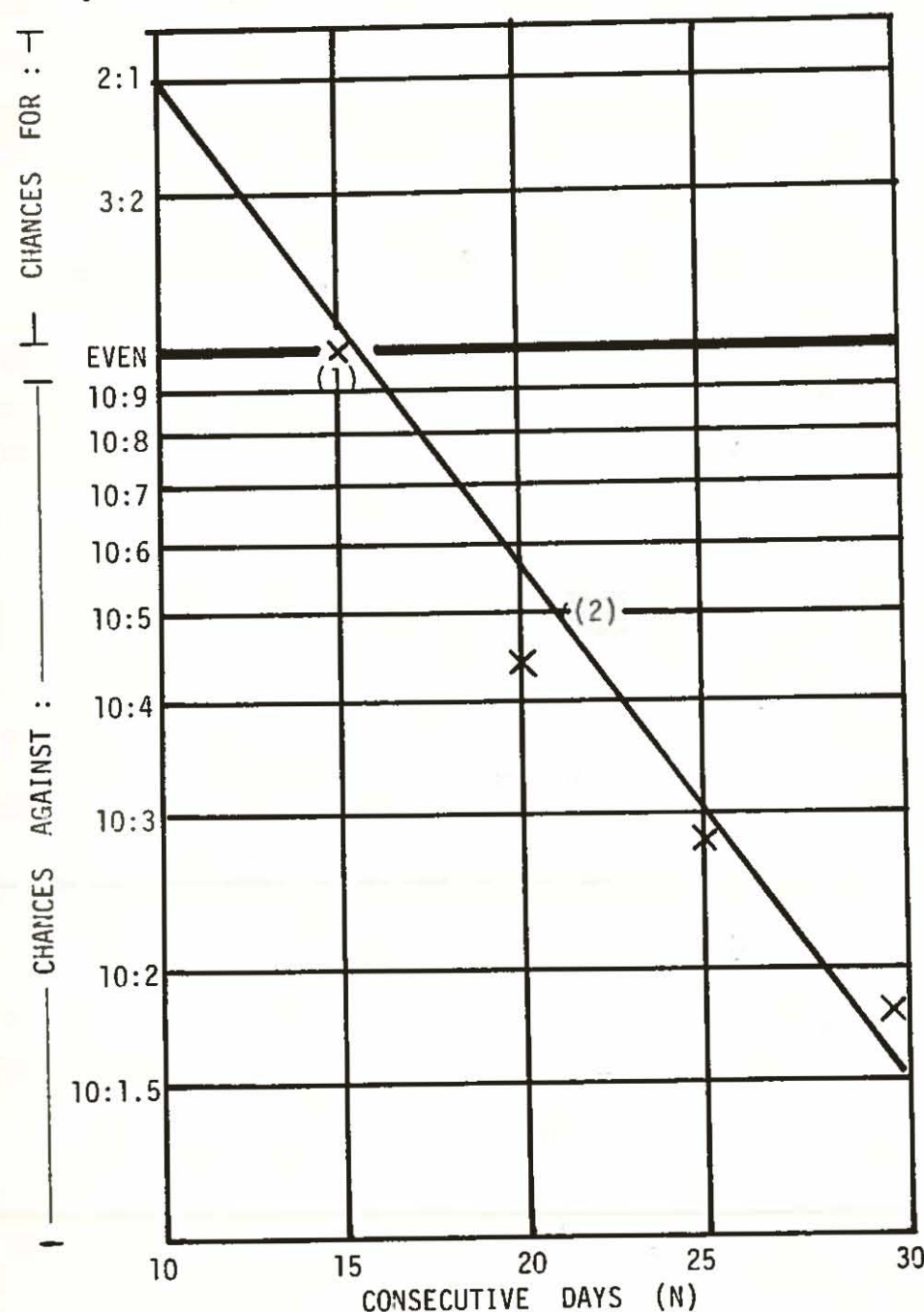
The groundwater reservoir beneath the northern plateau essentially floats in delicate equilibrium on top of seawater, which permeates the porous limestone structure (Fig. 11). A "lens," as a groundwater reservoir is called, is a dynamic phenomenon. Its dimensions depend on the amount of recharge flowing into it from above, the amount flowing seaward along its margins, and, of great importance, the amount being removed by pumping for drinking-water purposes. The freshwater lens is separated from the undiluted saltwater (35 parts per thousand) by a mixing zone, or interface, the thickness of which is a function of vertical displacements caused by tidal fluctuations (which become less important with increasing distance from the coast) and fluctuations caused by excessive or improper removal of water by pumping activities.

The above is a description of an ideal unconfined basal lens. We must now consider certain geologic complications and their effects. First, the lens under the northern plateau of Guam is not completely unconfined. Basement volcanic structures intersect the lens in two areas--along the interface between the northern plateau and the central block, and adjacent to the Mt. Santa Rosa block (Fig. 12). Second, various other geologic complications produce local alterations in recharge characteristics with the non-uniform lens distribution.

Other major limestone formations along the eastern coast and on top of the southern cuesta have percolation and permeability properties that are similar to the basal lens system of the northern plateau (Fig. 13). There are no surface flows. Rain falling on these structures sinks to the impermeable volcanic basement. The water then pools and flows out through the perimeter. This mechanism makes up the major sources of water for the Fena Reservoir.

FIGURE 10

Chances of experiencing a specified number of consecutive days (N) with no more than 0.09 inches of rain on any one day during the dry season (defined as December through May). From (4).



- EXAMPLE: (1) In any one year the chances are even that there will be a dry period (as defined) of 15 or more days, beginning sometime between December 1st and May 31st.
- (2) The chances are 10:5 or 2:1 against a dry period of 21 or more days.

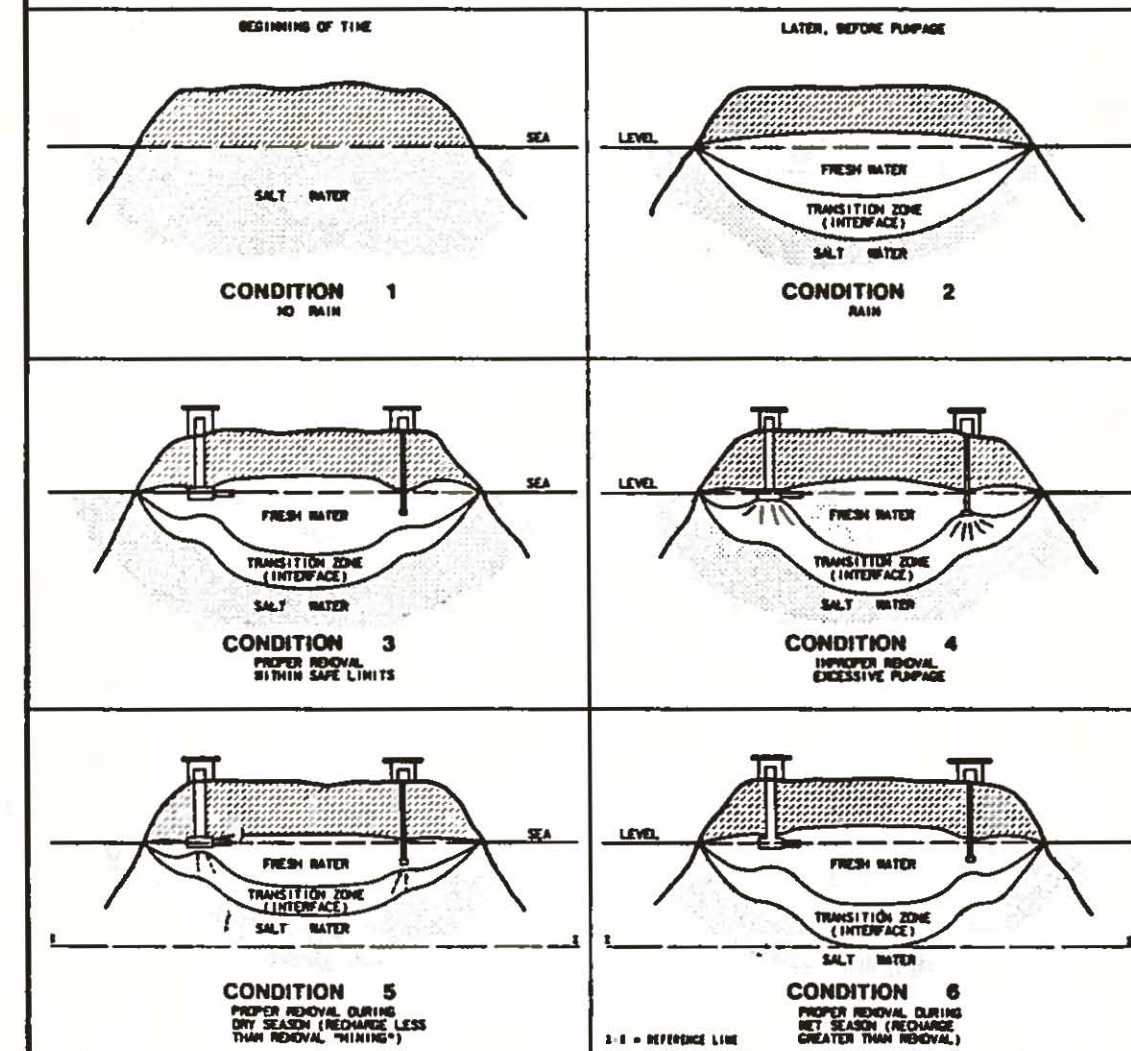
V-38A

UNCONFINED BASAL WATER GHYBEN-HERZBERG LENS

TYPICAL OF NORTHERN GUAM - MARIANA IS



CROSS SECTION THROUGH NORTHERN GUAM



SCHEMATIC SHOWING HOW EXCESSIVE WITHDRAWAL OF FRESH WATER FROM AN UNCONFINED LENS MAY PRODUCE A HIGH SALINE WATER SOURCE

FIGURE 11

Diagram of the Water Lens in Northern Guam. From (10).

V-38B

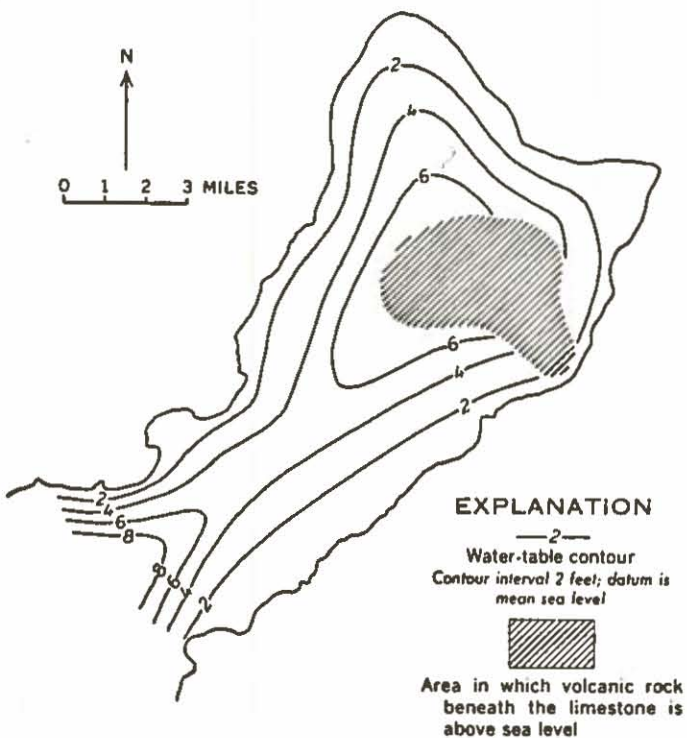
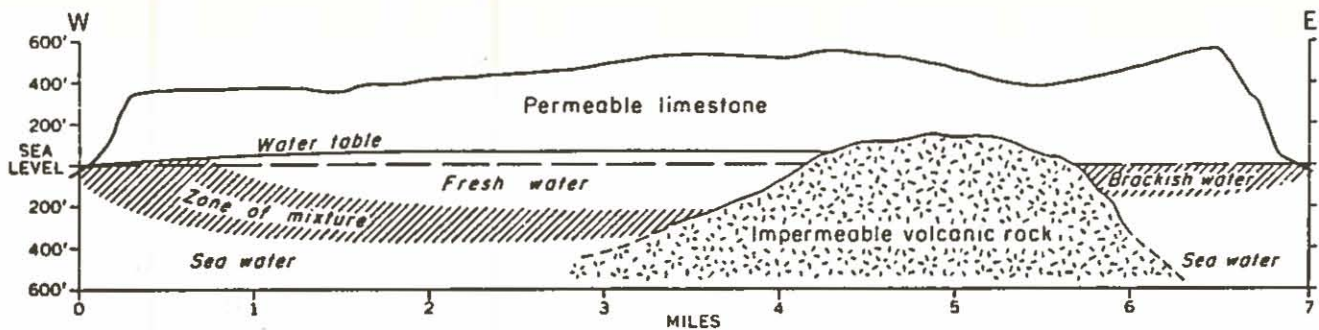


Figure 15 (at left). Approximate height of the water table in limestone in northern Guam. Figure taken from Ward *et al.* (1965).

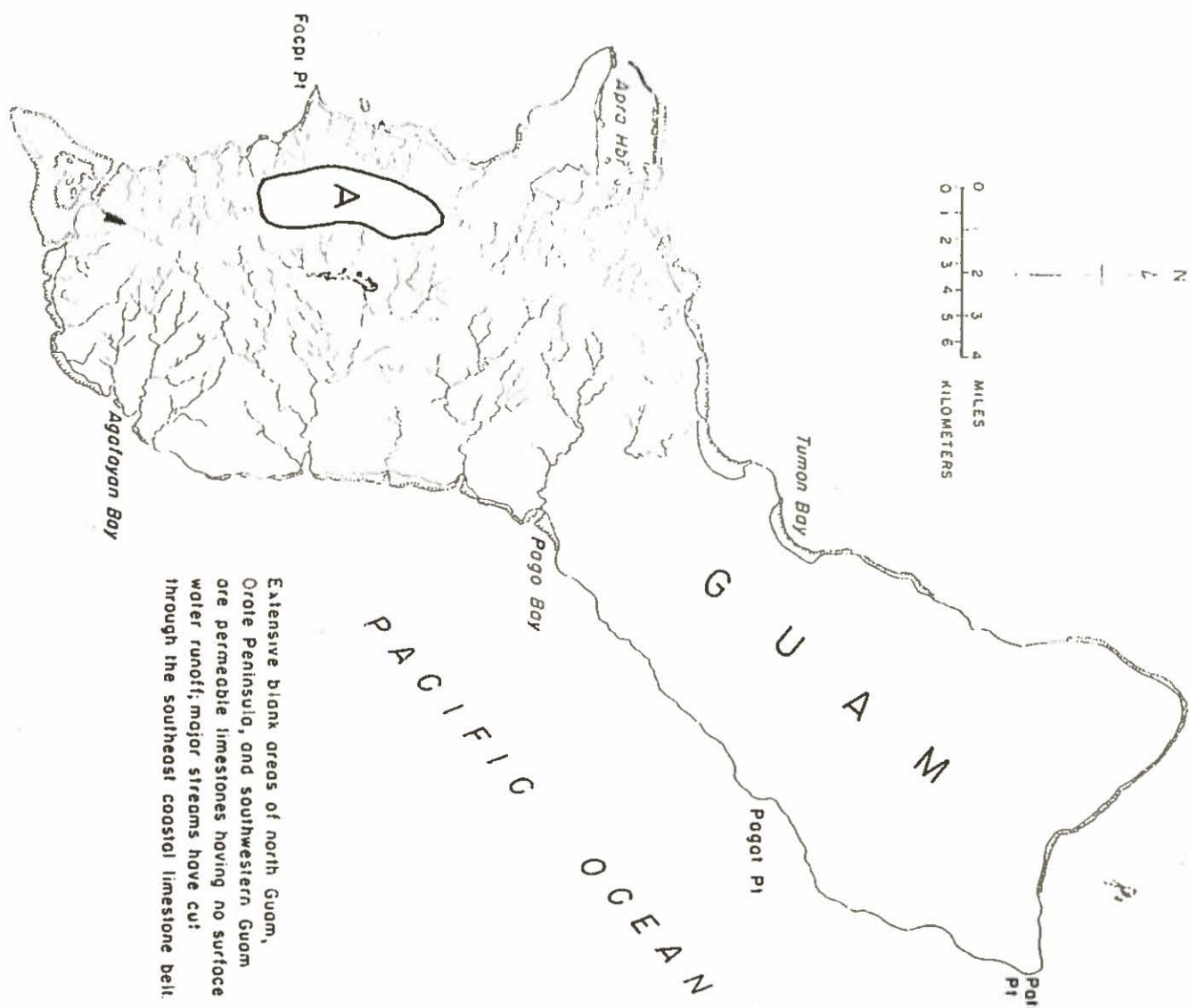
Figure 16 (above). Occurrence of the fresh-water lens in limestone in northern Guam. Figure taken from Ward *et al.* (1965).

FIGURE 12

Approximate Height of the Water Table and Occurrence of Volcanic Rock Intrusions in the Water Lens in Northern Guam. From (14), Figs. 15 & 16.

Surface Drainage Pattern and Occurrence of Permeable Limestone Regions on Guam. From (14).

FIGURE 13



The groundwater below the limestone cap along the southeast coast was previously thought to be of limited amount and too mixed with seawater to be developable. However, this source has now been tapped for irrigation purposes and is being considered for development of a drinking-water supply. There may be a high potential for contamination of this groundwater resource because of the high permeability of the rock and its fractured, dissected nature. Extreme care must be taken to protect the groundwaters against sewage and other pollutant discharge. Care must also be taken, especially during times of drought, to manage the lens so that excessive pump-out doesn't occur. A large number of small wells pumping continuously is better than a few large wells, which set up damaging fluctuations in level and thus allow saltwater to enter the aquifer (Fig. 11).

Southern freshwater resources include "perched" (trapped) groundwaters, surface flow, and the groundwater systems of the southern limestone regions. Groundwaters related to volcanics are limited in quantity and localized. Stearns (5) noted that the lava flows of southern Guam have been secondarily mineralized, resulting in quartz filling up the spaces in the rock. Thus these rocks do not transmit large volumes of water. Also, many rock layers that are capable of transmitting artesian water have been broken up and offset, resulting in very limited artesian spring flow (a flow caused by underground water pressure). On the western side of the southern ridge, vertical dikes create local prisms of water that discharge into upland ravines. These perched water systems, however, are small and limited in quantity. Their flow drops off markedly during periods of drought. The Geus River, which is used as a drinking-water source for Merizo, is fed by such a system. During the drought of 1973, the flow was insufficient to supply the village.

The heavily weathered surface volcanic rock on the eastern side of the southern mountains is capable of holding much water. However, because the soil is impermeable, rainwater does not sink through it. A large proportion of the rainfall runs off into adjacent ravines or channels. The remainder, which is stored in a high water table, is released slowly through seepage or is released at points where the water table intersects the surface, such as depressions or ravines (6). Other seepage is added to the flow from waters flowing around the cracks and fault planes of impermeable rock as the stream grows on its journey to the sea. These seeps, as well as small springs, establish the base flow in southern rivers. The average runoff to the sea from the streams of Guam amounts to about 250 million gallons of water per day (3).

As a stream descends to lower elevations, losses as well as gains in flow may occur, depending on the characteristics of the underlying stream bed. On April 4, 1968, Austin, Smith and Associates (7) measured the flow of the Ugam River immediately above Talofofa Falls as 9 million gallons per day. During the same period, the U. S. Geological Survey gauging station approximately one mile downstream from Talofofa Falls measured a flow of 5.2 million gallons per day. After the water flows over the falls, a significant fraction of the total sinks vertically or moves laterally through the porous alluvial soils (deposits from erosion occurring elsewhere) of the lower valley floor. A similar situation is common to many of Guam's rivers. If the daily discharge upstream exceeds the loss resulting from vertical or horizontal flow through rock or soil of high permeability, the downstream flow will be greater than zero. If the daily discharge upstream is exceeded by flow loss downstream, there will be no visible flow at the mouth of the river.

The sources of Guam's largest rivers are in the steep upland ravines near the crests of the central and southern ridgelines. The four largest rivers have cut the gently sloping expanse of heavily weathered volcanic rock layers through which they flow. The drainage basins of these large rivers range from 4.5 square miles (Inarajan River) to more than 16 square miles (Talofofa River).

During the period from 1952 through 1965, the Ugam River discharge averaged 19.5 million gallons per day. The lowest flow for this river, which occurred in July 1965, was 0.7 million gallons per day. The maximum recorded flow during the period was nearly 4,000 million gallons per day on December 4, 1963 (8). The Ugam watershed measures 6.6 square miles. The runoff from the limestone formations making up the upper Talofofa Basin, including the Fena Valley, averaged 33 million gallons per day from 1952 through 1961. The highest recorded flow for this period was 5,500 million gallons per day on October 15, 1953. The lowest flow was 0.34 million gallons per day in June 1959 (8).

Records indicate that the Pago River watershed, an area of 6.17 square miles, averaged 16.5 million gallons per day from 1952 through 1965. The highest recorded flow was 6,100 million gallons on August 2, 1962, during a severe flood. However, no flow at all was observed on several days during June 1959 (8).

According to Ward, et al. (3), the geology of the drainage basins of the Pago and Ylig rivers is such that the ground absorbs less rainfall and has less storage capacity than the Ugam River, which is of similar size. Therefore, the low flow of the Ylig and Pago rivers may drop to zero or near-zero during droughts, causing water losses to the areas serviced by the Ylig Water Treatment Plant. Adequate knowledge of the flow characteristics of a river system is essential in development of water resources.

ENVIRONMENTAL DESCRIPTION OF GUAM'S RIVERS

Surface waters such as rivers, streams and marshes of Guam are restricted to the southern end of the island. They vary considerably in source waters, the geology of their basins and channels, and in the plants and animals that live in them and along their banks.

The central coastline from East Agana westward to Cabras Island supports six medium and small streams (Figs. 14, 15). The Chaot River feeds the Agana Marsh to the east, and the Fonte flows onto the coastal reef near Adelup. The Asan, Matque, Taguag, and Masso rivers also empty onto a fringing reef platform lining the shore. These rivers begin from springs or seepage in the volcanic central mountains and flow downward through a bank of limestone that was laid down during the submergences of the last ice ages and which was formed at the same time as the surface limestone making up the northern plateau. However, volcanic soils that washed off the uplands settled on the fringing reefs and were incorporated with the structure of the limestone. The presence of the volcanic material in this kind of limestone (argillaceous limestone) gives it less permeability than pure limestone. As a consequence, loss through this material is less than runoff from upstream and water then flows in the streams during the wet season or during periods of heavy rain. Upland runoff is so low during extensive dry periods that the flow is totally absorbed along the streambeds. Thus, the surface flow ceases.

The vegetation in the valleys of the central coastline streams varies from stream to stream and at different points along each stream bed. In the steep ravines at the head of the basins, dense ravine vegetation is typical (see Chapt. 3). On the lower stretches of the streams, man's presence becomes more obvious as tangan-tangan (*Leucaena*) and other plants characteristic of disturbed areas become more apparent. Scattered mango, breadfruit (*Artocarpus* sp.), and coconut trees are more evident. Along stretches of the Chaot and Masso rivers, there are large stands of bamboo and the fragrance of the ilang-ilang fills the air on a quiet evening.

The expansive Agana Marsh (Fig. 15) is a permanent basin 8.7 miles square and is supplied with water from the Agana Spring, the Chaot River, and general seepage from the argillaceous limestone surrounding the marsh. Agana Springs was once the largest single water source on Guam, with an average discharge of 1.5 million gallons per day. However, pollution from cesspools and latrines in Sinajana reached such a level that the source could not be used without treatment. Installation of sewers in Sinajana has improved the quality of the water and Kennedy Engineers (9) and Austin, Smith and Associates (7, 10) have proposed using the spring for drinking water again.

Six species of fish are known to inhabit the marsh waters, including *Tilapia* species, and the "hasule" (*Anguilla marmorata*), an edible black freshwater eel (11). Mullet and some large shrimp have been seen in the Agana River estuary (area where salt and fresh waters mix).

Nine bird species have been reported in the marsh, including the "gangot karriso" (reed warbler), "pulatata" (gallinule), "kakkog" (Chinese least bittern), and the fantail. The reed warbler has not been seen since 1969, although its song has been heard (12).

The marsh floor is composed of thick accumulations of alluvial soils and muck. A

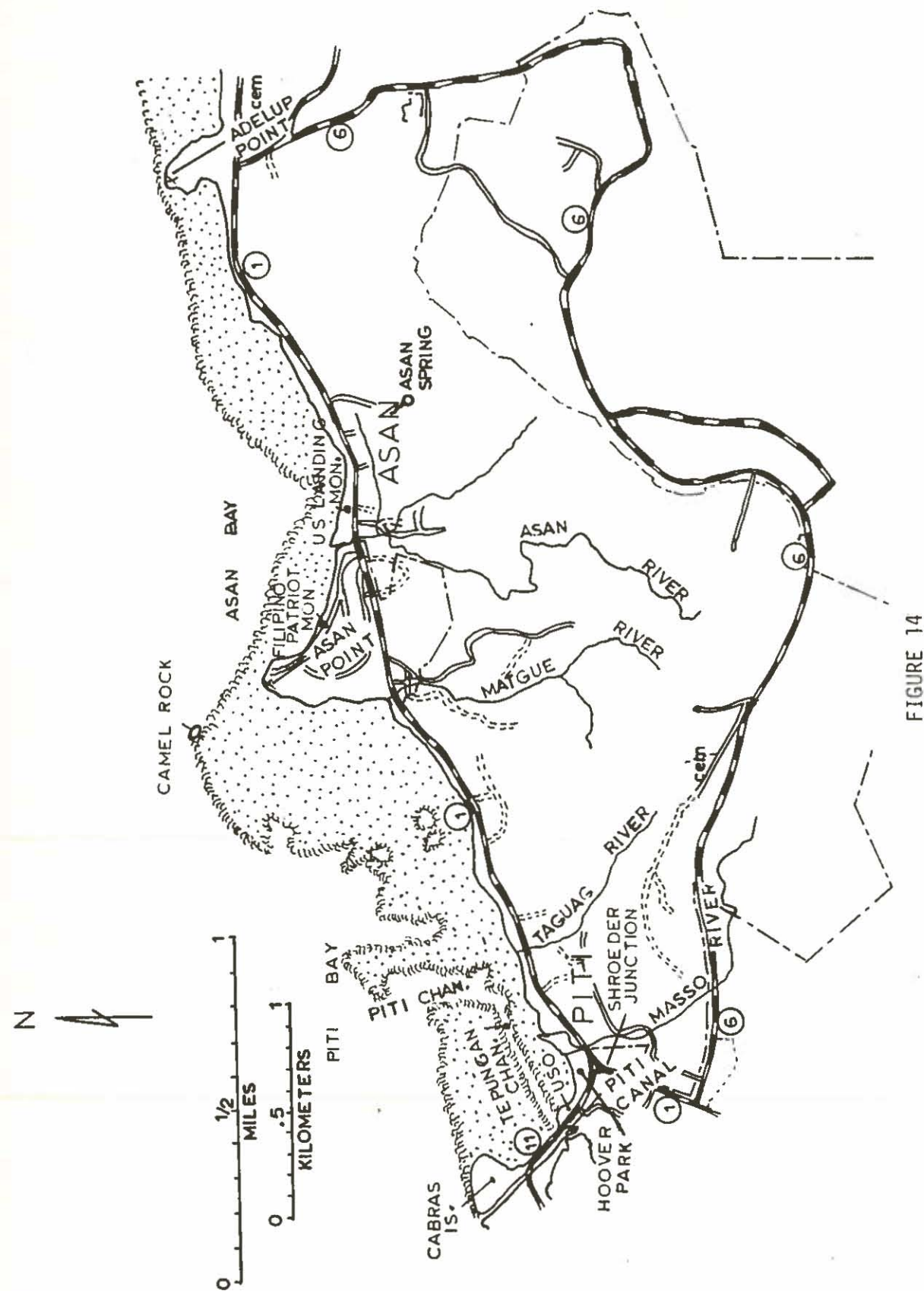


FIGURE 14

Location Map for Streams on West-Central Coastline of Guam from East Agana to Cabras Island. From (14).

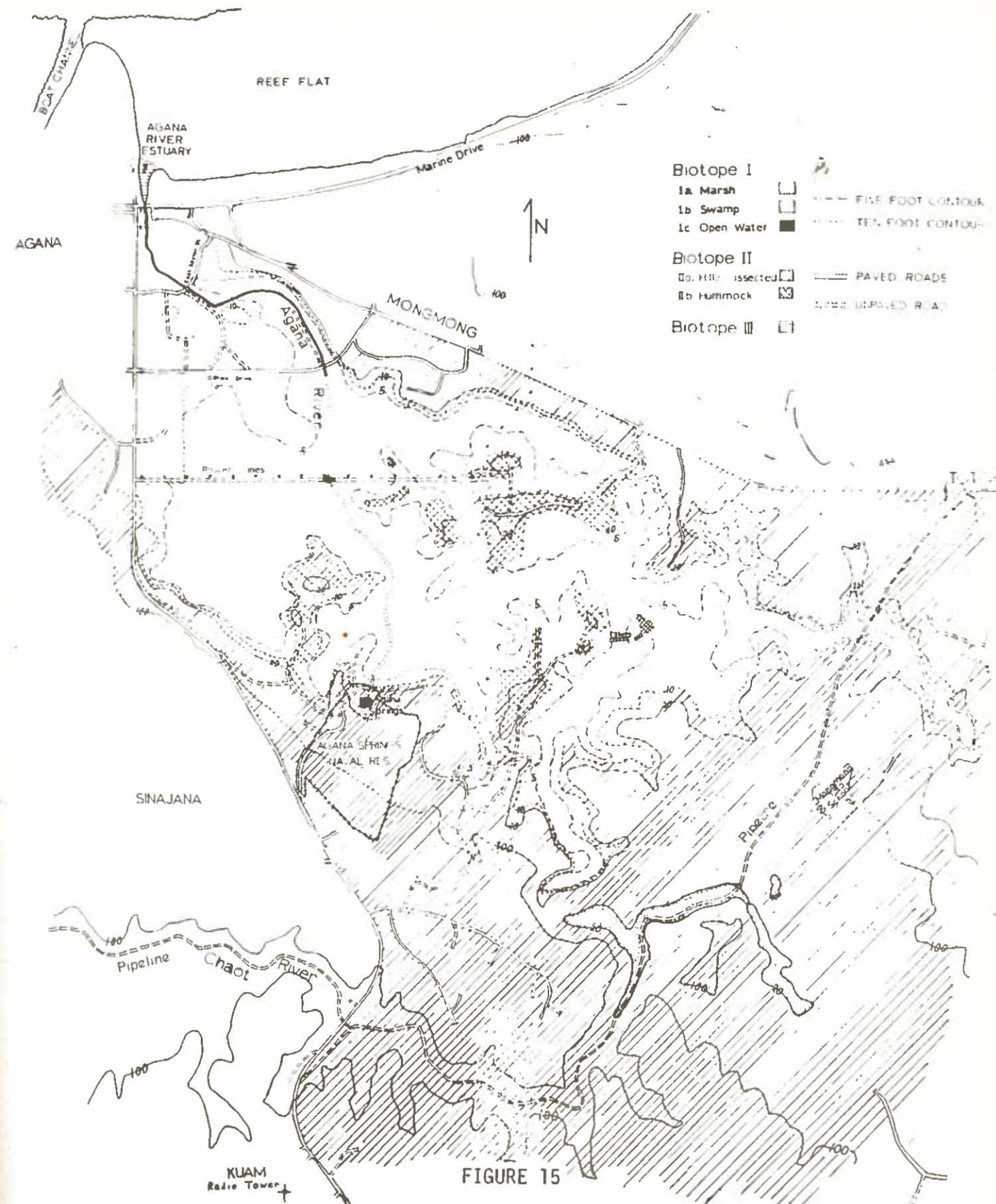


FIGURE 15

Map of Agana Marsh, Showing Various Habitat Types. From (13).

number of limestone hummocks, or mounds, can be seen. They are covered with "niyog" (coconut) and shrubs. The dominant plant in the wet area of the marsh is *Phragmites karka*, a tall reed which attains a height of four to six feet. A large fern (*Acrostichum aureum*), which can be as high as ten feet, is also abundant (12). The outer edges of the marsh show evidence of invasion of woody swamp vegetation, which indicates that a normal transformation from a reed swamp to a tree swamp is occurring. Near the coast, the channelized river is frequently choked with water hyacinth (*Eichhornia crassipes*) and another floating plant, *Pistia stratiotes*.

On the west side of the central mountains, several short-run streams flow from steep ravines through lowlands that are covered by reed marshes or woody swampland (Fig. 16). A large reed (*Phragmites*) marsh lies southwest of Mt. Tenjo and is fed by the Guatali-Tenjo-Atantano river systems. The smaller marshes on the isthmus between Orote Point and the mainland are dominated by bullrushes (*Scirpus erectus*) or sedge (*Cyperus* sp.). The undeveloped shoreline from Piti to Abo Cove near the present Navy OICC complex is covered with large mangroves (*Avicennia abbo*). This stretch of lowland has been dissected by Marine Drive and large areas of it have been drained and filled for various naval activities.

The ten small streams from the Namo River south to Facpi Point (Fig. 17) arise in the western foothills of the southern range of Mt. Alifan. They are fed by perched water from the Mt. Alifan limestone cap or by diked water or by seepage from volcanic sources. The streams pass through quarter-mile-wide alluvial lowlands much of which are poorly drained and marshy. During World War II, rice cultivation took place in much of this lowland. Now much of the wetland area is being cleared for houses or farmland.

There are ten streams or stream systems from Facpi Point to Cocos Lagoon (Fig. 18). Several streams arise from ravines in the steep, rugged western side of the southern mountains and flow to the Umatac River Valley (the largest of the region). The rugged gorges of this area are uninhabited. The sources of the flow in the rivers of this region are largely dike-complexes and seepage. At least 100 dikes, appearing as vertical walls, emerge at the coastline (5). In addition, small deposits of limestone and agglomerate volcanic material contribute to the flow. The relative geologic activity of the region is evident by the extreme relief of its V-shaped valleys and the amount of relatively unweathered rock. The high ridges and hillsides are covered with swordgrass (*Miscanthus*), and scattered small upland depressions contain the reed *Phragmites*. The ravines and valley floors are densely covered with ravine-type growth and tropical forest vegetation (described in Chapt. 3). There is virtually no coastal lowland, and vegetation near river mouths grades from ravine growth to beach strand vegetation.

The rivers that flow into the Cocos Lagoon share common hydrology, or flow characteristics, with those to the north (Fig. 19). Merizo village lies on the narrow coastal bench facing the lagoon. There are relatively well-developed flood plains that usually contain standing water associated with the Geus River and Achang River basins. Most of this land is cultivated with stands of "niyog" (coconut) plantations, breadfruit and mango trees, and small vegetable gardens. There are scattered patches of mangrove near the mouths of these rivers (14). The streams that empty onto the wide fringing reefs from south of Manell Channel to Ajayan Point (Fig. 20) support nipa and mangrove swamps near their mouths. Much of the shoreline is lined with mangrove vegetation.

Vegetation patterns along the large southern streams range from dense ravine-type vegetation associated with the steep V-shaped notches at the heads of the streams to alluvial flood plain or swamp communities within the estuaries. Reed marshes, notably *Phragmites* marshes, can be seen in the uplands where the gradient of the stream drops or the water table intersects the land surface. At several points along the course of a stream, basalt, tuffaceous sandstone or resistant agglomerate layers create spectacular waterfalls, cataracts and systems of pools in which "uhang," or freshwater shrimp (*Macrobrachium*), and "hasule," the black freshwater eel, may be found.

Below Fena Dam the limestones form a structure with abundant sink holes and depressions which are filled with reed marshes or woody swamp vegetation. At one point the Hidden River disappears entirely into caverns or fissures below the ground.

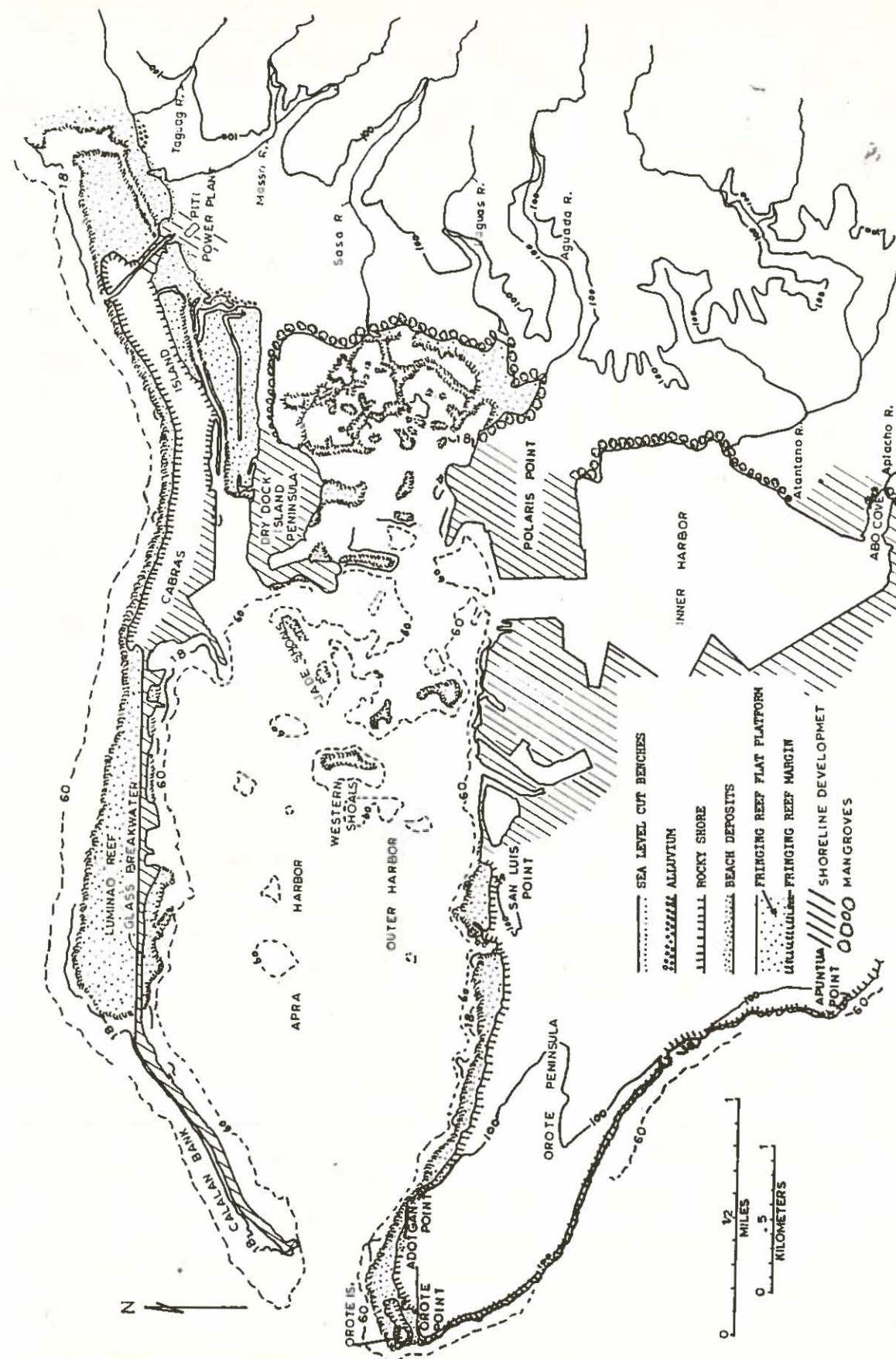


FIGURE 16

Map of Apra Harbor and Streams Flowing into it. From (14).

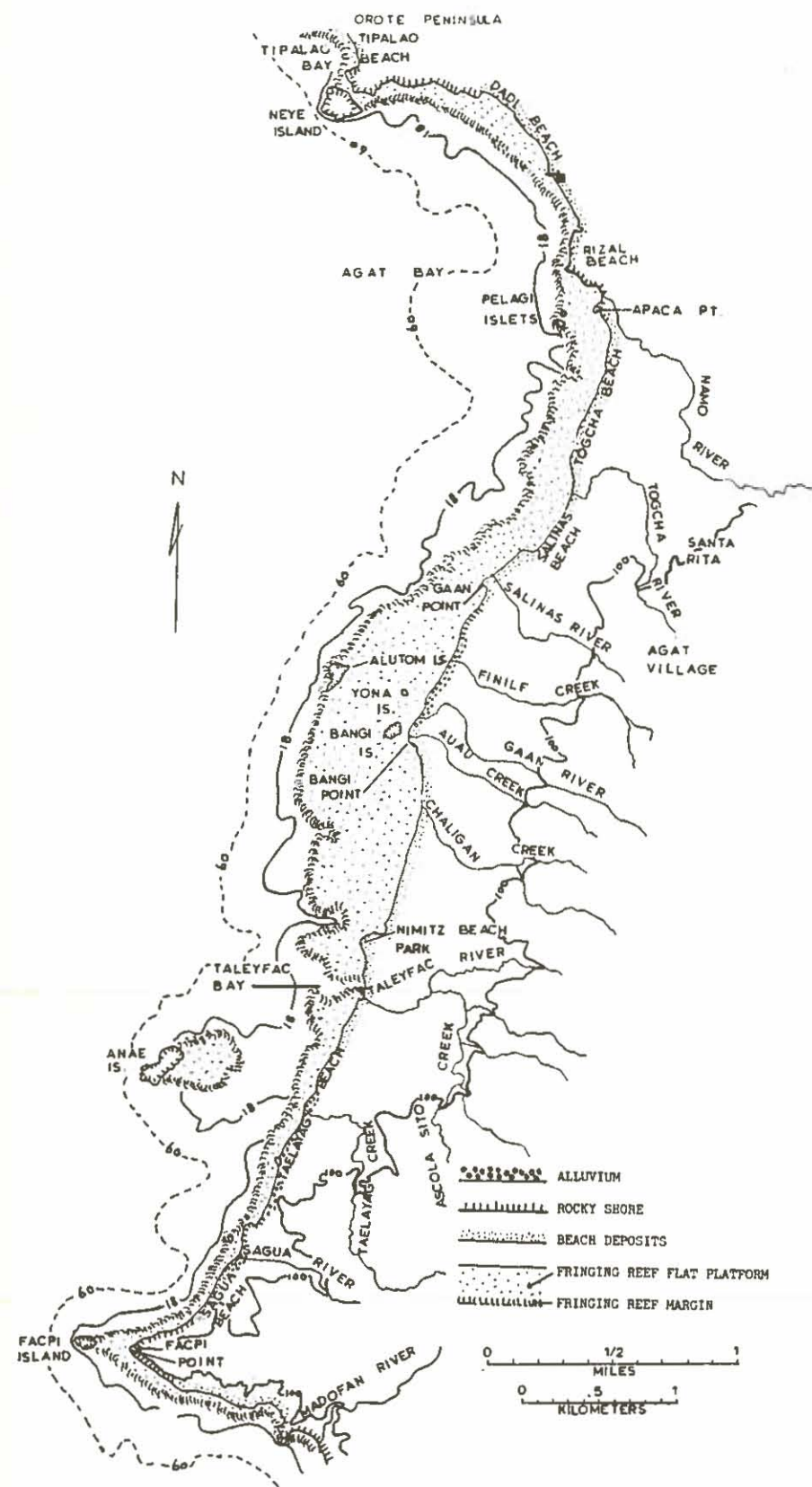


FIGURE 17

Location Map for Streams on Western Coastline of Guam from Orote Peninsula to Facpi Point. From (14).

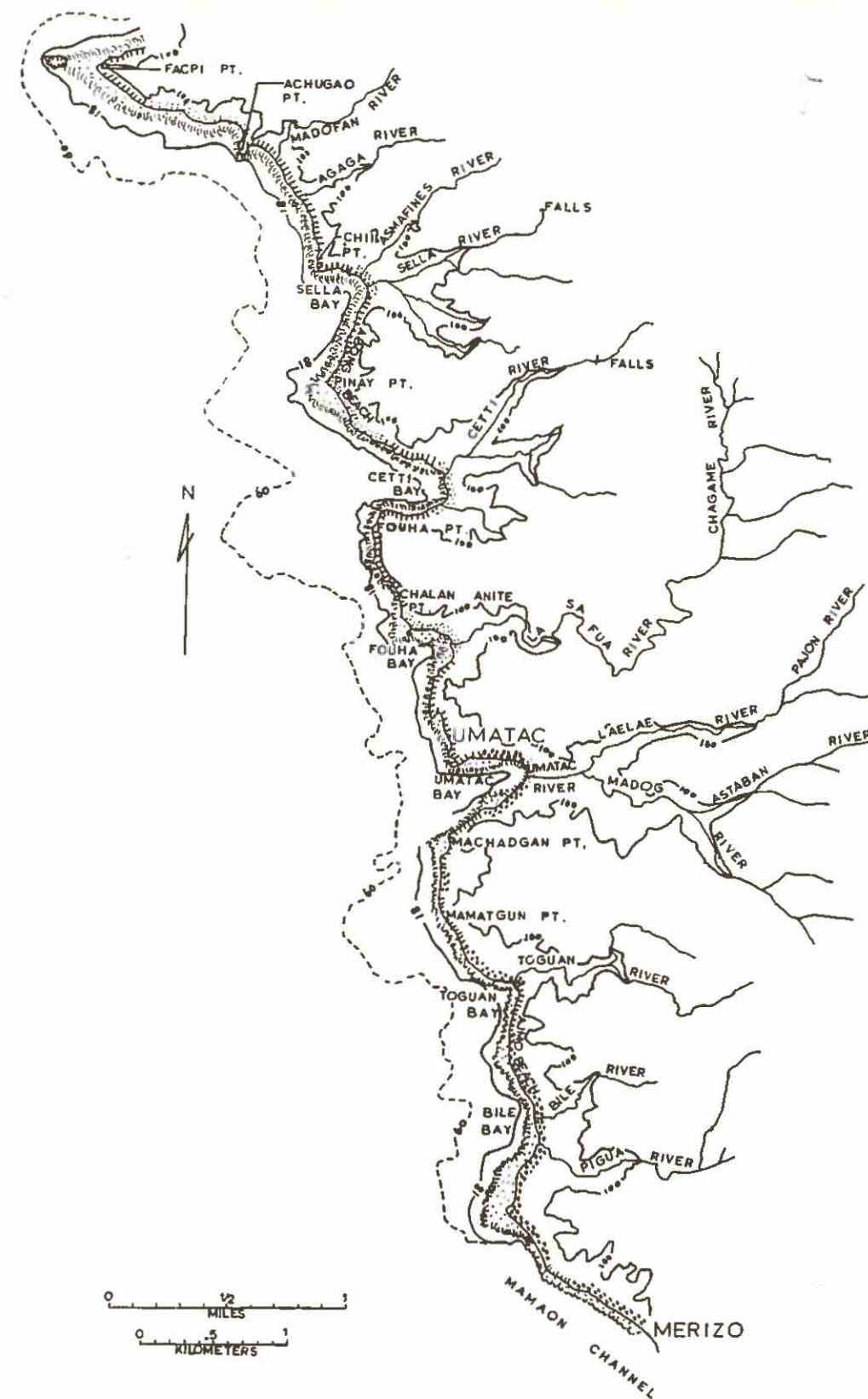


FIGURE 18

Location Map for Streams on Western Coastline of Guam from Facpi Point to Cocos Lagoon. From (14).



Map of Cocos Lagoon and Streams Flowing into it. From (14).



Location Map for Streams on Southern Coastline of Guam from Cocos Lagoon to Pauliluc Bay. From (14).

The lowlands and river bottoms of the large southern rivers are alluvial in formation, with accumulations of eroded soils from upstream. Drainage ranges from moderate to poor. Water may stand in basins for days after a heavy rain. Most of the river bottom areas are agricultural and are interspersed with a mosaic of ranch huts, vegetable patches, animal herds, and reed marshes or swamps. Nipa palms line the river banks of the Inarajan, Ylig, Talofofo, and Pago rivers. There is also "pago," the yellow native hibiscus, interspersed with grasslands and marshes along the river banks. During the dry season the Talofofo river channel is often completely covered with the floating water plant Pistia stratiotes. Tangan-tangan and papaya grow in disturbed areas, especially on the argillaceous limestone areas near the mouths of the rivers.

Various species of marine fish can be seen far upstream. Mullet, snappers, and manahac can survive reasonably well. Within the Talofofo estuary, during times of low river-flow, freshwater flowing seaward is supported on top of the denser saltwater. A highly stratified system develops. When heavy rains cause massive river discharge, the stratification is removed and saltwater can be detected only in deep pockets (15).

HUMAN IMPACT ON THE NATURAL SYSTEM

In trying to preserve the water quality of the Territory we are faced with a dilemma in developing the northern plateau. On one hand, the terrain and the geology seem ideal for massive development. On the other hand, the northern-plateau groundwater system is the primary source of drinking water for the civilian community; the demand for greater use of this resource is growing yearly as the population increases and the economy expands.

Since World War II, many families have moved from other island locations to build permanent homes in Dededo, Yigo, Barrigada, and Mangilao municipalities. These areas have been identified as important locations for development of wells. The only means of human waste disposal are latrines or cesspools. The installation of septic-tank leaching-field systems in conjunction with new building construction has been a requirement of the Department of Public Health and Social Services since 1969. Installation of such systems now comes under the aegis of Guam Environmental Protection Agency. The treatment efficiency of an individual sewage treatment process of this kind is a 50 percent reduction of waste. A high potential for contamination of groundwaters exists if the number of these systems in a given area is such that inorganic substances (e.g. nitrates) build up concentrations in the water lens.

In addition to the growth related to families building homes in the above-mentioned municipalities, the Government of Guam also began leasing tracts of public lands as subdivisions. The earliest ones did not provide for sewage collection. Also, local and off-island developers began building tract developments and apartment complexes.

In 1970, in order to fulfill the requirements of federal water pollution control laws, the Government of Guam and the military drew up a plan for islandwide sewage collection and treatment facilities. The plan recognized the massive development occurring in northern areas. Previous sewage planners (16) had used population projections that proved to be inadequate: in 1970 the populations of Yigo, Dededo, and Mangilao had already exceeded the 1980 projections for those villages (17). Several subdivisions were built in answer to the needs of a rapidly growing population. However, the un-planned growth occurred before sewage treatment facilities were available. This resulted in the construction of package (pre-fabricated) aeration treatment plants with ground discharge.

Another factor in sewage planning difficulties is illustrated by the Tumon Bay predicament. Sewage facilities were originally planned for R-1 zoning (single family dwelling). By the time the facilities were planned, approved, and funded, land use in Tumon Bay had changed to include the construction of hotels. At present, there are nine major hotels and a variety of large apartment buildings, luxury condominiums, and shopping complexes. Sewage generated by hotels is handled by timed pumpout from holding tanks. However, the potential for sewage overflow into the watershed of Tumon Bay is a distinct possibility.

Under the present plan, a sewage treatment plant to serve the northern sewage district is to be constructed by 1978. The interceptors (sewer lines) and collection facilities are to be completed by the same year. The Integrated Wastewater Plan (17) estimated that the flow in the main sewer line in upper Tamuning that carries the flow from the northern district would reach capacity by that time. However, in a letter from the Director of Public Works to the Navy OICC Project Manager for the Northern Sewage System and Treatment Plant, dated February 28, 1974, the Director stated:

The existing Dededo to Agana trunk sewer is so seriously overloaded that surcharging is already occurring in many sections of the sewer. Overflows of raw sewage can be expected in the near future as the hotels in the Tumon Bay area reach full capacity.

At present, agencies are debating options that, at one extreme, would involve discharge of raw sewage into an outfall at Hilaan Point prior to completion of the Northern District Treatment Plan (a clear violation of the 1972 Federal Water Pollution Control Act), and which would prevent massive overflows in the Harmon Sink area, and, at the other extreme, an option that would declare a moratorium on further developments in the Northern District pending completion of the Northern District Sewage Treatment Plant. Present flow of sewage through the Agana Outfall averages eight to ten million gallons per day (PUAG Pumping Station tally sheet), compared with about 1.7 million gallons per day in 1971.

Because of intensive land use and development in the northern part of Guam, the Schedule of Compliance, established in the 1968 Guam Water Quality Standards (18), placed priority on constructing sewage facilities on the northern plateau to ensure protection of the drinking-water source. The southern villages were to be provided with facilities later. However, the southern villages have problems unique to geography. Except for Talofofo, which lies on a plateau, the southern villages are packed along narrow stretches of coastal bench. There is little room to build new homes to meet the demands of the growing population. There is even less room to build septic-tank leaching-field systems. Indeed, the effluent, or overflow, from such a system is not readily absorbed into the ground. More and more people are moving to floodplain areas or near marshes because of a scarcity of inexpensive land. Rising waters during times of heavy rain cause the existing cesspools and latrines to overflow. These conditions have led to long-recognized health problems, including parasitic infestation and hepatitis. It is important to build sewer collection systems for the southern villages. However, there are those who say that building such systems without proper controls would open up new areas for large-scale development in the southern end, as has occurred in the North, with resulting negative impact on other utilities and services and on life styles.

It is imperative that we move to protect the quality of the freshwater lens of the North. We must also ensure that adequate recharge takes place so that the dynamics of the lens is not altered to the extent that a reduction of total volume occurs. Land clearing, massive removal of vegetation, paving, and building houses all affect recharge characteristics.

What limits are placed on the lens in terms of water available for domestic use? As described previously, nearly 200 million gallons of water per day sinks into the earth and eventually reaches the groundwater source in the northern plateau. Only a portion of this total is developable as drinking water. How much is recoverable? Estimates range from as low as 12 million gallons per day to as high as 100 million gallons per day. Mink (19, 20) estimates that, on the basis of the latest information, a realistic figure may range from 35 to 50 million gallons per day, given proper management and wise hydrologic decisions.

How much water will be demanded in the future? Austin, Smith and Associates (7) estimated civilian domestic water needs in 2010 as 27.5 million gallons per day. This was based on an average per capita usage of 110 gallons per day (utilizing the usage statistics for Honolulu and adjusted for commercial use) and population projections furnished by the Economic Research Center, the 1966 Master Plan, and U. S. Census Records. It was further assumed that the military population would remain constant at 33,000, bringing the total population on Guam to 250,000 persons by 2010.

How much water is presently being removed from the northern aquifer? PUAG now produces

an average of 11 to 12 million gallons per day. The Air Force removes an average of 3 to 4 million gallons per day. This gives a figure of 14 to 16 million gallons per day, or approximately half the minimum amount of groundwater available as drinking water as estimated by Mink (19, 20).

In order to preserve the quantity and maximize the quality of recharge entering the limestone aquifer, adequate infiltration capacity must be maintained. Changes made in ground cover vegetation or other changes to the natural system alter the equilibrium status of the freshwater lens. If recharge area is reduced while demand is constantly increasing, overpumping, or "mining," may occur, resulting in saltwater intrusion and long-term damage to the aquifer (Fig. 11). In order to prevent this, conservation practices must be instituted in the form of either reserving tracts of land in their natural state or, where changes have been made, by channeling runoff into natural or man-made depressions. Mink, in (21), has proposed that the Government of Guam reserve as much natural area as feasible in northern Guam to assure a continuous replenishment of the basal lens with rainwater. Each area would consist of a conservation zone surrounded by a low-density use zone. The conservation zones would total 7,850 acres, or 12 to 13 percent of the area of northern plateau. The low-density zones would equal 11,400 acres, accounting for 18 percent of the land area. If the total recommended conservation zones cannot be established, those areas outside the actual assignment should be restricted to low-density use. In addition, Mink recommended that the immediate vicinity of all wells should be placed in a conservation zone to prevent accidental contamination.

The recommendation to establish the conservation zones in the north has not been implemented. On the contrary, a number of planned unit developments have been approved or are pending in the heart of Area 2 and the low-density zone of Area 1 (Figs. 21, 22).

The proposal to create buffer zones around individual wells also has not been implemented. The high cost of land and the hesitancy of the government to obtain easements on private lands has resulted in the placing of wells on parcels of government land on school grounds, near public buildings, or near highways. Although the proposal to establish conservation areas in the North has not been implemented, large developments such as Barrigada Heights, Liguana Terrace, and Latte Heights have built large ponding basins into which storm water flows. This practice, primarily implemented to control flooding problems, also provides for recharge to groundwaters. However, the storm runoff from yards and streets may contain materials such as pesticides and fertilizers, oil and grease, and an assortment of heavy metals that could have toxic effects or otherwise render the water source unusable for drinking water. In addition, the discharge of large volumes of runoff through a ponding basin rather than diffusing water over a large area may alter lens dynamics in the immediate zone beneath the development. (Additional information regarding storm runoff may be found in Chapt. 5 of this section.)

In order to evaluate the effect of discharge of storm runoff from a large development on the quality of groundwaters, the Guam Environmental Protection Agency, Public Utility Agency of Guam and the U. S. Geological Survey have required Hyundai America Corporation to establish two monitoring wells in the vicinity of the ponding basins serving the Barrigada Heights subdivision. Specifically, the monitoring wells will be used to:

- ... determine whether disposal of storm-runoff water in ponding basins will adversely affect freshwater lens quality; that is, whether or not the overlying limestone can filter out storm run-off contaminants before they reach the lens. (22)

A secondary purpose for establishing the monitoring well is to study the thickness of the freshwater lens and the transition zone between salt and freshwater as it relates to the presence of a major subdivision within an important infiltration zone.

Another potential source for contamination of the lens is related to the use of dry wells to control storm runoff. In June 1973, six dry wells were placed throughout the village of Barrigada to control flooding of yards and streets. The wells penetrated the relatively impermeable argillaceous limestone and allowed runoff to enter the underlying pure limestone rock which bears the lens. Several drinking water wells are located in



FIGURE 21

Recommended Conservation and Low-Density Zones for Area 1 and Encroachment of Developments in this Zone. Dark areas indicate planned unit development; gray areas are zoned for single-family dwellings (R-1). See Fig. 23 for general location of conservation areas. Figure from (10), as modified by GEPA.

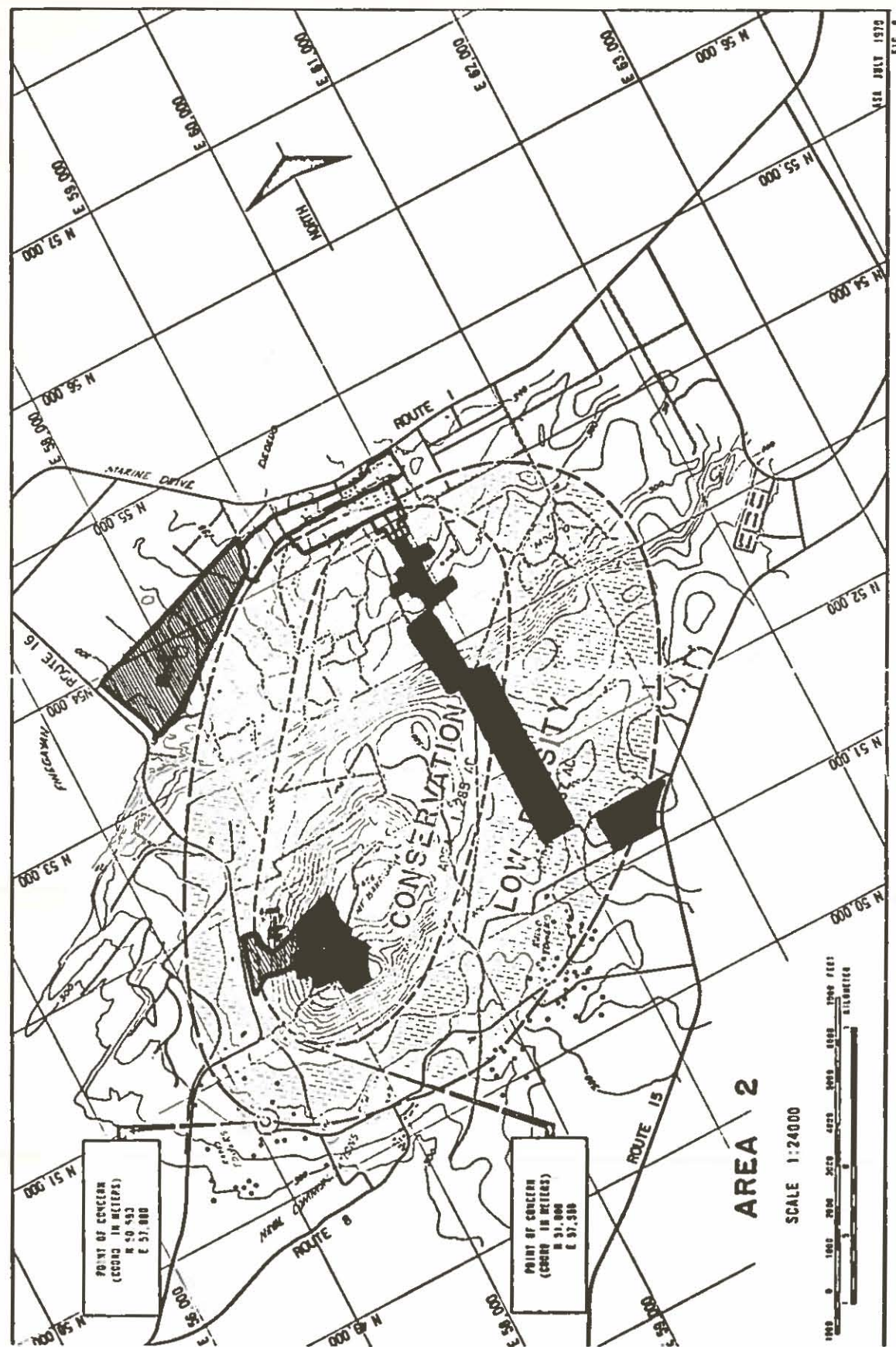


FIGURE 22

Recommended Conservation and Low-Density Zones for Area 2 and Encroachment of Development in this Zone. Dark areas indicate planned unit developments; gray areas are zoned for single-family dwellings (R-1). See Fig. 23 for general location of conservation areas. Figure from (10), as modified by GEPA.

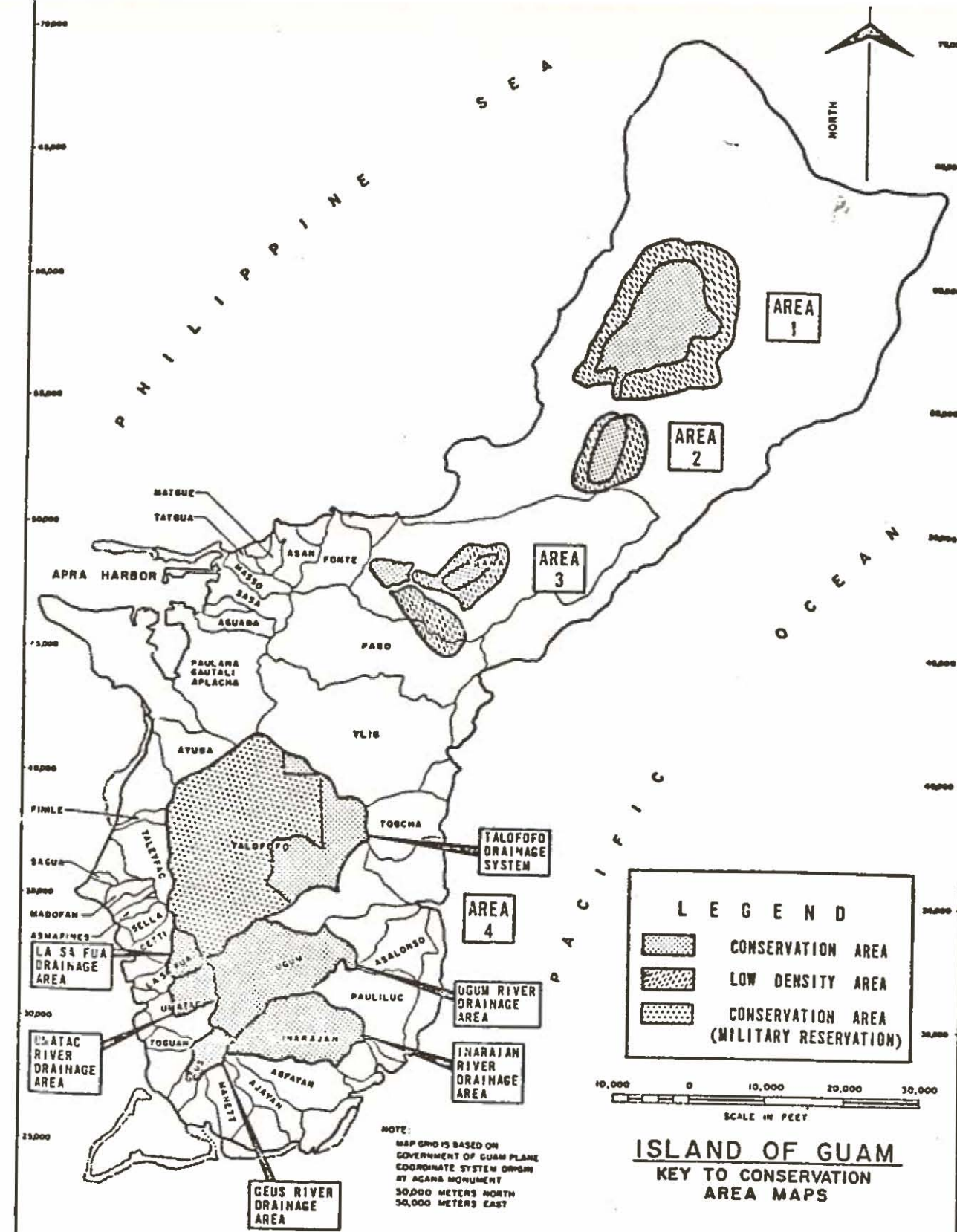


FIGURE 23

Map Showing Locations of Recommended Conservation and Low-Density Zones in Various Areas. From (10).

the vicinity. Regular monitoring for bacterial contamination has revealed no such contamination in the wells. However, other possible contaminants have not been analyzed.

Feltz, et al. (23) have studied potential contamination to groundwaters at Andersen Air Force Base. As in Barrigada, dry wells are used rather than surface means to control storm runoff. Over 90 dry wells were in use at the time of the study (1970). Pollution sources were identified as cleaning waste arising from a jet engine repair facility (alkaline base detergents, petroleum distillate, carbon remover, trichloroethylene), an Air Force housing area (pesticides, including aldrin, dieldrin, DDD, DDE, DDT, 2, 4, 5-T, and 2, 4-D), and a trench used to dispose of sanitary wastes.

Austin, Smith and Associates (7) (1968) predicted that a civilian population of 200,000 will require 24.5 million gallons of drinking water per day by 2020. According to more recent estimates (21), however, 228,000 civilians will require 27.5 million gallons of freshwater daily. Earliest estimates of the amount of basal groundwater available were 8 million gallons per day (9) primarily in the Dededo area. Austin, Smith and Associates (7) estimated 12 million gallons per day would be available throughout the year. Mink (19, 20), on the other hand, has estimated that 35 to 50 million gallons per day may be safely recoverable from the lens.

It is clear that the experts do not agree on the exact developable limit of our northern basal lens system. It is also clear that our civilian population is growing faster than past predictions have indicated. The military population may increase with the apparent plans for military buildup in the western Pacific islands. There is a distinct possibility that the development now occurring on the northern plateau may reach such a level that the capacity of the water lens will be reduced. In addition, over 5,000 acres, or 20 percent of the fertile land in southern Guam, can be considered available for agricultural development if adequate irrigation potential is developed (24). Therefore, there is strong justification for development of dams and reservoirs on several of the more suitable southern rivers as freshwater sources (Fig. 23).

The first proposal to build reservoirs on the southern rivers came in 1946. Piper (6) prepared a map indicating potential reservoir sites on the Pago, Upper Ugam, Talofoto, and Ugam River systems. In 1950, Fena Reservoir was constructed by the Navy. Fena Lake, with a storage capacity of 2,000 million gallons per day (25), became the primary source of water for the island. At present, the reservoir supplies 10 million gallons per day.

In 1965, the Kennedy Engineers (9) proposed phased construction of a dam and reservoir with an 11 million gallon per day discharge capacity for the Ugam River and an 8 million gallon per day dam and reservoir on the Pago River.

In 1968, Austin, Smith and Associates (7) proposed establishing dams, reservoirs, and strict watershed control on six southern rivers, including the Ugam River (4.4 million gallons per day), the Talofoto River (2.00 million gallons per day), and the Inarajan River (2.00 million gallons per day). In addition, they recommended redevelopment of the Agana Springs as a source capable of producing a capacity of 1.5 million gallons per day. Their report estimated that the production of 9.5 million gallons per day from developed southern sources, together with the 12 million gallons per day from well supplies in the North, would be sufficient to meet demands till 2010. At that time, the costs of saltwater desalination or complete wastewater recycling should be compared to the costs of more massive dam developments.

In 1971, Austin, Smith and Associates (26), again revised their population estimates upward and recomputed water demands based on these estimates. They included irrigation needs in their report. By FY 1982, the civilian community would number 139,000 persons (compared to about 107,000 persons estimated in 1968). The total water requirements would be 26.6 million gallons per day; 19.5 MGD would be the domestic demand, and 7.1 MGD the agricultural demand. Austin, Smith and Associates emphasized the need to purchase land outright to establish certain conservation and low-density zones for the purpose "of construction of improvements and protection of infiltration and watershed areas." The conservation low-density zones on the northern plateau remained the same as those included in their 1970 report (10). Proposals for southern area dam-reservoirs were revised from 1968. The estimated discharge capacity for the Ugam River was

increased from 4.4 MGD to 6 MGD. Completion was recommended for FY 79. The reservoir would be used for both domestic and irrigation use. Talofoto source development was recommended for FY 78 under this proposal. The estimated 1.5 MGD capacity of the dam was recommended exclusively for irrigation use under this proposal. Inarajan River development would be completed by FY 81. The use of these waters would be for irrigation water supply. The estimated capacity remained 1.0 MGD, as in 1968. Under the 1968 plan, the Umatac/LaSaFua River source development project was to produce 1.0 MGD through construction of small dams and control of watershed area. The 1971 proposal called for development of a 0.8 MGD capacity reservoir-dam, treatment plant, and related distribution lines. The proposal was recommended for implementation by FY 72; however, there has been no action.

Because of growing government interest in expanding the agricultural base of the Territory, a study was carried out to assess the feasibility of providing water for irrigation (24). For northern Guam, the feasibility study recommended using surplus well water for irrigation purposes for the present. The study cited John Mink as stating that the yield of the basal lens is 25 MGD. Since there is presently an average daily demand for domestic water of nearly 13 MGD, a surplus of 12 MGD is available for irrigation use. As demand for domestic water supply increases, the feasibility study recommends using the 12 MGD discharge from the Northern District Sewage Treatment Plant. The initial daily flow of 5.5 million gallons would be sufficient to irrigate 750 acres of land.

There are several important obstacles to development of agriculture in northern Guam. First, there is little knowledge available of the impact of pesticide and fertilizer use on groundwater quality. Since the basal lens will be the basic source of domestic water, at least for the near future, any activity that could possibly contaminate the lens must be severely restricted. Second, although recycling of our water resources is an important goal in itself, sufficient study will have to be undertaken to determine the extent of treatment necessary to preserve the quality of the basal lens.

The Department of Agriculture estimates that a total of 800 acres of land in southern Guam is used for full-time or part-time agricultural pursuits. Three hundred acres are privately owned and the remainder is government land. None of the land is intensively farmed (24). Analysis of soil conditions indicates that the five southern municipalities of Yona, Talofoto, Inarajan, Merizo, and Umatac have the potential for agricultural use on river bottoms, coastal uplands, or argillaceous limestone, and inland plateaus where the terrain is suitable. An estimated 5,000 acres of arable land is available for agricultural development, according to the study (see Chapt. 3). The irrigation feasibility study proposed maximum development of dams and reservoirs to provide as much water as necessary for both domestic and agricultural use. For this reason, several of the dam-reservoir systems are recommended for greater capacity than planned by Austin, Smith and Associates (26).

According to the irrigation feasibility study (24), Talofoto Reservoir would have a yield capacity of 4.5 MGD (Austin, Smith estimated 1.5 MGD) with dual domestic-agricultural use. Total cost of the project is estimated at \$4,100,000, including \$300,000 for purchase of an estimated 20 acres required for the development of the Talofoto River.

The Ugam River development yield capacity as seen by the irrigation study is 2.5 MGD less than the Austin, Smith and Associates report. The former capacity was estimated at 3.5 MGD, with a cost of \$2,400,000.

The Inarajan Reservoir would have a potential domestic yield of 3.6 MGD according to the irrigation study. The total cost of development is estimated to be \$2.5 million, exclusive of land acquisition costs.

Umatac/LaSaFua development would yield 1.8 MGD at a cost of \$2 million, exclusive of land purchases, according to the irrigation study.

In summary, the irrigation feasibility proposal (24) estimated a combined domestic water yield of 13.4 million gallons per day at a total estimated cost, exclusive of land purchases, of \$11 million.

Data on complete systematic chemical analyses of Guam's waters are difficult to obtain. Mink (20) has made a complete statistical analysis of the available data. These include calcium, chloride, silica, nitrate, magnesium, and total hardness. Few analyses of heavy or toxic metals have been conducted.

Calcium and magnesium carbonates give water the quality of hardness, which inhibits sudsing properties and forms troublesome deposits in distillation equipment, plumbing fixtures, and air conditioners. The source of the calcium and magnesium carbonates is Guam's limestones. Rainwater percolates through soils where carbon dioxide, produced as a by-product of normal decomposition and respiration processes, combines with the water to form carbonic acid, which promotes solution of the limestone. As a consequence, groundwaters from the northern plateau are much higher in total hardness than surface waters from the volcanic south. Groundwaters associated with the argillaceous limestone show higher hardness values than those of pure limestone. Mink (20) relates the higher values to greater biological activity in the soils overlying the argillaceous limestone, or perhaps to the effects of the thick clay soils on the chemical equilibrium.

Since silicates are characteristic of volcanic rock, higher concentrations of silica in lens groundwaters indicate proximity to volcanic masses. Thus, wells in Afame-Chalan Pago/Ordot, which are located in the argillaceous limestone, show significantly higher silica values than do wells located in Mangilao, Barrigada, Dededo, or Yigo. The same high values are evident in the several limestone aquifers of the southeast coast and in surface flows. Like calcium and magnesium carbonate, highly silaceous waters cause some difficulties with scaling, (i.e. accumulation and flaking-off of deposits).

The groundwaters of the northern limestones have very high nitrate concentration, ranging up to 10 milligrams per liter (mg/l). This is far higher than would be expected in normal groundwaters. Normal nitrate concentrations of natural waters in equilibrium with the growth and decay cycle of biological matter center around 1.0 mg/l or less, which is typical of Guam's southern sources. In addition to normal decomposition mechanisms in nature, pollutants and wastes related to agriculture and urbanization contribute to the nitrate load in groundwaters. Mink (20) identified six possible mechanisms for producing nitrates: 1) rainfall, 2) organic decay in the natural growth cycle, 3) fertilizers, 4) domestic wastes, 5) nitrate as part of the composition of rock, and 6) legume plants. (See Fig. 24).

Mink discounted rainfall as a significant source of nitrate. The absence of large-scale vegetation instability in the North led him to discount natural growth cycle disruption as a nitrate source. In addition, the relative absence of guano or other fossil matter of biologic origin incorporated in the limestone eliminates this as a significant source of nitrate.

No large-scale use of nitrogenous fertilizers is presently being undertaken on the island. Mink compares northern Guam with a 20,000-acre irrigated sugar cane plantation in southern Oahu. The two areas share similar groundwater fluctuations. The Hawaii site had been fertilized with 300 lbs. of nitrogen per acre per year over a 60-year period. The resulting equilibrium concentration of nitrate in the Oahu groundwaters is 10 mg/l. Although such intensive fertilizer applications are absent from Guam's northern plateau at present, the potential for agricultural development on the northern plateau has been considered (24). In view of the present high concentrations of nitrate concentrations in drinking water, the unfavorable implications of mass agriculture on the northern plateau must be thoroughly understood.

A portion of the nitrate present in northern groundwaters is due to wastewater discharge into the ground. Mink estimated that, on the basis of a maximum figure of 2 million gallons per day of sewage being discharged into the water lens, the concentration of nitrate in groundwater attributable to wastewater would be about 1.7 mg/l. Mink further calculated that if 16 million gallons per day of wastewater were discharged into the water lens, the resulting concentration of nitrate in the groundwater would be 9.4 mg/l, assuming complete mixing.

Legume plants produce an average of 200 lbs. nitrogen per acre per year. Surplus

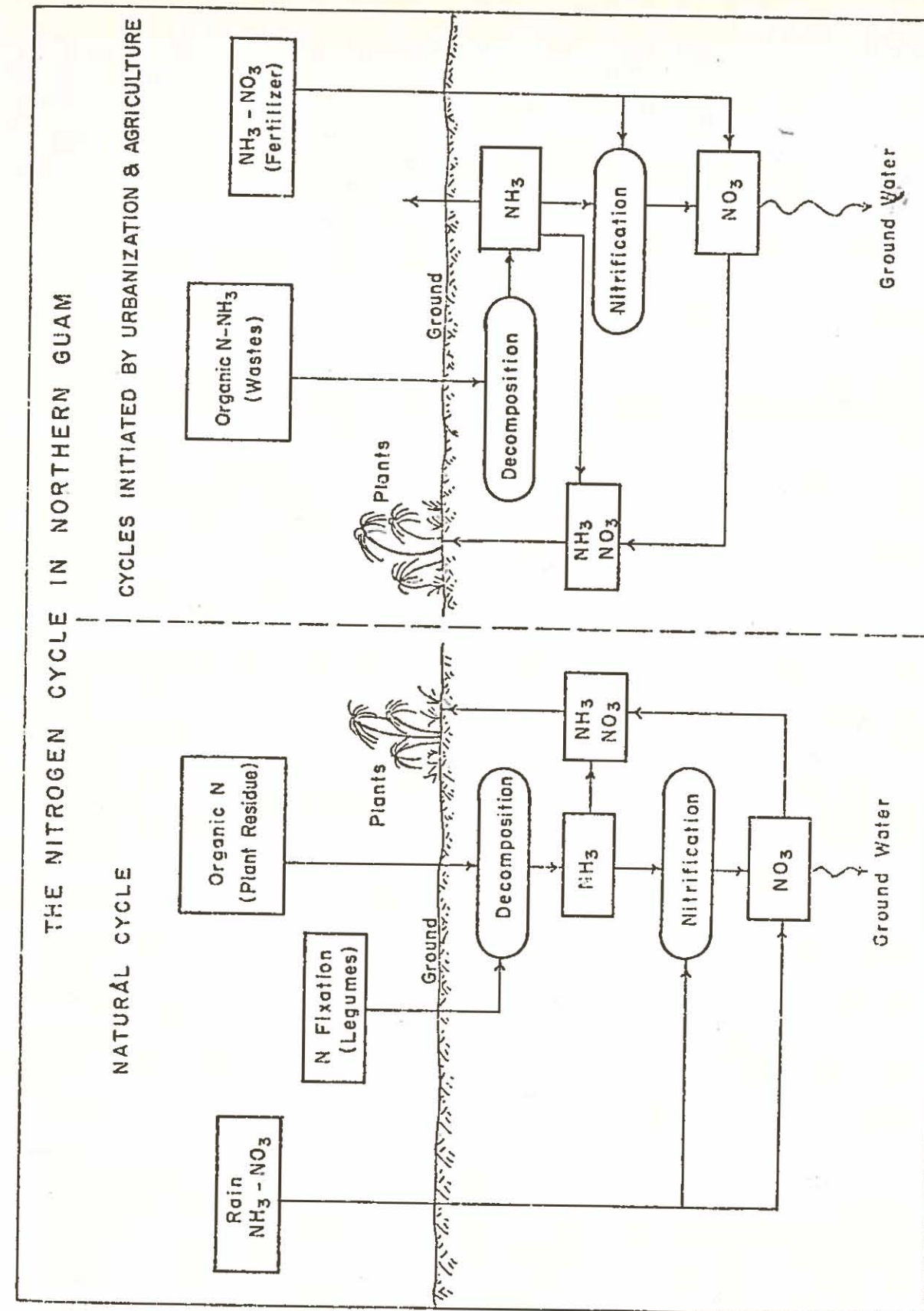


FIGURE 24
Diagram of the Nitrogen Cycle in Northern Guam. From (20).

nitrogen then infiltrates into the ground. Although little is known about the nitrogen production potential of tanga-tanga and other legumes, Mink strongly suggested that legumes are the major contributor to the nitrate content of the limestone waters in northern Guam. He calculated that if a 200 lb. surplus of nitrogen per acre per year were produced by tanga-tanga, the groundwater would have a concentration of 90 mg/l of nitrate. A surplus of only 20 lbs. of legume nitrogen would produce 9 mg/l of nitrate in groundwater.

Few analyses of groundwaters or surface waters for heavy metals and toxic materials have been conducted. Austin, Smith and Associates (7) conducted chemical sampling as part of their survey of Guam's surface waters. Analysis of the samples indicated consistently high concentrations of manganese. In addition, high phenol concentrations and a substance suspected of being TNT were found in the upper Talofofo River. This was attributed to abandoned ammunition storage areas. A rather high phenol reading of 6 parts per billion was also found in the Fena Reservoir, indicating probable contamination by buried ammunition. The concern over possible contamination of the Fena Reservoir by toxic materials is such that a U. S. EPA specialist was asked to survey the problem.

The high manganese concentrations found by Austin, Smith and Associates in several southern rivers are undoubtedly due to high concentrations of manganese in the clay soils of the South. Stearns (5) reported the presence of deposits of manganese at several locations in the upper Talofofo River valley. In World War II, the Japanese actively mined several deposits.

The high content of manganese in Guam's southern rivers has lately been of interest to the National Institute of Neurological Diseases and Stroke, a branch of U. S. Public Health Service. They have conducted analyses of water and fish samples to ascertain whether manganese may become concentrated in fish tissue and whether there is a link between consumption of fish and the occurrence of the two endemic neurological diseases, litico and bodig (memoranda and correspondence of the NINDS Research Center, Guam, 1973).

A continuing water quality problem in southern rivers is animal and human waste contamination. In most of the rivers, livestock waste washes into the river during periods of moderate-to-heavy rain. The highest fecal bacterial contamination occurs when the initial surface runoff reaches the stream, after which a lower constant level is established. During periods of dry weather, the bacterial numbers reach their lowest level.

Latrines, cesspools and improperly functioning septic tanks also contribute pollutants to rivers and marshes. Although a home waste disposal system may appear to be functioning correctly during dry soil conditions, rainfall causes improperly functioning systems to overflow. An additional factor in the failure of home disposal systems is increased water discharge from washing machines and modern flush toilets, which produce five gallons of wastewater per flush. Often, an expanding family will build additional buildings on a lot and connect their disposal facilities to the existing system, leading to failure of the system. This problem is most evident in southern villages although it is by no means restricted to the southern end of the island. The 1974 islandwide outbreak of hepatitis is strongly suspected of being related to the problem of waste disposal.

The impact of wastewater discharge into the northern limestones, from the standpoint of bacterial contamination, is related to the ability of the limestone to filter out organic matter. The lagoon deposits found in the interior of the northern plateau appear to be an effective filter. Monitoring of wells within the villages of Barrigada, Dededo, and Yigo has revealed no gross contamination by bacteria. Of greater concern is the possibility of contamination from nitrate and heavy metals associated with runoff from subdivisions and developments on the northern end of Guam.

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MARINE RESOURCES

SPECIFIC CHARACTERISTICS OF THE MARINE ENVIRONMENT

According to Emery (1), ten percent, or 21 square miles of Guam's 212 square miles, is in the form of fringing reefs and lagoons. A more recent determination of reef area by Randall and Holloman (2) of 13 square miles is perhaps a more accurate estimate. In any event, the ratio of coastline to land area is high in such a small island setting. In terms of linear dimensions, Guam has approximately 80 miles of fringing reef surrounding the island. Reefs of Guam show characteristic features that seem to depend on their orientation to prevailing winds and ocean currents, the kind of rock on which they grow, and the pre-existing topography. Randall (3) lists three basic types of Guam reefs:

- (1) reefs of the bay areas of the northern limestone plateaus,
- (2) reefs of the volcanic platform on southern Guam, and
- (3) barrier reef enclosing Cocos Lagoon.

Fringing reefs surround most of the island and are a tremendously valuable asset in terms of marine life, aesthetics, food, recreation, and protection of Guam's highly erodible soils from wave action. The width of the fringing reefs ranges from very narrow benches (as narrow as 10-20 feet) on the northeastern coast and elsewhere around limestone areas to broad reef flats more than 3000 feet wide (4). The broad reef flats form the popular recreation areas in Tumon Bay, Agana Bay, Asan and Agat bays, and Cocos Lagoon.

In their recent Coastal Survey of Guam, Randall and Holloman (3) have divided the coast of Guam into twelve contiguous sections, each having a distinct set of terrestrial and marine features. In viewing a "typical" broad reef such as the Tumon Bay section, one can see definitive reef zones. The physical parameters of these zones depend primarily upon the degree of reef surface exposure at high tide, the slope of the reef, coral growth, and erosional features. Four basic zones exist from the beach seaward:

- (1) the reef flat,
- (2) reef margin,
- (3) reef front, and
- (4) submarine terrace.

The reef flat itself can be subdivided (from the beach seaward) into a sand zone of approximately 500 feet, a coral zone of 500 feet, and the outer reef flat of 250 feet. The sand and coral zones remain covered with water at low tide, whereas the outer reef flat is exposed at low tide. Coral colonies and associated marine life are scattered in the shallow pools of water on the portions of the reef flat that remain covered during low tides.

The reef margin is the seaward edge of the reef. It is awash at low tide and the surface is rather irregular, having surge channels and cracks. The margin is approximately 100 feet wide.

The reef front slopes gently downward to the terrace at a depth of approximately 20-30 feet. Here, submarine channels cut the surface of the reef. These channels are lined with living corals and contain the richest fauna (animal life) to be found in any reef zone. The submarine terrace slopes gently downward to a depth of 30-50 feet. This zone supports many scattered colonies of coral.

Guam's most developed barrier reef is at the southern end of the island and encloses Cocos Lagoon. The reefs and lagoon, together with Cocos Island, form an atoll-like environment about four square miles in area (3). A second and less developed barrier-reef environment is that of Apra Harbor on the west coast. Apra Harbor is a deep-water lagoon surrounded by volcanic and limestone land, the uplifted limestone plateau of Orote Peninsula, and an artificial breakwater that was built upon a shallow reef platform.

Guam's reefs provide countless ecological niches for a wide variety of plant and animal forms. Nowhere on earth is there as great a diversity of flora and fauna as can be found within, on, and around tropical reefs. Most of these organisms inhabit particular zones on the reef and each contributes to the complex ecology of the reef as a whole. Many of these plants and animals are vividly colored, and one is aware of their existence while snorkeling over a shallow reef. Many, however, are obscure and live within the coral or under the sand and are seldom seen except by the keen observer.

The reef itself is a dynamic process and product of living organisms. These organisms have the ability to absorb calcium and other minerals found in sea water and to secrete these minerals in the form of a calcium carbonate (limestone) skeleton. Many marine organisms have this ability, but the reef builders are primarily the corals and certain algae.

On the windward reefs of Guam (such as Ritidian Point), algal ridges (formed almost exclusively by limestone-secreting seaweeds) can be seen near the edge of the reef. The main contribution of calcareous algae to the reefs of Guam is their cementation of reef fragments into compact masses. The reef is built up and protected from erosion as a result of this cementation.

The dominant plants on land are, of course, the flowering species; but in the marine environment flowering forms are scantily present and algae are the dominant forms. Four major groups of macroscopic algae (i.e. visible to the naked eye) make up most of the shallow-water attached forms: blue-green algae, green algae, brown algae, and red algae. The importance of the algae to the total ecology of the reef is enormous. As previously mentioned, calcareous red algae help build the reef and act as a cementing agent on the reef. The only way oxygen is replenished in the water is through the photosynthetic activity of the reef algae. Numerous animals on the reef are herbivorous and feed entirely on the algae. The larger forms of algae provide shelter for a myriad of fish, crustaceans, mollusks and other organisms. Many animals attach permanently to algal plants and gain support and protection from this association. There are many species of marine algae inhabiting the reef waters of Guam.

The coelenterates are primitive animals often found in colonies. Many secrete a calcareous skeleton or spicules (microscopic skeletal parts) and, as mentioned before, these forms aid in reef building. The coelenterates are all tentacle-bearing animals which possess stinging cells. Jellyfish, soft and hard corals, sea fans, sea anemones, and other coelenterates are abundant on the reefs of Guam.

There are many different kinds of worms that live in and on our reefs. Some are free-living and can be found swimming or crawling, while others reside in burrows or secreted tubes which they never leave. Flatworms and segmented worms of a multitude of shapes and sizes are present on the reefs.

The mollusks are one of the oldest and largest groups of present-day animals. They are also one of the best known groups, as the shelled forms are attractive and have been collected through the ages. Mollusks range in size from nearly microscopic sea snails to the giant squids, which may reach a length of 50 feet. They all have a muscular foot, or a modification of it such as tentacles, and many have external shells of secreted calcium carbonate. Mollusks have adapted to nearly every conceivable environment, with the most diverse mollusk fauna being found on tropical reefs. Guam's reef mollusks include the many types of sea shells, clams, oysters, and octopuses. Occasionally, small squids can be seen within reef waters.

The echinoderms are entirely marine animals whose skeletons have limy plates, often with spines. The plates may be connected in such a way as to be movable, as in the sea urchins. In some echinoderms the plates are not connected at all and are found randomly distributed throughout the layers of skin, as in the sea cucumbers. Echinoderms show a star-like shape either in the form of radiating arms or in the pattern that exists in their shells. Most echinoderms have tube feet that function as tiny suction cups and enable the animals to move. Echinoderms are abundant on our reefs, occupying every conceivable niche. They include starfish, brittlestars, sea cucumbers, and sea urchins.

The crustaceans belong to the same major group of animals as insects, spiders, and

crabs, and occur worldwide in marine, aquatic, and terrestrial environments. Some 25,000 species of ticks, shrimps, and lobsters are known.

Our reef crustaceans are many and varied. They can be divided into five groups: swimming crabs, walking crabs, shrimps, lobsters, and barnacles. Many small crustaceans are found simply by lifting coral heads. Barnacles, highly modified crustaceans, can be found attached to rocks where there is constant rough water. The larger crustaceans can be seen under rocks and algal mats, and exposed on the edge of the reef.

Fish are probably the main attraction for most people interested in the natural history of our reefs. The fish add to the reefs their bizarre shapes and colors, and they provide entertainment in the form of their unique courtship, feeding and territorial behavior. Ninety-nine families of fish are recognized on Guam (5). Many are harvested as a source of food by the people of Guam by means of net fishing, spear and line fishing, fish trapping, and to some extent, offshore fishing.

The existing quality of Guam's reefs and adjacent marine waters varies, depending upon location and stress factors generally attributed to population density and accessibility. Specific marine environmental problems will be discussed later in this chapter. Generally, however, the quality of Guam's reefs and marine waters ranges from what can only be described as "pristine" to severely damaged or highly polluted reef areas. There are pristine areas along parts of the windward northeastern coast, which remain undeveloped and inaccessible, and also in parts of the southwestern coast, including Facpi Point, Sella, Cetti and Fouha bays. There are severely damaged or highly polluted reef areas around populated areas, particularly urban Piti-Agana-Tamuning; in the South where rivers enter the bays; along much of the western and northwestern coast where once-abundant coral colonies have been destroyed by the crown-of-thorns starfish predation; and around areas of industrial impact such as Tanguisson Point and Cabras Island.

The present usage of Guam's coastal area depends primarily upon topography and accessibility. The fact that on a small island the ratio of coastline to total land area is high tends to increase the degree of shoreline use and development. As a result, the importance of the coastal environment is tremendous, but the coastal and reef resources are limited. For a succinct description of present coastal usage, the reader is referred to Chapter V of the Coastal Survey of Guam (2):

Guam is undergoing rapid development at the present time and land is being utilized at a frantic rate. Less coastal development has occurred in northern Guam because the northern plateau region consists of steep, rocky slopes, cliffs, and much of it is occupied by military reservations. The southeastern, southern, and parts of the southwestern coasts are not heavily populated and with the exception of the Merizo area there is correspondingly less coastal development. Much of the population of Guam is located in the central part of the island, particularly on the western coast, where most of the coastal development is presently found.

Tourism and the development of the tourist industry is occurring primarily in the Tumon Bay and Merizo/Cocos Lagoon areas. Small coastal tourist and recreation developments are also in Ylig Bay and Sella Bay.

Much of the Tamuning, East Agana, Agana, and Anigua coastal area is utilized by commercial establishments which have been built up to, or encroaching upon, the public domain (35 feet from the mean high water mark, as defined by Section 17203, Title XVIII, Government Code of Guam).

As the needs of the resident population increase, public coastal recreation areas are being established. Ypao Beach on the northwest coast, Talofofo Bay and Ipan Beach on the east coast, and Nimitz Beach on the southwest coast are examples of developed public recreation areas.

The military on Guam controls access to much of the coast, and maintains several recreation areas, including NCS Beach on the northwest coast, Tarague Beach on the north coast, and GabGab Beach in Apra Harbor. Two coastal recreation sites previously

controlled by the military have recently been opened to the public--the southern part of Cocos Island and Rizal Beach on the southwest coast. The USO beach in Piti is also open to the public.

Many prime areas on the southeastern coast of the island were at one time accessible to public use, but are now essentially closed as access becomes posted with "No Trespassing" signs.

Wharf and docking facilities utilize the shoreline and inshore waters in Apra Harbor, the location of the Commercial Port of Guam; the Naval Station; and the Naval Ship Repair Facility. Small boat marinas are located in the harbor, as well as in Agana and Merizo. The harbor is used for sailing, diving, water skiing and other recreation. Coral growth and development is rich and varied in Apra Harbor where the lagoon has not been disturbed by dredging or filling.

The Fish and Wildlife Division of the Guam Department of Agriculture issues 15 fish weir permits yearly to qualified residents. Two weirs are permitted in Apra Harbor and 13 in the Merizo area.

The reefs and bays are utilized to varying degrees by shell collectors; net, spear and line fishermen; surfers; picnickers; photographers; and beachcombers. As indicated in Chapt. 2, much of Guam's uniqueness, natural beauty, and primary natural resources are indeed the coasts and reefs surrounding the island.

The coasts of Guam are utilized in another manner not previously described. A recent but unpublished survey of point-source discharges conducted by the Guam Environmental Protection Agency indicates a total of 81 sewage, storm drain and other direct discharges into the marine environment. This inventory does not include the military reservations, which control access to approximately one-fourth of the coastal waters of Guam.

LEGAL CONSIDERATIONS

Local concern for clean water is not new. As early as 1956, laws were enacted to curb water pollution on Guam. These and other laws were adopted under various departments or agencies of the Government of Guam and retained by them until March 7, 1973. On that date, Public Law 11-191 created the Guam Environmental Protection Agency and transferred enforcement of most laws concerning environmental protection to the new agency. This move paralleled a similar consolidation of environmental authority in the federal government and the creation of the United States Environmental Protection Agency. The purpose for consolidating these laws under one authority was "to provide a united, integrated, and comprehensive . . . program of environmental protection." Local laws providing legal controls and regulation of pollution within the marine waters surrounding Guam, its reefs and beaches, will now be discussed.

Public Law 9-76, known as the Water Pollution Control Act, was adopted July 29, 1967. The Act emphasizes Guam's need:

To conserve its water resources and to protect, maintain, and improve the quality and potability thereof for public water supplies, for the propagation of wildlife, fish and aquatic life, and for . . . other legitimate beneficial uses; to provide a comprehensive program . . . for the prevention, abatement and control of new or existing water pollution; and to provide effective means for the carrying out and enforcement of such program.

This act makes it unlawful "for any person to cause the pollution . . . of any waters of the Territory." As defined in the act, "pollution" shall mean "the alteration of the physical, chemical or biological properties of any waters of the territory which renders said waters harmful or detrimental for their most beneficial uses"; "waters of the Territory" means "all shore waters surrounding Guam, streams, lakes, wells, springs, irrigation systems, marshes, watercourses, waterways, drainage systems and other bodies of water, surface and underground, natural or artificial, publicly or privately owned."

The Standards of Water Quality for Waters of the Territory of Guam were adopted in April 1968 by the Guam Water Pollution Control Commission. These standards were adopted under the authority of the Water Pollution Control Act and fulfilled a territorial requirement of the Federal Water Pollution Control Act.

The Standards of Water Quality established the following policies:

1. All sewage and all wastes prior to discharge will receive the best practicable treatment or control.
2. Waters whose existing quality is better than the established standards . . . will be maintained at their existing high quality.
3. No direct discharges of sewage or other wastes . . . will be permitted into fresh surface waters, near-shore coastal waters, or fresh groundwaters of the Territory.
4. In no case will (sewage) outfalls be permitted inside a reef area or at depths of less than 10 fathoms (60 feet).

The Standards of Water Quality established five criteria, referred to as the "Five Freedoms," which apply to all waters of the Territory:

1. Free from visible floating materials, oils, grease, scum, foam, and other floating matter.
2. Free from materials . . . that will produce visible turbidity or settle to form deposits.
3. Free from materials . . . that will produce color, odor, or taste.
4. Free from substances . . . that will induce undesirable aquatic life.
5. Free from substances . . . toxic or irritant to humans, animals, plants, and aquatic life.

The Standards classify waters of the Territory according to their most beneficial uses and establish additional water quality criteria for each classification. These classifications include:

1. Public or Domestic Water Supply,
2. Recreation,
3. Propagation of Fish and Other Aquatic Life,
4. Navigation.

The Standards specifically identify "near shore coastal waters" and their uses as:

Protected for the present and future uses of industrial water supply, propagation of fish and other aquatic life and wildlife (including waters reserved for conservation of native marine biota, shellfish propagation, and commercial and sports fishing); esthetic enjoyment, and recreation. The following near-shore water will also be protected for uses of navigation in addition to uses listed above: Pago Bay, Ylig Bay, Talofofo Bay, Agfayan Bay, Manell and Mamaon Channels, Port Emnzo (Merizo), Umatac Bay, Outer Apra Harbor, and Agana Small Craft Harbor. Only navigation uses are protected in the following: Inner Apra Harbor and the areas immediately adjacent to docks, piers, wharves, and loading facilities of the new Apra commercial docks, oil and ammunition docks, and Piti channel.

Primary water contact recreation is excluded as a permitted use of Outer Apra Harbor and other harbor and marina areas.

The Standards of Water Quality are presently being revised by the Guam Environmental Protection Agency. Important changes in terms of the marine environment will include the following policy statement:

Waters whose existing quality was better than the established standards, as of April 1968, will be maintained at the same high quality existing at that time.

Waters whose existing quality is less than the established standards for their use due to the presence of substances, conditions, or combinations thereof attributable to domestic, commercial and industrial discharges or agricultural, construction and other land-use practices, shall be improved to comply with the established standards.

Waters will not be lowered in quality unless and until it has been affirmatively demonstrated to the Board of Directors of Guam Environmental Protection Agency that such a change is justifiable as a result of necessary social, environmental, or economic development and will not interfere with or become injurious to any uses made of, or potentially possible, in such waters.

The revised Standards of Water Quality will categorize the marine waters so as to protect coral reef organisms and establish pollution-free reef conservation areas.

Other local policies, laws and regulations impacting upon Guam's marine environment include the following:

- (1) The Environmental Policy Statement, Government of Guam, 1974, has as a basic policy: "the protection and pollution abatement of marine resources."
- (2) The Guam Territorial Seashore Protection Act, Public Law 12-108, signed into law on March 12, 1974, proposes a "Territorial Seashore Protection Commission to plan for the conservation of seashore resources, and to prepare an enforceable plan for orderly management and development of the seashore reserve." This plan must include provision for acquisition of property and public access, land use, recreation, population density, and educational elements. The Commission has, at the time of this writing, not been appointed by the Governor of Guam.
- (3) The Guam Register of Historic Places, Department of Commerce, establishes official sites which are protected against construction or improvements (Section 13985.19 Civil Code of Guam). Of the several registered areas, the following coastal sites are included:

Agat Invasion Beach
Sella Bay Complex
Fouha Bay Complex
Fafai Beach Complex
Gadado's Cave
Ritidian Complex
Talaiha Complex
Tarague Beach Complex
Asiga Beach Complex
Abong Beach Complex
Pati Point Complex
"Cormoran" (ship in Apra Harbor)
Uruno Complex
Hilaan Complex
Lajuna Site
Haputo Complex
Machom Complex
Pagat Complex

- (4) Government Code of Guam, Title XVIII, Section 17203, commonly known as the "zoning law," restricts building in beach areas. Specifically, building is prohibited along any beach in the Territory of Guam, within 35 feet of the mean high water mark bounding said beach.

- (5) Public Law 12-19, signed into law on April 24, 1973, defines Territorial Recreational Areas as land owned by the Government of Guam between mean high water mark (including the 35-foot setback) and privately owned land. It becomes policy that it is the right of the public to have unrestricted access to the ocean shores of Guam for common use by all people. The law also provides for reacquisition of private coastal property for recreational development.

Federal laws, policies and regulations impacting upon Guam's marine environment will now be discussed.

Public Law 91-190, "The National Environmental Policy Act of 1969," establishes a National Council on Environmental Quality. This Council must provide a yearly report to the President setting forth the status of the marine environment of the coastal states and territories. The Act requires all federal installations and proposed federal actions to prepare and submit for Territorial review and comment, environmental impact assessments and statements. Thus, any local military action which may affect Guam's marine environment, must be preceded by an environmental impact analysis which must be made public and provide for public comment.

Public Law 92-500, the "Water Pollution Control Act" as amended, provides the National (and Territorial) goal that:

- (1) The discharge of pollutants into navigable waters be eliminated by 1985;
- (2) Wherever attainable an interim goal of water quality which provides for the protection and propagation of fish, shellfish and wildlife, and provides for recreation in and on the water, be achieved by July 1, 1983; and
- (3) The discharge of toxic pollutants in toxic amounts be prohibited.

The U. S. Environmental Protection Agency administers Public Law 92-500 and provides Guam Environmental Protection Agency with federal funds for GEPA's operation and planning as well as funds for the construction of pollution-abatement sewage treatment facilities.

Section 401 of the Act requires the issuance of permits for any point-source discharge into the navigable waters of Guam. At the present time, all legal permit enforcement is with the regional EPA office in San Francisco. Eventually, the Guam Environmental Protection Agency will be given the legal authority to administer the permit program.

The Act provides that Guam's Water Quality Standards, previously discussed, must be complied with in terms of pollutant discharges. Further, the Act provides that a National and Regional Oil Pollution Contingency Plan be developed. Guam's Contingency Plan, as part of the larger Region IX Plan, has been developed by the U. S. Coast Guard, 12th District, and is locally administered by the U. S. Coast Guard.

The Army Corps of Engineers, under Title 33, Part 209 (Federal Register, Volume 39, No. 65, 1974) regarding "permits for activities in waterways," prohibits the unauthorized alteration of any navigable water of Guam ("navigable water" being defined as that subject to the ebb and flow of the tide). An application for any dredging, construction, or similar activity on the reefs of Guam by any government or private concern must be filed with the Corps of Engineers in its Hawaii District Office. The Corps must place a public notice in the local press and provide for public comment on the proposed activity before a permit is considered. The Corps will also require an environmental impact assessment of the proposed project, and, if necessary, a thorough environmental impact statement. The Government of Guam, Department of Land Management, acts as the liaison with the Corps on all permit applications and provides comments on applications before a decision to issue or deny a permit is made.

MARINE ENVIRONMENTAL PROBLEMS

By way of introduction to this section concerning marine environmental problems, the following statements are provided to indicate two premises:

- (1) Guam's coral reefs, while biologically productive, are extremely sensitive and fragile.
- (2) Marine pollution exists on Guam to a significant degree, and the potential for destroying the reef environment is considerable.

Governor Camacho's Environmental Policy of 1974 (6) stated that:

Guam's marine life is particularly vulnerable to damage resulting from imprudent construction activities such as siltation caused by erosion of improperly graded cleared sites. Damage also occurs from indiscriminate public and commercial coral and shell harvesting, illegal fish weirs, use of explosives and poisons for killing reef fish, thermal outfalls, untreated sewage, and storm drains all jeopardize (marine) environmental quality.

C. M. Yonge (7) wrote in Micronesica that:

With increased population, sewage pollution, can become serious and also industrial and thermal pollution Not only may reefs be destroyed by pollution but imbalance produced Over wide regions of the Pacific the more spectacular members of the marine fauna . . . are being collected Because the larger and more striking species are so conspicuous they are easily found. At the apex of the food chain in many cases, they are not abundant, indeed often rare, and can be, and probably are being, exterminated in many regions. Apart from the loss of most interesting members of the fauna, there is a disruption in the balance of the ecosystem

The Navy's Environmental Protection Plan (8) states:

Guam's environmental deficiencies, a listing of known pollution sources cooling water, boiler blown down, stack emissions, chemical waters, septic tank and sewer outfall wastes, oil spills, storm water runoff, disposal of paints and thinners, ship discharges, waste oil disposal, acid cleaning

SILTATION

Silt has a very important effect on the growth and distribution of corals (9). When dropped from suspension in water and deposited upon reefs, it actually smothers living corals and produces bottom conditions which prevent further coral growth. In Guam's case the fine clay and mud of our volcanic soils is particularly harmful. When corals die, associated marine life such as fish leave the area. The recovery time of reef corals, if recovery in fact ever occurs, is measured in decades.

Siltation of the reefs and bays of Guam occurs because of the removal of natural plant cover, primarily from the river drainage basins of the southern part of the island. Agassiz, as early as 1903 (10), observed a large amount of erosion and denudation occurring in the volcanic areas of Guam. The removal of vegetation cover may occur naturally as a result of phenomena such as fires. However, rather than being a natural phenomenon, present-day reef siltation on Guam is primarily a result of man's activity. Fires that are deliberately set to clear land and rout wildlife, and the removal of natural cover by earth-moving construction equipment cause a tremendous silt load in areas where rivers enter the bays and lagoons and dissect reefs.

A tragic example of the damage siltation can cause occurred in East Piti Bay. The problem was first investigated by the Guam Environmental Protection Agency in November 1973. Red silt, transported down the Matgue River from the Nimitz Hill subdivision construction project, formed a blanket of laterite "ooze" over approximately 130,000 square meters of inner reef flat. The blanket spread westward from the Matgue River mouth to the Tagnag River area. The extent of siltation could easily be seen from Marine Drive or from a higher vantage point on Nimitz Hill. A once highly productive reef area and popular recreation spot located in parts of East Piti Bay is now almost totally unproductive. There is a lack of coral, bottom-dwelling marine organisms, and fish in the area. The water, once clear and clean, is now turbid and its quality is degraded.

In March 1974, unseasonably heavy rains resulted in further siltation of Piti Bay and prompted concern from the public. Several hundred petitioners presented their case to the Governor, resulting in a stop-work order issued by the GEPA. Additional site controls were instituted. Unfortunately however, the damage done to Piti Bay was extensive and irreversible. In an intra-agency memorandum to the Administrator of the Guam Environmental Protection Agency on March 11, 1974, the Enforcement Officer summed up the action:

Our first major problem with siltation has occurred. It is important that we learn as much as possible about this incident so as to prevent more devastating problems from occurring.

Other problems were quick in coming: the Kaiser subdivision at Windward Hills involved mass cut and filling and the resulting soil runoff found its way into the Ylig and Togcha Rivers and their tributaries. Initial investigations of this problem began in June 1974, and continued through September and October.

The primary measure to prevent such siltation is the promulgation of strict erosion control rules and regulations which provide for the development of erosion control plans before the government issues construction permits to contractors. Reforestation in the presently eroded areas of southern Guam is also necessary.

DREDGING AND FILLING

Dredging and filling in subtidal waters increases the load of sediment and dissolved organic and inorganic materials in the water column within the immediate area of disturbance, and may also affect other regions as currents carry material to nearby areas. A great deal of dredging and filling is presently occurring or expected to occur within the relatively shallow areas of Guam's marine environment. Swimming areas for the hotels, channels for sea water intake and effluent for power plants, small boat marinas, and increased docking facilities within Apra Harbor are all activities which require dredging and/or filling, with resultant destruction of corals and the reef habitat.

For example, in a letter dated April 17, 1973, to the Army Corps of Engineers, Honolulu District, from the Guam Environmental Protection Agency, it was brought to the Corps' attention that significant environmental damage to an active coral community had occurred as a result of dredging by the Guam Power Authority's contractor for the Cabras Power Plant construction. In violation of a Corps permit condition, heavy equipment was moved across the reef community. As much as 15-25 years of coral growth was destroyed. Marsh and Gordon (11) recommended that conditions of the Corps of Engineers' permits for dredging be carefully monitored to assure that contractors abide by the terms and to assure minimum damage to the reef environment.

In 1959, the area of Guam coastal zones which had been filled was measured at 965 acres or 0.71 percent of total island land area (12). The majority of this fill occurred in Apra Harbor and the figure did not include the Glass Breakwater. In order to update the estimate of Guam's filled areas, one must consider the Glass Breakwater, Commercial Port expansion, the Agana Sewage Treatment Plant site (proposed), and various recreation sites proposed in the Outdoor Recreation Plan (13). On several occasions, another type of coastal-zone fill has been discussed among government

decision makers: a "reef highway." The impact upon the marine environment as a result of such large-scale dredging and filling would be disastrous. In effect, the reef would be replaced by a highway since the two could not coexist.

As previously mentioned, much of the actual and proposed dredging and filling has occurred and will occur in Apra Harbor, one of two barrier reef lagoons on Guam. Randall and Holloman (2) describe the present reef fauna found in Apra Harbor which might be lost without careful assessment of the probable environmental impact, should further dredging occur:

Coral growth and development is rich and varied where the lagoon has not been disturbed by dredging or filling, especially along the Orote Peninsula fringing reefs. The only records of several species of corals are from outer Apra Harbor lagoon. Extensive beds of solitary fungiid corals are found on the lagoon slope and floor along Calalan Bank and Luminao Reef. Some patch reefs have been dredged to depths safe for shipping, and coral growth has been reduced but deepwater species are still abundant on the rubble slopes. Coral growth is also well developed and diverse on the shallow patch reef located at the eastern end of the outer harbor.

Continuing, Randall and Holloman recommend that whenever dredging is contemplated in an area, the biological communities present should be assessed and currents studied to determine the probable movement of the dredged material. Recommendations should then be made accordingly.

At the Regional Symposium on Conservation of Nature--Reefs and Lagoons, conducted by the South Pacific Commission in 1973 (14), the following resolution was passed:

RESOLUTION NO. 12

Utilization of Coastal Marine Resources

The Symposium -

Being concerned at the extensive ecological damage that has been caused in certain Pacific Islands by utilization of coastal marine resources, including reef materials and by the development of tourism;

Being concerned particularly at the building of hotels and other developmental activities on beach fronts, at the gathering of sand and coral in large quantities for building and industrial use without thought to the disturbance of beaches, reefs and lagoons, extensive dredging operations and overharvesting of marine shells and other forms of marine life;

Recommends to the South Pacific Commission and all governments and administrations concerned that relevant ecological studies should be a necessary prelude to approval of any development projects in coastal areas;

And further recommends that appropriate control measures linked to the findings of such surveys should be applied to regulate the building of hotels, the disposal of wastes, the gathering of sand and coral, the collecting and harvesting of marine shells and other forms of marine life as well as other types of exploitations so as to reduce or remove environmental disturbances resulting from such activities.

OIL AND HAZARDOUS MATERIALS

The Apra Harbor Pollution Study (15) states that "oil spillage is considered to have

the greatest damaging effect to the harbor." The study further states that 15 damaging oil spills occurred in the harbor during Fiscal Year 1971.

Volume V, Issue IV of the U. S. Coast Guard Pollution Newsletter provides the following statistics for March, 1974:

28 February - Wharf G Apra Harbor - approximately 3 gallons of diesel was discharged by a fishing vessel. Apparently crewmen dumped the oil after cleaning engine parts. A \$500 civil penalty has been assessed in this case.

10 March - Pier F-2 Apra Harbor - a preliminary report indicates that approximately 20 gallons of waste oil was discharged from MITO MARU #2.

18 March - Apra Harbor - approximately 25 gallons of diesel was discharged when a yacht sank at her moorings. With the owner off-island, the Coast Guard hired a civilian contractor for clean-up. \$133.79 was expended in this effort. A notice of violation has been sent preparatory to assessment of a civil penalty.

During calendar year 1973, some 326 pollution cases were reported. Of this number 170 were of such a nature as to require enforcement action. This action took the form of either a letter of warning (issued to first offenders in minor cases or when the evidence was insufficient to initiate prosecution), or civil penalty assessment under the authority of the Federal Water Pollution Control Act. These assessments can range up to the legal maximum of \$5,000 per incident. The money collected is deposited in a special revolving fund for use in federally funded pollution cleanup operations.

Similar reports of oil spills in Apra Harbor are becoming all too frequent in the Coast Guard newsletter.

The following information regarding the Sasa Fuel Farm was extracted from an oil-spill field report prepared by staff members of the Fish and Wildlife Division, Guam Department of Agriculture (July 16, 1974):

Field Inspection of Oil Spilled Into the Sasa River

A field inspection was made on July 1, 1974, to assess damages to the Sasa River by oil spilled into the river on June 25, 1974, from a Navy storage tank situated in the Sasa Valley fuel farm. The inspection was conducted in the company of Lt. R. Collins, Director of Fuel Department at the Naval Supply Depot.

According to Lt. Collins, the spill was caused by mechanical and human error which resulted with the overflow of 1309 barrels of Navy special fuel oil from one of the storage tanks. Lt. Collins explained that most of the oil followed the natural drainage and formed pools along the drainage. Immediate steps were taken to prevent the oil from draining into the Sasa River. Barriers were formed along some of the major drainages. However, Lt. Collins stated that before effective clean-up could be carried out, heavy rainfalls washed out some of the barriers and unknown quantities of the oil flowed into the river. Even the barriers constructed in the river to trap the oil for recovery were washed out by the strong flow of the river. Consequently, the oil-laden water was carried down river and dispersed into a grassy marsh flat with some of the oil entering Apra Harbor. Lt. Commander Condor, Port Operations Officer at Naval Station, was contacted to determine the quantity of the oil that entered the inner Apra Harbor. According to Lt. Cdr. Condor, a boom had been placed in the harbor to contain the oil and about 50 gals. were recovered. He also reported that no additional oil was observed in the area during subsequent daily inspection of the area.

To prevent oil from any future spills from entering and traversing the length of the river and ultimately into Apra Harbor, it would seem prudent if permanent oil barriers should be constructed along strategic areas in the river. These barriers should be constructed so that water release valves at the base of the barriers can control the flow of the river and keep the oil on the surface from spilling over the barrier. The oil trapped on the surface can then be skimmed off and recovered.

The Federal Register, Volume 39, Number 169 (August 29, 1974) promulgates severe civil penalties for violation of oil pollution prevention regulations. These regulations and penalties are applicable to the Territory of Guam.

The Guam Oil Spill Contingency Plan (16) provides the following information concerning oil spills within the Territory:

3400.1 The purpose of this plan is to promote and coordinate, Federal, Government of Guam, and private efforts to combat oil and hazardous substance water pollution problems affecting the Guam Island. This plan has its origins in the Federal Water Quality Improvement Act of 1970.

3400.2 The 1970 Federal Act has two major beneficial effects on oil pollution combat. First, the pollutor has been made liable for expenses incurred during the cleanup. Second, a large revolving fund has been authorized to provide immediate funding for Federal cleanup expenses. This plan attempts to maintain the vital importance of the local government in meeting pollution problems, consistent with requirements of Federal legislation. The following criteria shall govern control of spill cleanup:

- a. The pollutor should handle the spill; if he fails,
- b. The local government should attempt to eliminate the problem; but, if the spill requires even greater resources,
- c. The Federal Government shall assume control.

3400.3 (a) Federal on Scene Commander (FOSC) - is the person designated in advance by the Federal Government to direct and coordinate operations during a pollution incident. The Commanding Officer, U. S. Coast Guard Captain of the Port, Guam has been so designated.

3400.3 (b) When a spill is caused by a United States public vessel or by a Federally controlled facility, the responsible agency shall provide the OSC and take the initial response actions. Continuous water pollution control actions for moderate and major spills should be coordinated through the RRT [Regional Response Team, composed of federal and local government representatives and other knowledgeable individuals]. For the purposes of this plan, Apra Inner Harbor is deemed to be a federally controlled facility.

3400.4 Local Government on Scene Commander (LOSC) - is the person designated in advance by the Government of Guam to direct and coordinate operations during a pollution incident.

3450 Oil Spills at Guam

3450.1 In Apra Harbor, oil spills may occur from:

- a. Bulk transfer of petroleum at the following facilities

	No. bbls handled annually
(1) Wharf "D" & "E" Naval Fuel	15,000,000
(2) Wharf "F-1" GORCO	11,000,000 (GORCO) 300,000 (ESSO)

(3) Wharf "G" Mobil Oil Co.	1,300,000
TOTAL	27,600,000

- b. Fueling vessels.
- c. Vessels discharging ballast and pumping bilges.
- d. Pipelines from Wharves "F-1", "D", and "E" to Navy fuel farm and GORCO refinery.
- e. Piti Power Plant and power ship.
- f. Collisions and groundings.

3450.2 Outside Apra Harbor Oil spills may occur from:

- a. Vessels discharging ballast inside 50 mile limit.
- b. Collisions and groundings on surrounding coral reef.
- c. Pipelines from Navy Fuel Farm to Andersen Air Force Base and Naval Air Station.

Basically, the Oil Spill Contingency Plan proposes five phases of action in the case of a spill incident (17):

- (1) discovery and notification;
- (2) containment and counter measures;
- (3) clean-up and disposal;
- (4) restoration;
- (5) recovery of damages and enforcement.

The oil spill potential on Guam is considerable. The biological damage from an oil spill may be extensive, particularly if the oil washes onto reef areas during low tidal states. If the oil remains afloat, on the other hand, little damage to benthic (bottom-dwelling) organisms may occur. The oil becomes an aesthetic and biological problem if it is deposited upon beach areas. The beach strand organisms may be adversely affected. It is believed that the effects of certain chemical dispersing and sinking agents used in oil spill clean-up may produce more biological harm than the oil itself. The least biologically damaging means of controlling oil spills is to contain the oil by using booms or barriers to recover the oil from the water through a skimming process. Guam has oil containment and removal equipment available through private industry and the military. Presently, a great deal of research is being conducted on the international scene to determine the extent and rate of natural biodegradation of oil in the sea and on the beach.

Periodically, oil slicks are associated with sewage effluents. During a study of the Agana Sewage Ocean Outfall (18), light oils were consistently found in the rising sewage boil from the outfall, and oil slicks were observed ranging up to 2.5 nautical miles in length.

Oil pollution will become a more serious problem on Guam as our port facilities grow. GORCO, the Guam Oil and Refining Company, is currently refining approximately 25-30,000 barrels of crude oil per day into jet and boiler fuels. There has been some discussion of constructing an off-shore fueling dock for the GORCO facility in Agat Bay. There would be a distinct possibility of a major oil spill causing irreversible marine damage should such a facility be built to accommodate the largest supertankers.

Spills of other hazardous materials have recently occurred on Guam. On July 23, 1974, a damaged containerized shipment of paint was opened in the PCC warehouse yard in East Agana. A large amount of acrylic paint containing a fungicide agent (formaldehyde) was released on the ground. In an effort to clean up the paint, much of it was washed into a storm drain and was ultimately discharged into East Agana Bay. The discharge resulted in severe damage to the marine environment, including the deaths of juvenile fish and many benthic organisms such as crabs, sea cucumbers and shrimps.

Yap recently suffered a sodium arsenate pesticide spill which was considered extremely dangerous to the human population. The leaking pesticide containers were shipped to Guam and temporarily stored at Commercial Port for trans-shipment and ultimate safe disposal in California. The containers continued to leak while on the dock at Commercial Port. Fortunately, the situation was recognized and remedied before the sodium arsenate entered the waters of Apra Harbor. Since Guam has no means of safe disposal of dangerous and illegal pesticides, the Guam Environmental Protection Agency has requested funds for the removal and transportation of such hazardous chemicals to an approved federal EPA site in California.

First, it is obvious that a viable oil spill contingency plan is essential for the protection of Guam's marine environment. Second, strict pesticide control must be legislated to protect all of the island's environment. Such legislation is presently being drafted by the GEPA. New federal regulations on oil spill prevention, control and countermeasures require that all facilities on Guam, public, private, or federal, which store 1320 gallons of petro-chemicals above ground (or in a single container in excess of 660 gallons capacity), or 42,000 gallons below ground, to submit and implement a spill contingency plan (EPA Regulations 40 CFR, Part 112).

At the Regional Symposium on Conservation of Nature--Reefs and Lagoons conducted by the South Pacific Commission in 1973 (14), the following resolution was passed:

RESOLUTION NO. 17

Pesticides and Toxic Chemicals

The Symposium -

Being concerned at the environmental disturbances being experienced in Pacific Island ecosystems, both terrestrial and aquatic, because of unwise and excessive use of pesticides and other toxic chemicals;

Recommends to the South Pacific Commission and all governments and administrations concerned--

- (1) That strict controls be instituted on the importation and use of such materials;
- (2) That public education programmes be instituted to make all users aware of the need for adequate care in usage and the long-term risks of using certain persistent chemicals;
- (3) That consideration be given to the establishing of regional analytical and monitoring services for pesticides and other toxic chemicals;
- (4) That more intensive studies be instituted on the rate and manner of accumulation and decomposition of such materials; and
- (5) That action be taken to initiate studies within the region on biological control and to explore the possibility of establishing a local branch of the International Organization for Biological Control.

THERMAL DISCHARGES

The effect of thermal stress upon marine organisms, particularly corals, is documented by Jones and Randall (19) in their studies of the biological impact of the Tanguisson Power Plant, Unit No. 1. This study suggests an upper temperature tolerance limit for reef-margin corals of between 30 and 32°C. During the first year of Tanguisson's operation, the outfall temperature ranges were 32.8 to 34.8°C, or 4 to 7°C above natural conditions. Guam's Water Quality Standards, on the other hand, state that receiving waters shall not deviate from natural conditions by more than 1.5°F (0.8°C). A massive kill of the reef margin coral community occurred as a result of the Tanguisson Plant's thermal discharge. There was total destruction of reef margin corals in a zone of 4320 square meters, and damage to corals was evident in a peripheral

area of 10,000 square meters. The study suggests that additional damage to reef organisms is now resulting from the operation of Tanguisson Unit No. 2, which went into operation in early 1973. The study recommends an immediate abandonment of the present outfall structure, and the construction of a new outfall that will release effluent at the edge of the submarine slope. This would assure adequate mixing, which would allow the reef margin water temperatures to return to natural conditions.

There is no doubt that thermal loading adversely affects the marine environment. Wagner (20) states that thermal loading decreases available dissolved oxygen, promotes the growth of undesirable species of algae, and alters the entire food chain.

There are thermal pollution problems at Tanguisson, Cabras and Piti. According to the Apra Harbor Pollution Study (15), the Piti Power Plant discharge is 10°F higher than intake. Thermal problems will persist for both present and future power plant locations until outfall sites are carefully evaluated in terms of currents, depth, and the quality of the marine environment.

SEWAGE

A recent (October 16, 1974) inventory of point-source discharges directly into marine waters conducted by the Guam Environmental Protection Agency indicates the presence of 10 raw-sewage discharges and two primary-treated sewage outfalls on Guam. The total amount of sewage presently released in Guam's marine environment is difficult to estimate; however, the following data provide some indication:

Agana Outfall (raw sewage) - more than 8 million gallons daily

Agat Sewage Treatment Plant - 650,000 gallons daily
(primary treatment)

Pago Sewage Treatment Plant - 80,000 gallons daily
(package treatment)

Commercial Port Treatment - 20,000 gallons daily
Plant (package treatment)

In addition to the direct marine discharges, raw sewage is being discharged into many of the southern rivers; and two package sewage treatment plants (prefabricated plants ready for quick on-site assemblage) cause primary effluent river discharges (Pago River, and Baza Gardens at Togcha River). This sewage ultimately reaches Guam's marine surface waters. Several sewage ocean outfalls are presently in the design or planning phase, primarily as a result of sewerage plans for northern Guam and the southern villages.

The public health problems associated with inadequate collection, treatment, and sewage discharge have become evident on Guam. Recent outbreaks of hepatitis and cholera, and the potential for many other water-borne diseases including typhoid fever, have aroused public concern.

The Guam Environmental Protection Agency routinely monitors the effectiveness of local water pollution prevention efforts by sampling and analyzing surface waters and comparing the results with Guam's Water Quality Standards. The Water Quality Standards set a limit of 400 fecal coliform bacterial colonies (a reliable indicator of human and animal waste) per 100 milliliters of surface water in recreation areas. If contamination is detected, GEPA issues public warnings.

The following data are average fecal coliform counts taken at four major southern river mouths biweekly for the period of October 1, 1973 to October 1, 1974:

Talofofo River Mouth	1745 FC/100ml
Inarajan River Mouth	1008 FC/100ml
Geus River Mouth (Merizo)	4998 FC/100ml
Umatac River Mouth	4670 FC/100ml

The implications are clear: the southern reef flats around these rivers' mouths are highly polluted with human and animal wastes. In a study concerning the preservation of Guam's water resources that was developed for the Public Utility Agency of Guam (21), there are proposals for drainage basin watershed areas to be established for those four southern rivers, and for legislation to be enacted to limit access of live-stock (which contribute to the fecal coliform load) within those areas.

The effect upon the marine environment of such high fecal coliform counts, due mainly to secondary freshwater discharge, is poorly understood. It is known that considerable mixing and dilution occurs as the waste moves downstream and enters the bays, ultimately to be dispersed partially on the reef and partially in deeper ocean water. Also, there is evidence that associated chemical materials such as phosphates and nitrates disrupt the natural food chain and the ecological balance of reef communities.

Direct sewage discharges and subsequent damage within a bay supporting tropical corals and associated marine organisms has been well documented by Smith, Chave, and Kam, et al. (22). In their Atlas of Kaneohe Bay (Hawaii), the demise of what was once a rich and diverse coral community is described. The major factor in the destruction of this marine community was nutrient enrichment, eutrophication, and sedimentation due partially to the direct input of treated sewage into Kaneohe Bay. It is not known if the bay will ever recover, even if the sources of the pollution were upgraded to tertiary sewage treatment.

Other Guam reef areas in addition to the southern rivers are probably contaminated by raw sewage discharges. Sewage outfalls located on Guam's military reservations are discharging into narrow fringing reefs and, ultimately, deep ocean water. The effluent has not been monitored in the past by the GEPA; however, all point-source discharges are now being routinely monitored as of early 1975.

Guam Water Quality Standards permit no direct discharge of sewage or wastes from other than natural causes, treated or untreated, into fresh surface waters, near-shore coastal waters, or fresh ground waters of the Territory. An exception to location of outfalls in "near-shore waters" (up to 60 feet in depth) may be allowed at a distance less than 1000 feet from shore upon recommendation of the GEPA, with the concurrence of the federal EPA and only under certain conditions. Location within 1000 feet of shore may be allowed 1) provided that the outfall will occur off steep, precipitous cliffs where the ocean quickly drops to depths of more than 10 fathoms, 2) where the outfall and diffuser design will prevent aesthetic nuisance, and 3) where the outfall will not significantly produce ecological change in the marine environment. In no case will an outfall be permitted inside a reef area or at a depth of less than 10 fathoms.

A variance to these standards was granted for the Agat Sewage Treatment Plant which now has an outfall at a depth of 20 feet. The discharge area is being monitored to determine if there is adequate mixing of effluent to prevent biological damage in Agat Bay.

A study of Toguan Bay as a possible site for a sewage outfall (23) was conducted by the University of Guam Marine Laboratory. The study concluded that, short of providing tertiary treatment, a sewage outfall in Toguan Bay might well preclude any future use of the area for aesthetic and recreation purposes. In terms of public health, the bay would undoubtedly be posted to prohibit fishing and swimming.

The Guam Environmental Protection Agency has promulgated, through the Water Quality Standards, a "Pollution Abatement Inventory," under which the entire island is to be sewered in increments through an integrated sewer system (including sewage treatment plants and deep ocean outfalls) by 1977-1978.

In summary, Guam has the potential for disrupting and perhaps destroying much of its marine environment through the extensive use of ocean sewage outfalls if these outfalls are not properly placed 1) in water deep enough to assure adequate mixing of the effluent, and 2) along coasts where there are favorable currents to carry the sewage-laden waters offshore (2).

Resolution #18 of the Regional Symposium on Conservation of Nature--Reefs and Lagoons (14) states:

Pollution of Waters

The Symposium -

Being concerned at the increasing pollution of streams, lagoons and offshore waters of Pacific Islands with consequent environmental damage including destruction of many forms of aquatic life;

Being concerned also with the urgent need to maintain uncontaminated water supplies and to conserve and improve the valuable food resources produced in lagoon and reef zones;

Recommends to the South Pacific Commission and all governments and administrations concerned--

- (1) That no sewage be discharged into any body of water without appropriate treatment;
- (2) That the location of marine outfalls for the final disposal of effluent from treatment plants be settled only after careful ecological, hydrological and engineering studies.

STORMWATER RUNOFF

Fresh water can be a pollutant for the reef environment. Fresh water enters the reef areas naturally by escaping from the underground lens system. Randall and Holloman (2) noted that our reef organisms are "adjusted to this relatively slow and continual discharge, but when drains concentrate and increase the volume during rain storms there may be considerable damage by reducing the salinity in the localized area."

Storm-drain water is often contaminated with fecal coliform bacteria and toxic chemicals such as oils and pesticides that have accumulated on the drainage surfaces. Nutrients from fertilizers are also carried in storm-water runoff. An example of this problem occurs during heavy rains at the mouth of the Naval Air Station storm drain in East Agana, and at the "New Agana" storm drain in Anigua, both of which discharge on the reef near the shore. Fecal coliform counts go up dramatically on the adjacent reefs during rainy periods to the point that reef surface waters are heavily polluted.

Again, all point-source discharges, including storm drains, must receive permits from the U. S. Environmental Protection Agency under the authority of the National Pollutant Discharge Elimination System, Public Law 92-500. Guam has recently witnessed a proliferation of storm-drain construction, particularly in the hotel areas of Tumon Bay. Many of these discharges do not have permits. The GEPA Point-Source Discharge Inventory identifies 59 storm-water discharges where the receiving waters are actually within reef boundaries. This inventory does not include the military reservations.

Evidence of nutrient overloading can be seen at the mouth of most storm drains. The NAS drain in East Agana is a good example. Here, a large blue-green algal growth extends out from the mouth of the drain like a fan for a distance of 200-300 feet. At low tide, the algae are exposed to the air and begin to decompose, which accounts for the characteristic smell along that portion of Marine Drive.

The extent to which freshwater runoff and man-caused nutrient overloading is affecting our marine ecosystem is unknown. There is little doubt, however, that coral is being destroyed by this process. Considering the extensive development Guam is presently experiencing, it is obvious that storm drainage will become a major consideration in terms of treating it as a pollutant and ultimately disposing of it. Low-lying coastal developments will obviously have to dispose of storm run-off on or over the reefs. Northern interior developments are now being required to construct ponding basins to allow storm run-off to percolate back into the ground. A monitoring well is presently being constructed next to a large ponding area near the Barrigada Hill housing development. (See Human impact on the natural system, Chapt. 4 of this section.)

UNCONTROLLED SHELL-COLLECTING AND FISHING

Possibly man's greatest impacts upon the accessible reefs on Guam have been the direct and indiscriminate collecting of shells, coral removal by tourists and commercial harvesters, habitat destruction, illegal methods of fish harvesting (use of explosives and fish poisons such as chlorox), and the lack (until early 1975) of any regulations governing mesh size of fish nets.

Up through the middle 1960's, Guam was a "shellers paradise." A wide variety of mollusk species was abundant even in the most accessible areas of Tumon and Agana bays. As interest in shelling has markedly increased, along with problems associated with habitat destruction and pollution, the availability of shells has markedly decreased. It has decreased, in fact, to the point where only the most avid shellers equipped with SCUBA continue to find a fair variety of mollusks.

It has been observed by this writer that as the shell population decreased, more and more shellers began breaking up coral colonies in an effort to locate the more secretive shells, thereby destroying habitat. Immature specimens of mollusks are now collected, which depletes possible future populations. Tourism is having its impact also. There has been a distinct reduction of macro-mollusks such as trumpet shells and of the colorful blue starfish *Linckia laevigata*, both of which formerly were abundant in Tumon Bay (2). As mentioned previously, there are few coral colonies on the reef flat itself, and these are found primarily in depressions where deeper pools of water occur. On almost any day tourists may be observed bringing into shore pieces of live coral that have been broken off larger colonies. This coral is collected as souvenirs because of its beauty when it is alive. Much of it, however, is discarded the next day when the collector discovers that because the coral flesh has died the colony smells bad, has begun to decay and lose its beauty.

Corals are also harvested commercially from the reefs of Guam and, after cleaning and bleaching, are sold to tourists through hotel shops and other establishments. A concerned citizen recently wrote the Army Corps of Engineers regarding this problem. In response, a letter dated September 27, 1974, from the Acting District Engineer, Corps of Engineers, Honolulu, said:

In response to your letter . . . small scale removal of ornamental coral and shells on the reef is not considered to be excavation. Legislation and enforcement of these activities would properly be within the jurisdiction of the Government of Guam.

Governor Camacho's Environmental Policy Statement of 1974 (6) recommended "enforced regulations of coral harvesting." Legislation enacted in 1974 recognized the "over-harvesting of Guam's reef areas and diminution of octopus, shellfish, crustaceans, and reef fish." The law states that certain species of Guam's reef life are in danger of extinction. The law established four reef conservation zones from Tepungan Beach in the southwest to the northeast section of Tumon Bay. The harvesting of reef life during certain periods of the year is now illegal.

Other reef conservation areas have been proposed in the past. Resolution No. 158 of the 11th Guam Legislature proposed the preservation of the Cetti-Sella Bay area. A Guam National Seashore Park has been studied and proposed by the U. S. Department of Interior (24). The purpose of the proposed National Seashore is to preserve and maintain the undersea habitat through protection of coral, algae, starfish, sea urchins and other reef life.

The 1973 Outdoor Recreation Plan (13) of the Government of Guam (often referred to as the "Paradise Plan") states that if urbanization continues at its present pace, 30-35 percent of the usable portion of the island will be highly developed by 1995. It then becomes the "policy" of the government that shoreline frontage representing at least 25 percent of the total coast area, including contiguous water areas to a depth of 400 feet, be set aside for conservation reserves where only a minimum activity of a non-disturbance type would occur. The Recreation Plan calls for the establishment of a National Seashore Recreation Area, as well as the acquisition of several coastal areas for development into public beaches and marinas.

Although the Division of Fish and Wildlife, Department of Agriculture, has on several occasions asked the legislature to enact laws regulating the mesh size of fishing nets, such a rule did not exist until early 1975. Much of the net fishing is done in the inner reef flat, which is an area of fish propagation where many juvenile fish reside. It is not the intent of the legislation to stop net fishing but rather to control mesh size so that these juveniles can escape and grow into productive adult fish. Thus, the reef fish population will remain viable for future generations.

The Regional Symposium on Conservation of Nature--Reefs and Lagoons (14) resolved the following:

Regulation of Fish Net Sizes

The Symposium -

Being aware that in many Pacific Islands there are no restrictions on the use of small-meshed nets with resulting unwise exploitation of fisheries resources;

Being concerned that such practices result in eventual reduction of catches to below the maximum sustainable yields with consequent loss of protein supplies to the island peoples;

Recommends to all governments and administrations concerned that effective control measures be instituted to prevent the use of nets with meshes below a specified minimum size.

The use of explosives and fish poisons for killing reef fishes is practiced illegally on Guam. The extent of this practice is unknown; however, the impact upon the reef, its corals, and all marine life in a single area exposed to explosive or poisons is devastating.

Another resolution of the above-cited Symposium on Reefs and Lagoons states:

RESOLUTION NO. 14

Use of Explosives and Poisons

The Symposium -

Being aware of the extensive use of explosives and poisons for killing fish and in engineering works within island territories;

Being concerned at the unnecessary damage to habitats including the destruction of reefs, increase in silting and the incidental destruction of virtually all species of organisms within the ecosystem;

Recommends to all governments and administrations concerned that more effective control be exercised on the importation, sale and use of explosives and poisons including the enactment of rigid licensing laws;

And further recommends the total prohibition of the use of explosives and poisons in enclosed waters, ponds, lakes, lagoons and reefs.

SOLID WASTE DISPOSAL

Randall and Holloman (2) in their Coastal Survey of Guam make the following statement regarding the disposition of solid waste (garbage) in the marine environment:

Dumping of solid wastes in shallow marine waters covers the original benthic communities present and provides a different surface substrate. Solid wastes also commonly contain toxic substances which could be harmful to marine communities. There is some discussion of dumping certain solid wastes into shallow marine waters to provide artificial reef-like habitat areas for fishes and other marine animals. Before waste disposal of this manner is used, a careful study should be made as to the location of such sites. Sites for solid waste disposal should be selected in areas which are devoid of reef development and hard substrate marine communities. Sandy-floored terraces, which lack rich marine communities, should be considered.

EFFECTS OF "ACANTHASTER PLANCI" PREDATION UPON GUAM CORALS

A great deal has been written concerning the destruction of Guam's coral communities by the spiny starfish, Acanthaster planci. Chesher (25) describes the early population increases of Acanthaster which occurred simultaneously in widely separated areas of the Indo-Pacific Ocean. This tremendous population explosion was evidently not a short-term fluctuation. Ninety percent of the living coral along 38 kilometers of the Guam coast was destroyed to a depth of 65 meters. Chesher states that before 1967 A. planci was not common on Guam. In early 1967 the starfish became abundant on the reefs of Tumon and Piti bays. The depletion of the triton trumpet shell by collectors has been suggested as a possible cause of the population explosion because the triton trumpet mollusk is a natural predator of this starfish. Another theory is that blasting, dredging, and other human activities provide fresh surfaces free of bottom-dwelling filter feeders, and the starfish larvae may then settle and develop with a considerably less-than-normal mortality rate.

Randall (26), in his study of the coral reef adjacent to Tanguisson Power Plant, states that during 1968 over 95 percent of the living reef corals were killed by A. planci in the submarine terrace and seaward slope zones of Tanguisson Point. He concludes that coral recovery is occurring in these zones, but that it will take approximately 20 years to attain the same degree of coverage found before A. planci predation.

Tsuda (27), discussed the results of a re-survey of the A. planci population which included the outer reef slope and terrace areas, the fringing reef of Tumon, and the lagoons of Cocos and Apra Harbor. He stated that the distribution of A. planci on Guam was similar to that previously observed, and that A. planci were still concentrated in large numbers from Catalina Point to Pati Point, and from Ana'e Island to Tipalao Bay. The Piti-Agat-Tumon populations were moderate and were feeding upon the remains of nearly dead coral reef. There have been no apparent increases in areas of coral damage or in numbers of starfish since 1971 (2); however, there has not been a more recent islandwide survey.

EDUCATION

As indicated in the Introduction, instilling an environmental ethic in Guam's residents is paramount if we hope to preserve a quality of life for our future generations. In a concept paper presented to the Department of Education in 1974 by the Department's Environmental Education Consultant, a two-year environmental curriculum was proposed for all students, to extend from grades 7 through 12. This curriculum would include field experiences related to our coral reefs and in-service training for teachers presenting the coral reef units. The units would consist of two one-year programs (a program for junior high school students and one for senior high students), and would stress the preservation of the reef and marine environment. It is expected that the written materials for the units will be completed by July 1975.

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CHAPTER V-6

AIR RESOURCES

The climate on Guam can best be described as hot and humid. The temperature is an almost constant 80 to 85°F., with a humidity of 65 to 80 percent in the day and higher at night. The average annual rainfall ranges from 85 to 100 inches, 70 percent of which falls in the five months from July through November.

Easterly trade winds are dominant throughout the year and blow 90 percent of the time from January through May. Calms are rare from January through May and frequent from June through October. Trade wind speeds generally are between 4 and 12 miles per hour, and typhoons passing over or near the island may bring winds greater than 100 miles per hour.

In general, Guam has relatively good air circulation. Occasionally, surface-based nocturnal inversions do occur; but persistent periods of stagnation have never been experienced. Most of the time, winds strike the east side of Guam, level off across the plateau, spiral down the west side cliffs, and then head out to sea (1).

Even where one would expect clean air to be boundless, there can be air pollution. Moreover, damage to air resources is neither a new phenomenon nor one necessarily associated with modern technology. For example, according to R. Dubos (2), California historians have an interesting story concerning the origin of air pollution in their state:

When Juan Rodriguez Cabrillo surveyed the California coast and dropped anchor in San Pedro Bay in October of 1542, he could see the mountain peaks in the distance, but not their bases. He described how the smoke from Indian fires rose for a few hundred feet and spread out over the valley. This spectacle illustrated in a primitive, rustic form not only man-made pollution but also the phenomenon now designated as thermal inversion, or the trapping of warm air under cold air. Because of his experience, the Spanish explorer called the place he discovered 'Bay of the Smokes,' little realizing that the thermal inversion he had witnessed was a warning of far worse things to come.

Historically, little attention has been given to air pollution problems on Guam. As a result of the Federal Clean Air Act of 1970, Guam established an air pollution control program under the Department of Public Health and Social Services. Legislation was passed and regulations written. In 1971, Guam prepared an Air Implementation Plan (1) specifying the various sources of air pollution and projecting their growth to 1975 if no controls were instituted. It recommended an implementation program to correct the existing sources of pollution to meet ambient air quality standards. The plan was revised in 1972. However, gaining public acceptance of the program and its goals has been difficult. Few people on Guam feel that the degraded air quality characterizing mainland cities is a possibility for the island; the attitude of "it can't happen here" prevails.

Localized problems have occurred, nevertheless, primarily because of sulfur dioxide emissions from power plants (notably the Piti Power Plant), and because of particulates (airborne dust) generated by traffic on unpaved roads. As with almost all aspects of environmental problems, air pollution isn't viewed as a problem until it directly affects the individual. For example, the ill effects of sulfur dioxide emissions came to light at a hearing of the Guam Air Pollution Control Commission on June 22, 1972, during the testimony of Jud Rouch; his words, as reported in the Commission minutes, are indicative of local response when an air pollution problem is experienced first-hand:

I am Navy Chief Jud Rouch. The organization which I am representing is the Apra Harbor Naval Yacht Club. I am the Commodore of that organization. My statement is such. I am interested in the air pollution at Polaris Point, both in the capacity of Commodore of Apra Harbor Naval Yacht Club, and as a crew member of the

U.S.S. Hunley AS31. The problem there is bad enough during the day hours when it can be seen, but is even worse at night when the smoke and stack gas is not visible. I have a crew of three men from the Hunley who stand night watches at Polaris Point on a continual basis. They are constantly bothered by sore throats and burning eyes. The membership of the Sailing Association suffers because of this problem also. Since Polaris Point is the only area that Navy Special Services is willing to provide for sailing activities, many people refrain from sailing and boating rather than put up with the bad breathing and eye conditions. It would seem to me that either the air at the Polaris Point sailing facility should be cleaned up or the place be declared uninhabitable. . . .

The sources are the two power barges that are located at Polaris Point. I understand that one belongs to the Navy and one to the Guam Power Authority. The part I am talking about is just that one small area that, unfortunately, happens to be downwind from the barges--just the sailing club area there. The gas comes out of the barges and tends to loop up and pile right down on the building and beach at the sailing club area.

There have been continuing problems caused by sulfur dioxide emissions at the Piti Power Plant. When the trade winds prevail, stack emissions from the plant generally blow westward toward Apra Harbor. However, when the winds shift, the emissions can be carried eastward toward Piti Village and across the beach at the USO Club. Pollution problems at USO Beach have resulted in numerous complaints. In October, 1972, the beach was closed because of severe problems during a prolonged wind shift (3). Even after the beach was reopened, the USO Director reported that people were slow to come back and that the pollution scare was still costing the club money. Deliberations of the Guam Air Pollution Control Commission resulted in three alternatives: 1) close down the USO and nearby schools and businesses during times of pollution hazard; 2) reduce power output of the Piti Plant; 3) convert the plant to the use of low-sulfur fuel. While the latter alternative might seem the simplest, it is hampered by severe economic constraints which have been worsened by the energy crisis.

The new Cabras Power Plant has 200-foot stacks which are supposed to alleviate air pollution problems by preventing emissions from reaching ground level in the immediate vicinity. This may apply under conditions of prevailing trade winds, but there is still some disagreement about what may happen during unusual wind conditions. One possibility is that sulfur dioxide may be carried away from the immediate area but cause problems in adjacent areas.

The Tanguisson Power Plant is also located adjacent to a recreational beach, but any problems associated with it have not received the publicity that the Piti problems have. There has, however, been at least one complaint of a sulfur dioxide odor at Tumon Bay, Guam's major tourist area which lies more than a mile south of the Tanguisson Plant. Table 9 shows the amounts of sulfur oxides and other air pollutants caused by power plants and other sources in 1971.

During 1974, three applicants before the Territorial Planning Commission cited air pollution (dust) as a serious problem for them. Individuals living downwind of Hawaiian Rock Products in Mangilao have often complained of dust problems associated with the activities of the quarry. With the construction of new roads in Yona, Route 16 in Barrigada, and Marine Drive in Tamuning, complaints concerning dust have increased; and yet the citizenry as a whole continues to stress Guam's lack of any discernible air pollution. However, Mr. Frederick A. Cochran (4), Vice President and General Manager, GORCO, stated in an Environmental Awareness Conference in 1972:

Now it seems inconceivable that Guam, setting [sic] in the middle of a vast ocean, can even suffer from air pollution, but I direct your attention to Honolulu on the right day; Honolulu has air pollution and Guam can too.

Citizens have organized around specific issues related to air pollution on at least three occasions: once to protest the siting of a quarry/cement plant in Talofofo;

TABLE 9
1971 Emission Inventory of Air Pollutants

SOURCE CATEGORY	Particulates	Sulfur Oxides	EMISSIONS ^a		Nitrogen Oxides
			Carbon Monoxide	Hydrocarbons	
FUEL COMBUSTION, STATIONARY SOURCES					
Industrial Use	170,301	596,046	1,942,526	401,427	2,078,928
Steam-Electric Power Plants	698,104	42,666,540		436,315	9,163,062
PROCESS LOSS (other industrial acti- vities)	3,239,304	828,000	52,550,000	9,574,370	82,800
TRANSPORTATION	961,493	421,642	59,864,808	11,473,595	5,528,738
TOTALS	5,069,202	44,512,228	114,357,334	21,885,707	16,853,528

Source: (1)

^aEmissions expressed as pounds per year.

again, against a quarry/asphalt plant at Fadian Point near George Washington High School; and recently against the proposed siting of a cement plant in Dededo, just north of the village.

The growth in the use of passenger vehicles from 17,703 in 1964 to over 52,000 in 1973 (Table 10) discredits the notion that Guam will never have an air pollution problem (see Table 9 also). In 1970, for example, there was one vehicle for every 3.4 persons; by 1973, the ratio was one vehicle per 1.9 persons. Some estimates predicted there would be nearly 65,000 vehicles in operation on the island by 1975.

The Department of Public Works recently (October 1974) made application to the U. S. Urban Mass Transit Authority (Department of Transportation) for funds to commence a permanent bus system on Guam. Developing a sufficient number of riders to make an impact on the use of private vehicles will take a long time. Moreover, if present land-use trends continue (i.e. urban sprawl) Guam may never be able to lessen the reliance on private transportation.

For the most part, present pollution controls are geared toward controlling individual point sources such as power plants, reliance on built-in pollution control devices on new vehicles, paving of roads and shoulders, and siting major air pollution sources on the western side of the island to take advantage of the prevailing winds. Table 11 presents 1975 projected levels of various pollutants, assuming the application of control strategies.

SUMMARY

The National Ambient Air Standards, also adopted as law by the Government of Guam, should prevent our air resources from deteriorating to levels at which health is impaired. However, since Guam's air is currently far above these standards, maintenance of existing quality will be difficult. In addition, severe air pollution "episodes" will continue to occur in localized areas of the island.

This is particularly true of sulfur dioxide emissions from power plants. Several popular beaches will be affected until low sulfur fuel is available, either through importation, or desulfurization of fuels on Guam. Fugitive dust (particulates) will also continue to pose serious problems because of road construction, the lack of paved travelways, and the clearing of land. Control of these sources will depend on factors such as the willingness of the Department of Public Works to change its highway construction priorities and the enforcement of strict erosion control regulations.

Automobile use will continue to rise. Land-use development has proceeded across the landscape in a manner that necessitates extensive private vehicle use. Only a well developed master plan that strictly controls land-use development can impact appreciably on this problem. Disincentives to private vehicle use and incentives for mass transit will help, but only marginally. Land-use regulation as discussed in Chapt. 3, will continue to be the key to solving Guam's air pollution problems.

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TABLE 10
Motor Vehicles Licensed on Guam: FY 1964-1973

Fiscal Year	Private	Taxicab	Cargo	Trailer	Motor-cycle	Dealer	Bus	Special Equip.	Military	Total
1964	13,713	144	1,824	323	834	85	0	72	708	17,703
1965	14,350	135	1,810	253	760	91	4	30	438	17,871
1966	16,875	141	2,050	275	1,505	75	9	41	748	21,719
1967	17,953	146	2,050	275	1,505	75	9	41	748	22,802
1968	20,371	152	2,400	263	1,324	82	22	23	1,021	25,667
1969	22,304	136	2,834	403	1,051	79	25	27	852	27,711
1970	25,086	127	3,645	431	1,301	96	25	35	725	31,471
1971	30,365	100	5,056	658	1,983	86	35	80	1,750	40,113
1972	41,407	148	7,976	922	3,466	112	70	146	1,758	56,005
1973 ^a	38,570	170	9,332	1,214	2,271	150	109	153	963	52,932

Source: Dept. of Revenue and Taxation, Government of Guam.

^apreliminary figures.

TABLE 11

Projected 1975 Emission Inventory of Air Pollutants with the Application of Control Strategy

SOURCE CATEGORY	EMISSIONS ^a				Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
	Particulates	Sulfur Oxides ^b					
FUEL COMBUSTION, STATIONARY SOURCES	1,532,889	42,215,899 (59,567,604)			1,950,923	1,450,330	24,097,685
PROCESS LOSS (other industrial activities)	2,189,733	1,035,000 (1,035,000)			65,550,000	11,644,370	103,500
TRANSPORTATION	1,137,334	536,870 (536,870)			61,180,910	9,298,232	6,715,483
TOTALS	4,859,956	43,787,769 (68,875,478)			128,681,833	22,392,932	30,916,668

Source: (1)

^aEmissions expressed as pounds per year.^bNumbers in parentheses give estimates without the application of control strategy.

TECHNOLOGICAL ALTERNATIVES FOR SELECTED PROBLEMS

Some of Guam's most pressing environmental problems are solid waste, energy, transportation, and sewage. This chapter will consider these problems and discuss various technological alternatives that are deemed feasible. The emphasis is on long-term solutions rather than on alternative emergency measures that are regarded as temporary solutions.

SOLID WASTE

Solid waste includes anything that would normally be consigned to the garbage can (food scraps, tin cans, packaging, rags, lawn and garden refuse) and other larger items (furniture, appliances, cars, construction debris). It does not include sewage (household and industrial liquid waste).

A number of alternatives (1) exist for disposal of solid waste:

- 1) deposit solid waste on the land (dump or sanitary landfill);
- 2) deposit it in the ocean;
- 3) incinerate it and then deposit the residue on land or in the ocean;
- 4) separate what can be recycled (rag, paper, metallic articles, glass) and deposit the rest on land or in the ocean;
- 5) divide it as in #4; then further separate the combustible organics for:
 - a. discharge to the atmosphere by incineration and deposition of the residue on land or in the sea or,
 - b. composting of the solid waste for return to the land separate from the land- or sea-bound portions or,
 - c. pyrolyzation to produce useful raw materials and residues.

Alternatives 1 through 3 do not make it possible to recycle any portion of the solid waste and will not be considered further. (Alternative #1 is the present means of solid waste disposal on Guam.) Recycling, (#4), combined with constructive use of the organic portion, (#5), seems to be the most desirable alternative. A brief description of the three processes of item #5 follows:

- a. Incineration can be used simply as a means of decreasing the volume of the residue or it can be used as a means of power generation (2). Refuse can be shredded and used to replace up to 20 percent of the fuel (coal) in a boiler. Pilot projects have successfully demonstrated that refuse may be used as a source of a low grade gas or oil (called garboil) and has nearly 60 percent as much heat content as number 6 fuel oil.
- b. The chief use of composted refuse is as a soil additive. According to R. R. Grimstead (3):

Composting is essentially biological oxidation of the organic constituents of trash to relatively stable compounds. Trash is usually ground or shredded and allowed to cure, either in windrows which are turned occasionally over a several week period, or for three to five days in a large, slowly rotating, horizontal cylinder. Sewage sludge is often added to provide moisture and nutrients which aid in the composting process.

- c. Pyrolysis systems, according to Grimstead (4), are:

... all based on the central concept of heating the waste with little or no air to about 500°C. The products are a residue of charcoal and mineral materials, and a mixture of organic gases and liquids; all of the products except the mineral materials can be burned as fuel.

Pyrolysis systems have been considered for use in New York, N.Y., Baltimore, Md., Mt. Vernon, N.Y., and probably other cities as well. All systems use a portion of the products of the process to provide fuel for operation of the system. Usually, the inorganic portion (ferrous metals and glass) is separated from the solid waste. This is done either before or after the pyrolysis process. The residue from the process can either be deposited in a landfill, if in solid form, or sold as fuel.

In addition to the above, a complete recycling system that processes raw garbage is manufactured by the Black Clawson Company (4). This process involves forming a pulp of trash and water. Large non-disintegrating objects are separated mechanically. Finally, cellulose fibers are caught on a fine screen. These fibers are used by the paper industry instead of virgin fiber from wood pulp.

In adopting a recycling system, one must consider not only the potential value of the end products, but also such factors as the cost of separating the trash into its components, the market for these components, and the difficulty of disposing of the residue of the process.

In its Beverage Container Report (5) of May 1974, the Guam Environmental Protection Agency recommended, "... that the alternative which combines a tax on all beverage containers with monies used for a permanent government litter pick-up program, redemption centers, public education, increased enforcement, and long range solid waste recovery facilities is best." This is an excellent proposal because it not only takes the short range step of removing litter, but also it encourages the reuse of returnable bottles through the establishment of redemption centers and provides for a study of the establishment of redemption centers for aluminum cans.

Aluminum cans have a salvage value of about \$.02/lb. on Guam at Island Equipment Company, which also salvages other non-ferrous scrap. This is much less than the \$.10/lb. that was publicized on the mainland by the Reynolds Aluminum Company in about 1970. In order to provide an incentive for a voluntary aluminum recycling program, a significant deposit would have to be added to the price of the beverage.

In the past, junk cars have been salvaged on Guam. Laws now prohibit both the storage of junk cars in certain convenient areas and the burning of the combustible portion of the vehicles' interiors. The effect of these laws is to inhibit salvage of junk cars. Thus, Guam is faced with the problem of ecologically-motivated legislation contributing to a new ecological problem. A study should be made of this problem and a compromise proposed.

It appears that ferrous scrap is no longer salvaged on Guam. However, as is the case with junk cars, ferrous scrap markets do exist in the Orient. Further study is indicated. Cardboard is now being salvaged on Guam to a limited extent, but there is a lack of exact data on this kind of salvage activity. The feasibility of recycling newsprint and other waste paper should be investigated.

ENERGY

Guam and other Pacific islands are blessed with generous amounts of three non-depletable sources of energy: sun, wind, and water. Presently, Guam relies almost solely on the burning of fossil fuels as its source of energy. In view of increasing fossil fuel shortages (and consequent rising prices) and the thermal and air pollution associated with this energy source, it seems wise to investigate the feasibility of using one or more of the above "free", non-polluting, non-depletable energy sources (6).

The largest portion of the Guam homeowner's power bill is caused by the use of electric water heaters and air conditioners. Because Guam is near the equator and has clear skies, it is ideally located for the use of solar water heaters. They can be either simple or complex. Usually, a solar water heater consists of a grid of pipes for heating the water and a storage tank. Guam already has some solar heaters in use. An experimental heater was designed and built by the students and staff of the Guam Vocational-Technical School. A low cost heater is presently being developed by the Guam Energy Office as part of a larger project involving non-depletable sources of

energy. Two commercial manufacturers, Japanese¹ and Australian², have local distributors and a number of the Australian units are operating successfully on Guam.

Solar air conditioners usually operate on the same principle as the gas-powered absorption cycle refrigerator (7). An experimental model has been operating successfully in the home of Dr. G.O.G. Lof, Director of the Solar Applications Laboratory at the Colorado State University, and another will be part of a demonstration "solar house" being built at the same university (8). Another solar cooling unit is under development at the University of Colorado (9). Solar air conditioners (and refrigerators that would use the same principle) are not yet commercially available.

The second non-depletable and plentiful resource available to Guam is wind. The most familiar types of windmills are the large Dutch type used for pumping water and grinding grain, and the relatively small multivane pumpers that were common in the Midwest and elsewhere in the U.S. a few decades ago. Small wind generators (10 kilowatts or less) have been used for generating power in remote areas (10), and larger ones (100 to 200 kilowatts) have been tied into power grids that supply urban areas (11, 12).

Small wind power systems are most suitable (economical) in areas that 1) are windy, 2) are far removed from sources of cheap central power, and 3) are relatively inaccessible for refueling. These systems usually include a bank of batteries that provide uniform power during periods of diminished wind speed. According to M. F. Merriam (13):

Island applications would seem especially appropriate. The wind is usually strong, central station power is absent or expensive, and fuel transport is expensive. Moreover, island ecologies are fragile and limited, and wind power, by its very nature, is non-polluting.

The direct incorporation of large wind generators into an urban power grid merits consideration if adequate wind velocities exist (14). Because of the varying power output of a single wind generator, it is not possible to use it as the sole source of power. The use of a large wind generator can, however, significantly diminish the requirements for fossil fuels. The capital cost per kilowatt-hour for a single wind generator is roughly comparable with that of a nuclear power plant. The capital costs for a fossil fuel plant are 20 to 40 percent less than for nuclear plants (11). However, operating costs for a wind generator are very low.

The most promising method of large-scale power generation for tropical island areas involves utilizing the temperature difference between surface water (approximately 25° to 30°C) and water from depths of 4000 ft. or more (4° to 7°C). In the process of using deep water to cool surface water, low pressure steam is generated. The steam can be used to operate turbines. The cold water condenses the steam, making fresh water, and the now-heated deep water, which is rich in nutrients, may be used to grow algae and shellfish. This is one geothermal means of producing power.

The Lamont-Doherty Laboratory of Columbia University has designed such an experimental plant on St. Croix in the Virgin Islands. The Lamont study is successfully producing shellfish and crustaceans with deep sea water (15). Another study has indicated that, in view of continually increasing oil prices, geothermal power plants may be economically feasible (16).

A different type of geothermal power plant utilizes the steam generated by subterranean heat (17). The northern Marianas are probably suitable for the adoption of this type of power generation because of the volcanic activity there. It is not known whether there is sufficient subterranean heat to justify the construction of this type of power plant on Guam.

Tidal changes and wave motion have also been proposed as a means of power generation. Both of these approaches would probably require the destruction of large portions of the reef area. It is believed that the tidal variation on Guam may not be sufficient for power generation.

¹Sekisui Chemical Co., Ltd.; products distributed by Jack Peters & Co., Inc., P.O. Box CR, Agana.

²Beasley Industries Pty. Ltd.; products distributed by J & G Modular Homes, Inc., P.O. Box 7930, Tamuning.

TRANSPORTATION

The change from a subsistence economy to a money-based economy has resulted in a need for increased mobility on Guam. In a five-year period ending in 1973, the number of registered motor vehicles doubled, reaching a total of almost 53,000. The results were traffic problems and potential air pollution problems in congested areas (see Chapt. 6). An increasing amount of valuable land has been allocated to widening existing roads or to building new ones. The impact of highways on land-use patterns was discussed in Chapt. 3. Guam continues to rely on a one or two person per vehicle transportation pattern. It is desirable to halt this trend and to explore alternate means of transportation.

The Department of Public Works has proposed a bus transit system (18) that would provide an alternate mode of islandwide transportation. Among the advantages of this system would be 1) at least minimum service to all districts of the island, 2) reduced traffic on primary roadways, 3) alleviation of parking problems in Agana, 4) reduced overall fuel consumption, and 5) provision of transportation for the poor, elderly, and handicapped. A bus system would have the adverse environmental effect of requiring allocation of land both for parking lots (five acres) and for a passenger terminal (5,000 square feet).

If a bus system were provided, traffic congestion could be further reduced by constructing an elevated fixed-rail mass transit system within the heavily travelled business areas. Buses would then serve as a feeder system to transport people from outlying residential areas to business areas (possibly even eliminating the need for owning a car, as is true of many U.S. families who reside in areas serviced by a comprehensive mass transit system). Due to the permanence of an elevated system socio-political factors (19) should be considered in addition to technical, economic, and environmental ones when the feasibility of a fixed-rail system is investigated.

Other transportation systems have been suggested, such as a north-south freeway in the center of the island or a highway on the reef. Both of these alternatives perpetuate the traffic and air pollution problems discussed earlier. The latter poses extreme engineering problems in making such a structure typhoon-proof and would inflict virtually total destruction on reef ecosystems.

SEWAGE

Sewage is commonly regarded as something to be collected, treated (perhaps), and disposed of as expeditiously as possible. This approach is well documented in sanitation engineering textbooks (20) and will not be discussed here.

The journal Compost Science (21) reported that:

Good farmers for centuries have observed the beneficial effects of organic wastes returned to the soil. Before man was either a farmer or a hunter, mother nature used recycled organic wastes to maintain the productivity of the forest, the grasslands, and the sea. It was - and is - the only way life continues on earth.

Only in recent years has man had the advanced technology to temporarily short-circuit the natural cycle of life. Within the last generation he has become less conscious of returning his wastes to the land from which he gleaned them and has instead dumped them in oceans, rivers, streams, landfills, burned them or simply allowed them to accumulate.

The result of these "throw-away" processes is increased pollution of land, air, and water. However, a number of technically feasible methods of recycling sewage do exist. Among them are irrigation with treated waste water, sludge farming, and methane generation.

An experiment that began in May 1963 and continues today involves sprinkling treated waste water in amounts varying up to 4 inches per week on experimental agricultural and

wooded plots near the Pennsylvania State University. The object of the experiment was to determine "whether the soil and plants could transform the waste water to potable water quality" (22). (The waste water had previously undergone primary and secondary treatment and had been chlorinated.) The experiment has shown that the growth rate of both crops and young trees increases; that the soil is efficient in absorbing a large percentage of the phosphorous (responsible for the eutrophication, or overfertilization, of streams and lakes), nitrogen, and other pollutants found in waste water; and that the ground water continues to be of good quality and increased in quantity. Similar experiments performed elsewhere confirm these findings (23).

According to M. B. Kirkham (24):

The disposal of sludge [solid residue] from waste water treatment plants is the most difficult and increasingly costly problem confronting sanitary district staffs. The traditional means of sludge handling and disposal are 1) ocean disposal through barging or pipeline transport, 2) dewatering and drying with disposal in a landfill, 3) incineration, and 4) lagooning. These means of disposal only displace the wastes and do not get rid of them. Dried sludge sometimes can be sold or given away as fertilizer, but drying is expensive. Land application of wet sludge is another method of disposal which is economical and solves the disposal problem in a beneficial way.

The action of sludge on the land is similar to that of treated waste water. However, the deposition of sludge requires less area. A city of 100,000 would require approximately 2,000 acres to dispose of its domestic sewage by infiltration; it would require only 180 acres to take care of its sludge (25).

H. L. Bohn (26) reported that:

Organic waste, even dilute sewage, will spontaneously yield methane (natural gas) without adding any other substances, and water is necessary rather than limiting. What actually happens is that, in the absence of oxygen, microorganisms transform the wastes into methane. Called anaerobic digestion by sanitary engineers, this microbial fermentation yields a gaseous mixture of up to 72 percent methane, 25 percent or more carbon dioxide, ammonia, hydrogen, plus small amounts of other gases such as mercaptans and amines. Between 50 and 80 percent of the organic matter is transformed into volatile products. The remaining 20 to 50 percent - sludge - would have to be disposed of by incineration, land spreading (fertilization), and land fill, as our solid waste is now treated. The sludge could also be used in the Bureau of Mines process to make fuel oil. The water remaining after anaerobic digestion requires conventional sewage treatment to remove its oxidizable components.

The importance of this source of methane is that methane is being used in increasingly greater amounts compared to coal and petroleum because it is relatively pollution free. It is easily cleaned of potential pollutants, produces no ash, and combustion is far more complete than with coal or petroleum.

Methane generation can be used in conjunction with the previously described methods for recycling waste water and sludge. It is noted that one pound of organic waste will generate approximately ten cubic feet of methane gas.

On an individual basis, the citizen can take measures to minimize his water consumption and thereby reduce the amount of waste water that must be treated. One device that helps achieve this objective is a dry toilet (27) developed by a Swedish engineer. It is safe, odorless and, in a year's time, produces a fine quality compost from kitchen scraps and toilet waste.

As sanitation systems are developed for Guam, their object should be to recycle sewage rather than to dispose of it. This goal can be achieved by adopting, in whole or in part, any of the methods described above or by adopting similar methods.

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ENVIRONMENTAL OVERVIEW

Many of the problems discussed in the preceding chapters are clearly by-products of growth on the island--growth of the population, expansion of economic activity, increased construction, intensified demands on public utilities. Increasing numbers of people with an increasing per capita output of solid wastes create a growing need for sanitary landfill areas. However, the total land area of the island is limited, and, as described in Chapter 3, the land available and suitable for sanitary landfills is only a small percentage of the total land area. Moreover, the use of land for sanitary landfills precludes its availability for most other beneficial uses. In some cases, highways, sewers, water-supply systems, and power-generating facilities are also strained almost to the breaking-point.

Clearly, the number of people who can physically exist on Guam is much greater than the number living on the island in 1975. Singapore and Hong Kong are often cited as examples of the large number of people able to exist in a limited land area. However, a change in life styles among the people of Guam would occur if Guam's population were to reach Singapore or Hong Kong proportions. Guam's citizens must ask themselves if they want their island to be predominantly urban. As the island becomes more crowded, the maintenance of clean air and clean water, and freedom of access to open spaces and shorelines become more difficult and more expensive. This in turn places a strain on the Island Spirit.

The people of Guam cannot escape the fact that increased growth leads to increased environmental deterioration. The deterioration of environmental quality is not occurring overnight; in many cases it is coming about gradually and is therefore not obvious. One important lesson of ecology, as well as economics, is that it is impossible to have something for nothing. There are no power plants that are non-polluting and there are no technological activities that are free of environmental cost. Hidden costs can be absorbed for a while with no apparent damage, but we now understand that if we are to have, for example, an abundance of clean water, we must protect the freshwater lens in the northern plateau. It is not possible to have limitless development there and have an abundance of cheap water as well. If water conservation areas are not set aside now, if there is continuing encroachment upon the area overlying the heart of the lens system, it will eventually be necessary to look for alternate, more expensive sources of water. Could the cost of clean water eventually take as large a proportion of individual incomes as does the cost of electricity? Guam's natural resources are not inexhaustible, even with improved technology.

Economic growth is regarded as beneficial in terms of more jobs and increased financial security for individual citizens. In light of the fact that economic growth also has environmental and other costs, the people of Guam must ask themselves how much growth is enough? At what point do the disadvantages of growth outweigh the advantages? This is an issue which should receive the widest possible public attention and discussion.

It is now official Government of Guam policy to preserve part of the Guamanian heritage through legal protection of historical sites threatened by construction projects and other activities. The government acted for the good of the majority at the cost of limiting private business activity. The conflict between the public interest and the interests of private businessmen has been recognized and presumably resolved in this case. The choice has been made with limited information available but still with some idea of the costs as well as the benefits of the policy. Can this serve as a model for environmental protection? Is Guam's environment as much a part of its heritage as are historical sites?

Planning and decision making must include effective cost accounting. This should incorporate an evaluation of likely environmental costs and benefits as well as economic and social costs and benefits. For example, as long as clean air is regarded as a free and inexhaustible resource it is unlikely that provisions will be made to spend the necessary money to keep air clean when a power plant is built. If cooling-

water for such a plant is regarded as a "free" resource, with no thought taken of the environmental costs of dumping heated water back into the environment, it is unlikely that provisions will be made for minimizing the problem when new facilities are designed. Why shouldn't environmental costs be included as a routine part of planning procedures just as the costs of materials and labor are considered? Why shouldn't environmental values be included just as technological values are considered in the cost-accounting procedures of engineers and planners? It is only when a thorough accounting of costs and benefits is made in evaluating technological activities that we can hope to have a realistic understanding of the impact of those activities.

It is obvious that there are no easy answers to Guam's environmental problems. Most of the problems that have been discussed are extremely complex ones. Decisions must be examined from the standpoint of the compromises between conflicting interests that might be involved. It is unlikely that all of the problems will be solved to everyone's satisfaction, since most solutions will have their good and bad points and will appear to favor some interests over other equally legitimate interests. The best approach would seem to be to gather as much information as possible on all proposed solutions and to try to understand what the advantages and disadvantages are for each alternative before a decision is made. In particular, overall policies and trends and their projected consequences should be the subject of more public discussion.

Most of the compromises center around conflicting demands for the use of limited resources. Solutions are not easy to achieve. For example, the substitution of wind power for electrical power generated by fossil fuels would no doubt have benefits in terms of reduced air pollution and reduced thermal pollution in the marine environment, but what would be the amount of land required to build the proper structures to harness the wind economically? What would be the visual and aesthetic impact of many windmills scattered about the island? Windmills are considered an aesthetically pleasing part of the landscape in the Netherlands, particularly since windmills have become less common, but would they be pleasing to look at in modern Guam? As another example, the development of an aquaculture industry is perceived by many to be desirable and of economic benefit to the island, but what would be the cost in terms of river banks and reef flats that would have to be modified for this industry and placed off-limits for other beneficial uses such as recreation or resort development?

A number of other compromises should receive extensive public attention and discussion:

Is it better to have widespread single-family dwelling units that require large land areas so that each family has its own little patch of green? Or is it better to concentrate apartments in multiple-household units that require less land and allow other land to be set aside as open spaces where people may go for recreation?

Can Guam have continued economic growth and increasing participation in a westernized society and, at the same time, retain traditional culture and values?

Should the Government of Guam encourage continued population growth and increased urbanization, which would then involve increased demands for public utilities and large expenditures of public monies, or should population growth and dollar flows be limited, including dollar flows required for public services?

Should pollution sources such as sewage outfalls be dispersed so that they are located all along the periphery of the island or should pollution sources be confined to limited areas where pollution concentrations would be high? Is it better to concentrate sewage in one place or disperse it?

How is the Government of Guam to choose among various industries and activities that require shoreline utilization? Hotels, recreation areas, conservation areas, boat basins, power plants, sewage-treatment plants, and aquaculture ponds all require shore locations. Which of these, or which combinations of these, are to be allowed and which are to be disallowed? All of them presumably have some benefits to the public and all of them involve some environmental costs.

Should the government try to preserve the water lens in northern Guam, or should unlimited housing developments and agricultural activity be allowed there? Should the government depend upon the development of alternate (more expensive) water resources in the future?

What are the environmental impacts and other indirect effects of tax rebates granted to new industries?

Can Guam realistically expect to develop industries that require large quantities of water and also exploit other resources, or should encouragement of industry be limited to carefully selected ones that make comparatively smaller demands on resources?

Will the people of Guam continue to require large amounts of land area for solid-waste disposal? Will they try to minimize the problem through the encouragement of other, possibly more expensive, alternatives? Or will they attempt to limit population growth and the attendant increase in areas needed for solid-waste disposal? Will more and more areas of land be committed to ever-expanding airport facilities, power plants, sewage-treatment plants, and highways, or will there be some attempt to limit the demands for these structures?

Is there a conflict between federal, especially military, interests on the one hand, and local interests on the other hand? If so, are the citizens of Guam willing to give up the economic benefits derived from federal activities?

Can Guam achieve a balance between short-range interests, with perceived immediate benefits, and long-term interests with supposed future benefits?

Since increased beach access means increased beach destruction, what can be done to minimize the problem?

Does protection of the public interest mean less freedom for individuals? Can the government balance environmental needs of the majority with individual land-owner rights? Can the government resolve the conflict between public access and public abuse?

Given that new industries mean new sources of pollution, can Guam achieve a healthy balance between industrial growth and environmental protection? Can pollution regulations be viewed by businessmen as devices for protecting the public interest rather than as devices that hamper commercial interests?

Has a rise in fuel prices led to a corresponding conservation of energy by individuals?

How can the economic and environmental interests of high-income and low-income people be balanced?

How can the conflict between tourist development and the traditional kinds of fishing in Tumon Bay and other areas be balanced?

How can the conflicting requirements of boaters and water skiers be balanced with the needs of swimmers and fishermen?

How can Guam deal with the paradox that development of a tourist industry tends to eliminate the "unspoiled" island image that fostered tourism in the first place?

Many more conflicts and compromises could be enumerated. Each reader can undoubtedly furnish other examples of his own.

Probably the best way to balance conflicts, understand compromises, and arrive at thorough cost accounting that includes environmental considerations, as well as other important considerations, is to institute effective master planning, or comprehensive planning. While comprehensive planning is not a magic solution to Guam's problems, it is essential if the future direction of Guam's growth is to be controlled and guided rather than allowed to develop haphazardly. The Bordallo administration, which took office in January 1975, created an office that is responsible for comprehensive planning. It is still too early to evaluate the impact of this office.

Any truly comprehensive planning effort must include the military on Guam. An activity that controls one-third of the island's land area in a centralized authority is obviously a key element. There is, however, the difficulty that military officials are reluctant to discuss their long-range plans with non-military island officials. The conflict between military and non-military requirements will probably never be completely resolved on Guam, at least as long as there is a major military presence on the island, but there must be continuing efforts to seek cooperation since the success of comprehensive planning depends on cooperation. Could there be comprehensive planning for the Mariana Islands generally rather than for Guam alone? Certainly this point has important implications from the standpoint of long-range military planning.

While there has been a great deal said about the negative impacts of military land use on Guam, there are some positive considerations as well. Many of the military lands are presently not utilized or are utilized only to a limited degree. Hence, these lands serve as de facto conservation areas in some cases. Moreover, there are many who would contend that the military organizations are better caretakers of their land resources than are private owners or the Government of Guam. The military is more effective in enforcing poaching regulations on their land than the Government of Guam is in enforcement on non-military land. In the case of beach clean-up, the results are obvious even to the most casual observer. Military beaches are generally free of litter and are well cared for, while public beaches under the control of the Government of Guam are often littered to the point of being unsafe or unpleasant to walk on because of broken glass, rusty cans, and other debris. Some local governmental authorities have sought to have military beaches opened to general use, but little evidence of maintenance of what is already available to the general public can be presented. There is no guarantee that future military activities will not involve more intensive land use and lead to the destruction of de facto conservation areas.

Federal law requires environmental impact statements for federal projects and for projects that receive federal funding. Many states have adopted similar laws. The Territory of Guam has not enacted such laws, yet environmental assessments are an important aspect of comprehensive planning. Consideration should be given to local legislation in this area.

Ideally, comprehensive planning will help Guam's citizens arrive at a set of overall priorities for the island's development. Since Guam's resources are limited, the people should try to decide what they need or desire most and focus on those things. Comprehensive planning should be an ever-changing, dynamic process that is continually updated and refined. A sustained effort is required.

A major feature of much of the preceding discussion has been the key role of land-use patterns as they affect environmental enhancement and degradation on Guam. Land use, more than any other element, determines Guam's future environmental quality. Land use not only directly affects land resources but also indirectly affects freshwater, marine, and air resources as well. Any long-range planning for environmental protection must have land-use controls as one important aspect. Land-use controls can be accomplished partially through zoning and other legal considerations, but must also take into account the development of utilities, highways, housing, and business. Land use and its control are common to all the other parts of this study: legal, political, social, and economic.

Land use is also one point where conflicts are likely to arise between the concepts of government controls, on the one hand, and individual landowner rights, on the other hand. Private property rights are a basic part of the American system, yet the public welfare often seems to require increasing controls over individual property rights. This is likely to be an area of continuous conflict which must somehow be resolved if Guam's growth is to be orderly and planned. Since the same conflict is presently being debated in the U.S., Government of Guam officials need to keep in touch with what is happening there.

Garrett Hardin (1) has written of the "tragedy of the commons." He considered the cost-benefit ratio of individual actions when persons take actions which benefit them individually as they use some common resource (such as air, reef fish, swimming areas, beaches), but which cost the public interest in the long run. An individual's actions may be beneficial to himself in terms of the benefits gained from the use of a common resource, but the collective effect of a large number of such individual actions may

be to destroy the resource. Ultimately, everybody loses use of the resource; yet every individual, acting as an individual with no thought of the public good, benefits at least marginally. By the time the negative impacts of the large number of individual actions are realized, the common resource may be irreversibly degraded. Even if it is not, it is extremely difficult for the government, acting as the agent of the public good, to enforce changes in individual actions that will preserve the resource on a sustained-yield basis. This is the tragedy of the commons. It is a question of the long-term public good versus the short-term individual benefit.

The tragedy of the commons exists on Guam. Consider the reef fish, for example. Will fishermen be allowed to overfish their resource to its extinction, or will they or the government limit their take to a level that can be permanently maintained? Why not go ahead and fish out what is presently available without worrying about the future, since it is entirely possible that the favorable habitat will eventually be destroyed in any case? What assurance is there that the individual who limits his impact on the environment, through either conscious or unconscious decision, will benefit from this self-control in the future? Why worry about a compromise of immediate versus long-term interests if you or your heirs might lose the long-term benefits anyway? What motivation is there for citizens, either individually or collectively, to adopt a long-term viewpoint if they are not the ones who will benefit? Governmental action appears to be the only way to insure long-term interests in many cases.

Many times environmental insults (as well as negative impacts in the economic, cultural, and social realms) are not caused by willful intent but by ignorance or negligence on the part of persons charged with the responsibility of accomplishing specific tasks. An example is provided by the destruction in 1973 of an area of live coral on the Piti reef flat near the USO Club. (See Dredging and Filling section of Chapt. 5.) The public interest was not served; indeed, the public interest was harmed in this case. The government agency responsible for enforcing the terms of the dredging permit and protecting the public interest (the Corps of Engineers) levied no penalty against the contractor; consequently, there was no incentive for the company to avoid similar negligence in future activities.

It can be readily seen that, although the specific concern here is environmental problems, the important decisions to be made are public decisions. The basic limits can be defined by ecologists or other environmentally knowledgeable individuals, but the decisions themselves are social and political decisions and should be made by a majority of public opinion. This requires that the public be informed and have the necessary knowledge to evaluate information. The public cannot be expected to make wise decisions in no-information situations. Instead, the public must be provided the advantage of education. A key issue in environmental problems on Guam is how to get the public involved in decision making. This point is not unique to the environmental part of this report, of course, since it has bearing on all the other parts as well.

Hence, we come to the idea of the key role of education. Informed decisions require relevant information and the ability to evaluate information. As society and technology become more complex, and as the environmental systems around us are found to work in ever more subtle ways than we realized, the role of education becomes increasingly important. However, education cannot be provided by only the school system and university. Education must also depend on those individuals and institutions which possess special expertise in various areas. There are a large number of government agencies that have expertise in diverse areas. Surely it is to the public advantage that these agencies have public education as their mandate along with their other duties. Furthermore, this places a responsibility on the press, television, and radio since the media serve as the major source of non-formal education for most citizens. The role of the media as a primary educator on Guam is thus seen as a key factor. The stress on education is an appropriate way to end this report.

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PART VI. SOCIO-CULTURAL ISSUES

by

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OVERVIEW

Walter Scott Wilson

Part VI of this volume attempts to provide a picture of present-day Guam from the perspectives of the behavioral and social sciences. Guam is a modern, heterogeneous, cosmopolitan, and urban society. Although it is bounded by the sea on all sides, Guam cannot be understood in isolation. Guam is an unincorporated territory of the United States. Decisions made in Washington, D.C., 8,000 miles away, affect the people on Guam and their ability to make a living. At present, Guam imports over 90% of the food that is eaten on the island. The economy of Guam is dependent upon military expenditures on the island and, to a lesser degree, upon the tourist industry which is only a few years old.

Despite Guam's present dependence on outside forces, the time when Guam was virtually self-sufficient in food is within the memory of many people on the island. Two chapters in Part VI deal primarily with history. Wilson, in Chapter VI-2, outlines the history of cultural influences on the population of Guam. The science of anthropology tells us that population, culture, and language may vary independently of one another. Guam is good evidence of this. In Wilson's chapter we find that an almost complete change in the physical make-up of the Guam population has occurred over the centuries; however, despite severe depopulation and colonization by Spanish, Mexican, and Filipino elements, some aspects of culture and the basic language of the ancient Chamorro have remained.

The other chapter that deals primarily with history is Chapter VI-3 by Haverlandt. In his in-depth analysis of 450 years of economic history on Guam, Haverlandt argues that many of the economic attitudes and values of the Guamanian people are traceable to the ancient system in which man and nature existed in essential harmony for a period of at least 3,000 years. This harmony was disrupted first by the Spanish, then by the Americans, and later by the Japanese. The original attitudes and values have been modified by cultural adaptations that were developed in response to the forces of the colonial powers that dominated Guam. Haverlandt's ideas will undoubtedly lead to further examination of the economic history of Guam.

Klimek, in Chapter VI-4, examines the modern Guamanian family and household. He has found that the residential arrangements of Guamanian families are becoming similar to those of modern U.S. society. The typical household consists of father, mother, and unmarried children. There are exceptions, however, as many households contain relatives outside of this nuclear family group. One aspect not measured in the survey was the presence of related families in the immediate neighborhood; this would be high in the more "traditional" villages on Guam.

Despite the apparent similarity to U.S. residential patterns, Guamanian families are still tied by networks of reciprocal obligations. This feature of Guamanian family life is mentioned by Klimek, Wilson, and Haverlandt in their chapters. Klimek also reports that many of the traditional tasks of the old subsistence economy are still performed by Guamanian householders and that the division of labor in the household still appears to be traditional.

In the future, it will be interesting to see whether the extended-family ties survive the changes in technology and economy. Because Guam is an island that is limited in area and because families on Guam are near enough to one another for frequent visiting, some of the effects of modernization may be modified. In interpreting what Klimek has reported about U.S., Filipino, and Trust Territory families on Guam, the position of these groups as marginal to the rest of the community would affect their responses. Non-Guamanian families here would tend to find themselves isolated from the networks of kinship of which they would be a part in their communities of origin.

Lynn, in her examination of ethnic relations on Guam in Chapter VI-5, points up a situation which could cause tremendous social problems in the future. At present on

Guam there are a number of identifiable (at least to the local resident) ethnic groups. There is already discernible intergroup tension which is, however, mitigated by patterns of politeness and traditions of hospitality. In the past, Guam has been able to integrate its population of diverse physical and cultural backgrounds. The names of "Guamanian" families such as Underwood, Butler, Sgambelluri, Tanaka, and others testify to this ability. The task of integrating the present population under modern conditions is a great challenge.

In Chapter VI-6, Robinson discusses the role of the artist on Guam and warns us that the indigenous art of Guam, which was functionally integrated into the production of material culture in the past, is now in great danger of being completely lost if it has not already disappeared. Whatever else is clear, it is certain that if there is to be a viable local art, the local artist will have to find new ways to function. Perhaps the work of Western and Oriental artists, inspired by island artistic forms, may provide the role models for local artists who may then establish a new and locally-based revival of the arts.

Although it was impossible to include the many pages of statistics and analysis which would have been required to give an adequate picture of crime and delinquency on Guam, Chapter VI-7 by Ritchie, which constitutes a recommendation for building a police-community relationship, has been included. Not only does Guam need new technology to detect and preserve evidence of crimes which have been committed and to bring criminals to justice, there is also a need for ways to prevent crimes and to identify problems before they get out of control. When Guam was a small isolated community in which everyone knew the other members of their community and the character of each person was well known, crime was a problem of human dimensions. With growth of the population, increase in wealth, improvement in transportation, and loss of identity of large segments of the community, crime has grown out of proportion. Ritchie's proposal offers a way to utilize human relations in a new context to come to grips with the problem.

In Chapter VI-8, which analyzes values on Guam, Wilson has found that Guamanians put a high value on religion, family life, and land and that they have a favorable attitude toward government and the military. Modernization is perceived as a good thing and most changes seem to be for the better. Guamanians are not completely in favor of tourism. He reports that Guamanians identify closely with their land and their religion. They feel affected by and have positive feelings toward the Government of Guam. What the military does affects them as does the tourist industry. Present-day living appears to be better in some ways, but there is still a feeling that many good customs are being lost. There is a positive attitude toward the Chamorro language and it is agreed that Chamorro as well as English should be used in the schools.

The Guamanians have a strong feeling of respect for elders and for authority in general; however, authority figures are not always to be obeyed. Guamanians do not always feel that people should do what their religious leaders tell them. The government is perceived as working in the interests of the people, but is seen as having too much power. Guamanians tended to agree that business, tourism, and immigration should be controlled, and appear to look to the government to exercise these controls. There does not appear to be much concern about Guam's environment; Guamanians tend to trust the government to protect the environment. The general process of modernization, however, is seen as a threat to the beauty of Guam.

Jennison-Nolan's analysis of North-South value differences on Guam, Chapter VI-9, reveals that these differences were consistently the reverse of what would be expected. The Guamanians residing away from the more rural and relatively isolated villages were apparently more "traditional" in their responses. This finding leads us to believe that the Guamanians living in the more urban heterogeneous areas feel that their values are threatened whereas in the southern villages there is no feeling of an impending loss of traditional values.

Since the inception of this interdisciplinary research project and before the first results have reached print, Guam has undergone a number of crises. First, as the study was being designed, the oil embargo created an acute gasoline shortage and resulted in a sharp increase in the cost of energy. Second, inflation and the recession in the U.S. and in other countries made itself felt on Guam. Third, the Vietnam collapse and the use of Guam as a stopping-off point for refugees has created uncertainty.

Finally, the accumulated result of these events has been the fiscal crisis in the Government of Guam.

At such times, when events of the present loom and thoughts of the future and even the past become more difficult, it is more important than ever to gain a perspective of the past and the future. Guam is truly at a critical point in its development: it is a time when there are not only dangers to be overcome or avoided, but it is a time when there are also opportunities to shape the future--a future which takes into consideration the values and culture of the people of Guam.

HISTORICAL SUMMARY OF CULTURAL INFLUENCES
ON THE PEOPLE OF GUAM

Walter Scott Wilson

THE SETTLEMENT OF GUAM

Guam and the rest of the Mariana Islands were first settled about 1500 B.C., according to Spoehr (1).

There are three reasons for the assumption that the Chamorro people originated in Malaysia and that they came to Guam from the Philippines. The reasons are as follows:

1. the presence of pottery in the Marianas, which was a trait shared with the Western Carolines, but not with the rest of Micronesia;
2. the cultivation of rice, which was not shared with any other cultures in Micronesia;
3. and similarities between the Chamorro and Malayasian languages; although Chamorro is an Austronesian language, it is not closely related to other Austronesian languages in Micronesia.

The Chamorro people of Guam and the other Mariana Islanders had excellent sailing vessels and were able to sail among the islands in the Marianas (2). In spite of occasional contacts, the Marianas were culturally isolated. Although Thompson (3) believes there was an original settlement about 1500 B.C., and that an invasion of latte builders occurred about 900 or 800 B.C., there is little evidence to indicate there was any more than an initial settlement and subsequent cultural additions introduced by the accidental voyagers.

PRECONTACT CULTURE

Little is known of the culture of the early inhabitants of Guam. Further archaeological research and analysis of early contact documents being collected by the Micronesian Area Research Center will enable anthropologists and historians to fill in many of the missing details of the early culture. However, it is known that there were from 40,000 to 100,000 people living on Guam at the time of contact by Magellan (4). The island was divided into a number of independent chieftainships with no overall political authority. Although the Chamorros were probably not warlike, there were battles between rival chiefdoms.

Membership in social groups and inheritance of rank apparently was according to matrilineal principles: that is, women were not in positions of political authority, but rather, a man was affiliated with the same group as his mother and her brothers instead of becoming a member of his father's group. There were three classes or "castes" on Guam and the ranks held by both parents of an individual probably determined the position of a person in this system.

The place in the system defined the types of land rights that an individual could exercise, or perhaps it might be more accurate to say that the types of land rights held by an individual defined his place in the system.

As in other Micronesian social systems, the chief was accorded great respect and was presented with a share of the production of the people who owed him allegiance. The chief used this production to support his own household, to give feasts, and to distribute among his people. In Micronesia generally, class systems were reinforced by highly formal behavior rules which applied to anyone of a lower status coming into contact with one of higher rank.

Another feature of the early culture that was shared by many other Pacific peoples was the men's house. It was not unusual for a village, or part of a village, to have a

men's house in which both unmarried men and married men slept. The men's house usually served a number of purposes. One purpose was to provide a place for bachelors to sleep. Another purpose was to provide a place for meetings and ceremonies. Unmarried girls sometimes stayed in the men's house to administer to the sexual needs of the occupants.

The household group probably consisted of more than one nuclear family, (i.e. more than one set of parents and their children) and was economically self-sufficient. Households were continually engaged in the exchange of food and gifts with other households. According to Thompson (3), these ceremonial exchanges and feasts were competitive as in other parts of the Pacific. The Chamorro custom of an apparently free and easy exchange of property was to cause many misunderstandings with early European visitors.

The staple food of the people was rice. In addition, bananas, breadfruit, taro, yam and other starchy foods were abundant. The ground federico nut was made into flour.

Protein, which supplemented the starchy part of the diet, came from the seas and the rivers. Fish, crab, langusta, shrimp, and other marine products were eaten regularly. There were no land dwelling warm-blooded mammals other than rats and bats. The fruit bat was and still is considered a great delicacy on Guam.

Settlements were small and located along the rivers and coastal areas. In order for a settlement to survive and prosper, it had to have fresh water and access to the sea for fishing. In almost every settlement there were some houses built upon latte stones. These stones consisted of two rows of upright coral or basalt pillars topped with capstones of the same materials. The functions of the lattes are even now not generally known, although historians have evidence that they were the foundations for houses and canoe houses (3). The presence of burials at the latte sites does not argue against the conclusion that they were used as houses because it was common in the Micronesian area to bury people in association with their houses.

Although many of the details about religious beliefs of the early Chamorro people are lost, one extremely important element is known: the belief in the power of ghosts to affect human affairs, which persists to the present day. The Chamorro word for ghost, "Aniti" (5), is similar to words for ghost in other Micronesian languages.

EARLY CONTACT PERIOD

Guam's first contact with the Western world occurred on March 6, 1521 with the landing of Magellan. This occasion ended unhappily. The taking of a boat by the Chamorros led to a reprisal by the Spaniards in which several houses were burned.

The period between 1521 and 1668 was one of sporadic contact with Westerners. Several voyagers visited Guam and a number of sailors settled on Guam during this time. Guam became a stopping point for the galleons which plied between Acapulco and Manila. According to Underwood (4), the population remained stable during this period.

In terms of social organization, the early contact period was one in which the fabric of the society remained intact. Foreigners were not present in numbers that would cause major disruption. Outside contacts added a number of elements to the material culture. Perhaps one of the most important additions was metal. Dogs, pigs, cows, horses, carabao and other domestic animals were also introduced and became a part of the material culture of Guam.

The knowledge of a world beyond Guam and the Marianas had a profound effect on the Chamorro belief system even before conscious outside efforts were made to convert the population.

MISSIONIZATION AND CONTROL

1688 marks the year in which Spanish missionaries and soldiers from Spain and her colonies began to convert the inhabitants of Guam to Christianity. Although the mis-

sionization started peacefully under Father San Vitores, he was soon martyred. Christianization was backed up by the force of arms, which became necessary when the upper classes were offended by the missionaries' insistence upon equality in religious ritual.

One of the most destructive policies of the Spanish was the gathering of converts into central locations where the people would be close to a church. Shortly after 1680, the people of Guam were gathered in six church villages. In 1694 all the inhabitants of the Marianas were moved to Guam and Saipan, except for some holdouts on Rota. In 1698 the people of Saipan were moved to Guam.

The ravages of disease were added to the casualties of war. The Mariana Islanders' slingstones and hand held weapons were no match for Spanish arms, nor were the isolated islanders any match for Western diseases. An influenza epidemic took its toll in 1688, and in 1699 smallpox struck. Typhoons also added to the problems of the people.

By the time the population reached its minimum of 1500 in 1783, traditional features of social organization and many elements of the ancient culture had been lost. The surviving Mariana Islanders were living on Guam, except for a few on Rota. At this time, the indigenous population had been augmented by a number of other elements. In addition to the 1500 Mariana Islanders in 1783, there were also 818 Spanish and their descendants, 648 Filipinos, and 151 soldiers of unspecified nationality (4).

CULTURAL REINTEGRATION

The period from 1787 to 1898 was one in which the population of Guam became reintegrated and new cultural patterns emerged. Some elements of the old Mariana Islands culture were retained. These were the Chamorro language, parts of the old household economy, and many of the ideas regarding the raising of children. The language survived. Many of the colonists married women who spoke Chamorro to their children.

Some of the belief elements of the old culture were blended with outside ideas. The belief in the spirits of the "Taotaomona," or "old people," was consistent with the old beliefs in ghosts. The Chamorro respect for authority was possibly an amalgam of the old respect for and fear of the chief, new respect for the Spanish rulers, and new religious piety.

Elements of culture from Mexico and Spain also became part of the new cultural tradition. Rice as a staple was replaced by corn, which was ground on metates carried from Mexico on the Manila Galleons. Much of the vocabulary of the Chamorro language is Spanish. Spanish culture was the model to be followed in many other ways too. Some elements of Spanish culture did not come directly from Spain, but were modified by Filipino and Mexican elements.

It is impossible to trace the source of all of the cultural traits of the Spanish colonial period. Together, however, they created an integrated society and culture. The center of life in the village was the church. When the men went to work in their fields, they sometimes had to journey for a day or more. The basic economy of Guam was subsistence agriculture. Copra was also produced by households as a cash crop. As in former days, the basic unit of production was the household. Households were augmented by members of the older generation and sometimes by women or men who came to the family by marriage.

Kinship ties extended well beyond the confines of the households and, although the household was nominally self-sufficient, there was extensive sharing and exchange of food between households related by kinship, including marriage and god-parental relationships. Relationships between persons and households formed complex interlocking networks.

Social ties were symbolized and cemented by annual fiestas given in each village for its patron saint. Other social occasions, including marriages, baptisms, and funerals also called for feasts and brought people together from all parts of the island. Each household prepared and served the food at village fiestas and each household was assisted by related households. Fiestas and other special occasions served both to create and to discharge whole systems of obligations between households and individuals. During the

latter part of this period, Carolinians, then Chamorros, began resettling the Northern Marianas.

PREWAR AMERICAN PERIOD

In 1898 during the Spanish American War, the United States took over Guam. The transfer of power was accomplished without bloodshed. The most important cultural result of the transfer of power was that the U.S. Navy, rather than the Spanish Governor, became the leader of the political system. The Northern Marianas and the Caroline Islands were sold by Spain to Germany. At that time, Saipan had a population of about 3,000 Chamorros and Carolinians.

Very little was done to disrupt the integrity of the Guam community and culture under the prewar U.S. administration. The Catholic Church continued in its important role as center of community life and the number of Spanish priests was augmented by priests from the United States. English became the official language for the transaction of official business, but Chamorro was still the dominant language of the people.

In addition to the subsistence economy and copra production, wage work became available with the military establishment. A few families continued to operate small businesses and others also established businesses during this period. Guamanians were given the opportunity to join the U.S. Navy, but opportunities for Guamanians and other minority groups were severely restricted by racial policies then in effect. To supplement the limited educational opportunities afforded by the Catholic Church, the Navy established the beginnings of a public school system.

The Navy Government of Guam placed very little authority in the hands of the people. Nevertheless, the Guamanian people began to acquire a political awareness and a desire to improve their status.

The American influence on the local culture was profound, but there were no traumatic changes to disturb the equilibrium of the society and culture. There developed on Guam in this period a dual community: the local Chamorro community and the U.S. military community. Although there was much interaction between members of both communities, they remained separated by language, culture, and standard of living. This division continues today.

JAPANESE OCCUPATION

The outbreak of war between Japan and the United States in December 1941 shattered Guam's isolation and placed the Japanese in control of Guam after an invasion which the small U.S. force was powerless to resist.

The period from December 1941 to July 1944 was a difficult one for the Guamanian community. Many people were forced to return to their farms and to produce food for the Japanese forces. The people were also drafted as forced laborers. Japanese discipline seemed extremely harsh after almost 50 years of U.S. administration. The Guamanian people remained loyal to the United States.

The Japanese established schools for teaching the Japanese language and culture. In the administration of Guam, the Japanese enlisted the aid of Chamorros from Saipan, which had been under Japanese administration since 1914. The Saipanese were feared and resented by the Guamanians and it was a long time after the war before feelings toward the Saipanese improved.

At first the wartime period involved residential dislocations of the Guamanians and, later, the people were gathered in concentration camps. These acts, along with executions and murders which were especially marked in the final period of occupation, served to increase the cohesiveness of the Guamanian society. The Japanese culture was rejected and resisted by the Guamanians, with the exception of some food items.

U. S. forces invaded Guam on July 21, 1944. In contrast to the weakly resisted Japanese invasion, the U. S. forces were met by firmly entrenched Japanese forces. By August 10, 1944, the island was again secure. The destruction of the capital at Agana was almost complete. What remained of the prewar village was later bulldozed to form the Paseo de Susanna which extends into the shallow lagoon.

The re-occupation of Guam ushered in a radical cultural revolution. Subsistence agriculture all but disappeared as the Guamanians went to work for the U.S. Armed Forces. Much land was taken for military purposes, with very little given in compensation. New residential areas were laid out by military engineers and entire village populations were relocated. Although Guamanian culture would never again be what it had once been, people did return to growing some food in their house yards and at their ranches as things quieted down after the war. The number of military forces on the island did not return to the sleepy prewar level but remained relatively high with a naval station, several communications installations, a naval air station, and an air force base. Although much wartime and postwar construction was temporary, the roadways and utilities were modernized. Carabao carts were supplanted by jeeps and then automobiles. No longer would life on Guam be paced by the speed of walking.

CIVILIAN ADMINISTRATION

In 1946 a civilian government took the place of the military government, but the military establishment continued to exercise control over entry to Guam. For all practical purposes Guam was a military outpost.

In 1950 Guam's status changed from a U.S. possession to an unincorporated territory of the United States. The Organic Act gave Guam's people the status of U.S. citizens.

In addition to the military, another American community became established on Guam. It consisted of U.S. mainlanders, or "Statesiders," who were teachers, administrators, and others working for the Government of Guam. A number of businessmen also became established in the community. The composition of the population will be discussed in another section. Under civilian administration, education and other facilities were expanded for the growing population.

MODERN PERIOD

1962 marked another transition on Guam. Two very important events took place. Perhaps the more significant, although overshadowed by the other, was the rescinding of the requirement of a security clearance to enter Guam. This marked the beginning of a civilian economy and made it possible to develop forms of income not dependent upon expenditures of the military establishment and the federal government. The other event, which was more dramatic, was the destructive Typhoon Karen which killed seven persons and destroyed much of the inadequate, temporary housing and other buildings on the island. This brought forth rehabilitation funds from the federal government that were used for building and modernizing government facilities.

After Typhoon Karen, Guam entered a period of expansion sparked by a boom in construction that has changed and is changing the face of the island.

Unanticipated air traffic to and from the island increased to such an extent that the civilian airport facility dedicated at the Naval Air Station in 1967 became inadequate soon after it was finished.

Tourism has become a major industry on Guam, bringing honeymooning Japanese couples and even some former Japanese soldiers who once occupied Guam.

With numbers of immigrants from the U.S., the Philippines, and other places, the Chamorro population of Guam is becoming a minority. Only time will tell whether or not the new population will be assimilated and form a new Guamanian culture.

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THE GUAMANIAN ECONOMIC EXPERIENCE

R. Otto Haverlandt

INTRODUCTION

There is a story yet to be told about a group of island people who have overcome many incredible pressures. These people have persevered in spite of what some would consider was a continuing situation of intense cultural, political, and economic pressures. Although it might be affirmed that in the 1970s these same people have finally achieved a moderate amount of economic independence, they have done so at the cost of many valued island traditions.

In this analysis, the focus will be upon the evolutionary adaptations these people have made in order to engage in the world of modern wage-based economics. This chapter is an analysis of how a small isolated group coped with three colonizing powers. It is the story of the economic experience of the Guamanian people.

GUAM IN THE 1970s

The setting for this account is a peanut-shaped island located in the path of the trade winds in the Pacific Ocean. Guam is a beautiful tropical island and, when viewed from the marina which is located at the capital of Agana, the ranks of gray cliffs appear to march boldly into the blue Philippine Sea. As one drives southward from Agana the highway soon begins to climb upward through the swordgrass-covered flanks of a volcanic mountain range. To the right, nearly a thousand feet below and too far for one to hear the sounds of the surf, small bays sparkle in the late afternoon sun. The southern towns of Umatac, Merizo, and Inarajan still retain reminders of the past. Some archaeologists believe that the original inhabitants of Guam may have been the first settlers of Micronesia. By the time the Hawaiian Islands had been populated by A.D. 500, the islands of the Marianas had already been inhabited for well over 2000 years.

In terms of modern society, Guam in the 1970s represents an island come of age. In 1973, according to Government of Guam statistics, gross business receipts were \$499 million and total bank deposits amounted to \$272 million; construction gross receipts totaled \$112 million. There were nearly 50,000 automobiles on an island only 212 miles square. Bulldozers had already cleared extensive areas of jungle for numerous housing developments that offered concrete homes in the \$35,000 to \$100,000 price range. Guam in the 1970s is a multi-cultural urban center with all the attendant crime, drug, and inflation problems usually found in modern urban areas. It is also the home of approximately 100,000 people, half of whom are indigenous Guamanian islanders. Who are these people? How have they adapted to the recent economic boom on their island?

From data obtained through two surveys conducted by the University of Guam in 1974 (see Appendices), an economic profile of the average Guamanian family has been constructed. At that time, there was an average of 1.9 wage earners per household. Fewer than 17% of those who were employed indicated that they worked in the private sector of the local economy. Self-employment, retailing, construction, and finance accounted for more than 90% of their participation in the business section. None of the survey respondents worked directly in the tourist industry; less than 1% worked indirectly in this new industry. This is somewhat surprising when one realizes the potential to be developed in serving the more than 100,000 persons who have visited Guam each year since the end of 1970 (1).

On the other hand, 49.7% worked for the Government of Guam, 33% worked as Federal Civil Service employees, or were enlisted in the military service, or had jobs directly related to the U.S. military establishment on the island. Only .3% were engaged in agriculture as their primary means of support. On an island that imports almost all of its food, this represents a situation of serious economic imbalance.

In terms of occupational stratification, 12.9% of the Guamanians in the sample were classified as professional or managerial, 8.2% were in the teaching profession, 26.1% were in sales and clerical work, 10.7% were foremen, and 10.4% were in service work. There were 23.3% skilled laborers, 5% in transportation, 3% in the unskilled labor category and only .6% in farm labor. It is evident from the preponderance of responses in the "sales/clerical" and "skilled labor" categories that the majority of the Guamanians in the early 1970s were employed in lower middle class occupations.

In spite of this evidence of their assimilation into the world of wages and employment, there were still signs of an identifiably unique Guamanian adaptation to the world of modern economics. For example, of the 111 Guamanian families who responded to the item which asked if family members turned over their paychecks to the family, 53.1% indicated that they pooled at least portions of income. On the other hand, only 3.7% of the U.S. households and 11% of the Filipino households indicated that they did the same.

Island-style reciprocity was also indicated in the data on fiestas and parties. Both the Guamanian and the Micronesian families in the sample indicated that they spent at least four times the amount spent by Statesiders on parties, fiestas, and social gatherings.

Guamanian reliance upon subsistence was also still evident in 1974. Whereas the U.S., Filipino, and Micronesian families purchased an average of 91% of their food from the stores, the Guamanian families on the average purchased 84% of their food from stores. Furthermore, 82 of the 199 Guamanian families who responded to the question on where their food comes from indicated that they obtained approximately 21% of their food by farming or gardening, 62 of the Guamanian families obtained an average of 17% of their food by fishing, and 43 families obtained about 27% of their food from relatives and friends. This indicates that by 1974 the Guamanian family had adapted to the wage economy, but at the same time it had not yet totally given up the subsistence and reciprocity practices of the past.

Data from the household survey indicated that 67% of the Guamanian families still owned land, compared to 59% of those from the U.S. and 58% of the Filipinos in the sample. Median lot size was 2,343 square meters, or a little more than one-half an acre. Ninety-two percent of the Guamanian families, compared to 66.9% of the U.S. families, owned their own home. Thirty percent of the Guamanian families built their homes themselves or did so with the help of their friends. On the other hand, only 15% of the U.S. families in the sample indicated the same. Hence, after 300 years of foreign control, some of the traditional economic and social practices of the Guamanians were still evident in 1974.

This is not to say that the Guamanian family in 1974 was less than an avid participant in modern technological society. In fact, the data shows that the opposite may be true. For example, the survey indicated that the Guamanian household owns more automobiles than either the U.S. or Filipino households: 1.9 to 1.7 and 1.8 autos per household for the three groups. While 40.7% of the U.S. families reported owning a black and white TV, 58% of the Guamanian families said they owned one. Forty-six percent of the Guamanian and 55% of the U.S. families owned a color TV set. Another indication of the degree of participation in modern technological society is that, according to the survey, Guamanians spent an average of 4.5 hours per day watching TV, went to 1.7 movies per month, and went out to eat at a restaurant 2.1 times per month.

The Guamanians in 1974 seemed to have drawn the line on complete mechanization or not yet to have progressed to the stage of making widespread use of dishwashing machines. Less than 6% owned a dishwasher; however, after decades of coping with the daytime heat and humidity on Guam, 47% said they owned air conditioners.

The vast majority of Guamanian families owned not only a radio and a tape recorder but also monaural or stereo equipment. In fact, 67% said they owned a stereo set. They exceeded even the Statesiders in their movie-going and TV-watching; however, more Statesiders read the daily newspaper than did the Guamanians.

Despite all this evidence of material affluence and influence of the mass media, the 1974 median income of Guamanian families in the sample was only \$7,800. While for the last five years the Guamanian family, as well as all other Guam residents, has had to

live in an economy that experienced a cost of living at least 30% higher than that on the mainland U.S., it took nearly two wage earners per family to achieve a \$7,800 median income in 1974; moreover, the median income of the Guamanian family was nearly 40% less than the median income of families on the Mainland. It was more than 70% less than the median income of the U.S. families in the sample.¹ Nevertheless, the per capita annual income on Guam is greater than for any other Pacific island or Asian country except for Hawaii and Nauru.

Only 27% of the Guamanian families had income other than wages and salaries; however, 41% of the U.S. families in the sample reported other income. From the data on income, therefore, it is clear that the U.S. families surveyed on Guam in 1974 still enjoyed a distinct financial advantage over the average Guamanian family.

Some of the Guamanian families reported outside income of a considerable amount. A total of 54 families (of 182 who answered the question) reported "other income" sources and, because of a few large land transactions among the respondents, the total annual amount reported was more than one million dollars. More than \$700,000 of this came from the rental, lease, or sale of land on the part of only seven families and may represent an unusual circumstance. Similarly, outside business interests amounted to nearly \$200,000 annually for only nine of the Guamanian families. Interest as well as retirement accounted for the remaining \$100,000 for another 24 Guamanian families. While the median family income from sources other than wages and salaries for these 54 families amounted to a substantial \$6,638 in 1973, it is clear that there is a great disparity between the few families who own land and have business investments and the average wage-earning family on Guam. For example, two households reported land holdings in excess of one million square meters.

Thus, in 1974 the average Guamanian family, with a median income of only \$7,800 and 6.3 persons per household, had little opportunity to capitalize on the economic boom that had begun on their island only ten years previously. Guam in the 1970s, therefore, represents a highly stratified society: the strata seem to be divided not only on the basis of income but also according to property and business ownership.

The lower income level of the average Guamanian family appears to be directly associated with a lower overall educational level in the Guamanian family. For example, whereas the U.S. families in the sample had an average of 2.7 members with a high school education or more, this level of education was obtained in Guamanian households by an average of only 2.2 persons. Whereas the U.S. family on Guam had an average of 1.4 members with one to four years of college, the Guamanian family had only .9 members in this category. Finally, whereas the U.S. families had an average of .8 members with a college degree or more, Guamanian families had only .3 members in the same category. In each of the above categories, the average Filipino family in the sample was better educated than the average Guamanian family.

It is evident that the selective migration to Guam of highly skilled and highly educated persons has resulted in an educational-economic disadvantage of Guamanians in relation to outsiders. Because the modern world of competitive free enterprise and occupational specialization requires increased educational qualifications, the Guamanian wage-earners tend to operate at a disadvantage due partly to the lack of sufficient education. For example, the mean educational attainment of the head of the Guamanian household is only 10.6 years, or the junior year in high school. Only 51% of the Guamanian families interviewed had heads of households who had more than 12 years of education whereas 85% of stateside household heads had more than 12 years of education. Such statistics are related to the low income level of the Guamanian family. Education, therefore, is another factor in the present inability of the majority of Guamanian families to capitalize on the recent economic development of their island.

There is evidence, then, of a culturally-based, economic difference between the Guamanian and the other ethnic groups interviewed on Guam in 1974.

¹Sample size for the U.S. born was only 27; therefore, the data may not be representative.

In order to describe further the cultural uniqueness of the Guamanian people, it is necessary to discuss some of the questions that were asked of all respondents in an opinion survey. The opinion survey was conducted in conjunction with the household survey (Appendix C). The Opinion Questionnaire elicited a significantly different response from Guamanians compared to the other major ethnic groups on the island and provides the data for this portion of the analysis of the Guamanian experience.

In terms of child-rearing attitudes, when compared to the other major ethnic groups on the island, the Guamanians appear to manifest a belief in the virtue of obedience for the sake of obedience. For example, in response to the statement, "Young people should always obey their elders," 82% of the Guamanians agreed whereas only 62% of both U.S. and Micronesian respondents agreed. The Filipino exceeded even the Guamanian in this respect: 85% agreed that young people should always obey their elders.

Attitudes of the Guamanians and Filipinos toward religion and authority show up in their response to the statement that, "People should do what their religious leaders tell them to do": 45% of the Guamanians agreed, compared to only 19% of the U.S. respondents. When compared to Statesiders, Guamanians give much more credence and authority to their religious leaders. The percentage of Guamanian agree responses was again surpassed by the Filipinos.

As would be expected, the Guamanian identifies much more closely with government than do the other major ethnic groups on the island. In response to the item which asked if people can trust the government to solve their problems, only 12% of the Statesiders, 25% of the Micronesians, and 54% of the Filipinos agreed. On the other hand, 65% of the Guamanians agreed with the statement. When compared to the other two ethnic groups, the Guamanians perceived the actions of the government as having less effect on their lives. In response to the item, "What the government does is of little concern to me," 37% of the Guamanians agreed. None of the Micronesians agreed; only 18% of the Statesiders and 24% of the Filipinos agreed. If "the government" is interpreted as the local civilian government, this data might indicate on the part of all ethnic groups either that the Government of Guam is, in their eyes, pro-Guamanian or that there is a greater apathy toward the local government on the part of the Guamanians. In either case, the situation represents something that can be explained with reference to their own unique past. Perhaps the ambivalent Guamanian feelings toward government (trust in the midst of uninvolvedness) is a legacy of their lengthy cultural development under foreign powers.

Whereas all the ethnic groups represented in the sample agreed that "modernization" and the associated "change in people" were the two greatest changes on Guam, there is still evidence of a strong Guamanian tie to their own cultural past. For instance, 42% of the Guamanians in the sample indicated that they still have a cookhouse and 37% of those who have a cookhouse used their cookhouse daily. On the other hand, only 37.5% of the Micronesians and 20% of the Filipinos surveyed had a cookhouse. The fact that 25% of the Statesiders in the survey said that they owned a cookhouse is evidence of a two-way cultural exchange on the island and is an indication of the influence of the indigenous culture. Not only are Guamanians being "Westernized" and "modernized" but also it appears that at least in some ways some Statesiders on Guam are undergoing a process that might be termed "islandization."

Only 19% of the Guamanians said they had trouble falling asleep; 37% of the Statesiders said they had similar troubles. This may be viewed as a practical result of the cultural differences which remain despite the evidence of external adaptations of Guamanians to the American way of life.

The Guamanians also appear to recognize the meaning of the social changes occurring on their island. In an open-ended item in which the respondents were asked to list the greatest changes on Guam, the Guamanians most frequently listed physical changes (buildings, facilities, infrastructures, and tourism). They listed "improvement in education" and "changes in government and politics" next most frequently; and third was "the high cost of living."

In terms of the things people worried about the most, the Guamanians ranked "family" as the number one worry, "crime" was ranked second, and "money" was third. The survey data showed an ethnic bias on crime: whereas the Guamanians suffered an average of .6

crimes per household in the year 1973, Statesiders reported 1.4 crimes per household during the same time period. All ethnic groups in the survey indicated that crime was a major concern.

When asked to rank those things which they considered the most important in terms of getting ahead, the Guamanians differed once again from the Statesiders. Whereas both Guamanians and Statesiders ranked education as number one, the Guamanians ranked "family connections" second and "land ownership" third; the Statesiders ranked "job or profession" second and "family connections" third.

This survey data indicates that Guamanians have adapted to the modern world of wage and capital economics in a unique fashion. In addition, certain economic problems are demonstrated which include the following:

1. lack of sufficient education in order to increase wage earnings so that capital can be generated for investment purposes;
2. a resulting sanction against Guamanian participation in private business and a concomitant economic involution (i.e., reliance upon one or two major employers for most of the wage capital);
3. lack of commercial agriculture in the midst of available unused acreage.

Other economic problems may also be recognized:

1. unregulated profit, consumer acquiescence, and local governmental irregularities;
2. Guamanian exclusion from regional economic development;
3. increasing outside (i.e., other than Guamanian) ownership of business and land.

The remainder of this paper will explore possible explanations for these problems. It is hypothesized that each of these problems, as well as the uniqueness of the Guamanian's adaptation to the modern world of wage and capital economics is, to a large extent, the product of centuries of outside domination. The next portion of this chapter is a preliminary attempt to present an historical background of adaptations of the Guamanian people.

THE HISTORY OF THE GUAMANIAN ECONOMIC EXPERIENCE

Based upon this description of the Guamanian economic profile in the 1970s, it is clear that the indigenous Guamanian, when compared to the other major ethnic groups on the island, has made a unique adaptation to late 20th century economics.

In order to piece together a coherent picture of the evolution of the Guamanian adaptation to the Western world of economics, it is necessary to trace the economic relationships between the Guamanians and the series of governments that have controlled the island and its people. In this analysis, seven phases are identified:

- I The pre-contact period of ecological equilibrium
- II Early contact period and the collision of cultures
- III The Spanish colonial era: economic manipulation and cultural continuities
- IV Early U.S. era: a case of planned economic involution
- V 1940-1949: reaculturation and multi-ethnic complexities
- VI 1950-1962: the Government of Guam and cultural reintegration
- VII 1962 to the present: Karen, Kennedy, and an island culture in mass society

PHASE I: THE PRE-CONTACT PERIOD OF ECOLOGICAL EQUILIBRIUM

The people who inhabited the Mariana Islands at the time of Western contact were called Chamorros by the Spanish. At least one thing is clear about the economy of the ancient Chamorro inhabitants of the Mariana Island archipelago: they were masters of the complex art of achieving a life style that was in harmony with their island ecosystem. They

were not helpless pawns in the hands of environmental forces; they exercised conscious and cultural control of their limited resource base.

The entire land mass of the Mariana Islands totals only 482 miles (less than half the size of the state of Rhode Island). At the time of the first Western contacts, between the years 1521 and 1670, the population of these islands was estimated to be at least 40,000 and at most 100,000 (2). This would indicate a population density between 80 to 210 persons per square mile (or the equivalent of the present population of either New Hampshire or Ohio).

When compared to a temperate-zone continent, this tropical island environment is both more abundant and more renewable in terms of food and fiber. It can be inferred, therefore, that a different socio-cultural evolution occurs on an island chain as compared with Europe during the same time period (ca. 1500 B.C. to 1500 A.D.). Unfortunately, there exist no scientific descriptions of the ancient Chamorro culture. All that remains of their life style are a few historical accounts by ships' chroniclers and missionaries, a few cultural carry-overs that persisted after the extermination of the Chamorros by the Spanish, and an abundance of archaeological evidence.

The historical evidence on Chamorro economics was summarized most succinctly by Laura Thompson (3):

From the available evidence, we may infer that the ancient Chamorros had the usual South Sea type of economy based on gardening in bush clearings, on collecting in the jungle and on fishing. Sanvitores wrote, 'They live during four months of the year on products of the ground, coconuts, which are abundant, bananas, sugar cane and fish. The remainder of the year they supplement the lack of fruits with certain roots.' Horticulture in the Marianas differed from that of most island groups east of the Malay archipelago, however, in that rice, as well as the usual tubers like yams and taro, was cultivated. Organized craftsmanship, based on resources from both volcanic and limestone types of formation, was well developed. Stone work, including stone house-piles and polished stone implements; woodwork . . . and pot-making were outstanding crafts. The paper mulberry and barkcloth were absent, as was also, apparently, the loom. Economic exchange, facilitated by means of shell 'money,' was highly developed in the group and occurred also between the Marianas and the Carolines. Regarding the division of labor in the Marianas, Pigafetta stated: 'The women do not work in the fields but stay in the house, weaving mats, baskets and other things needed in their houses. . . . They busied themselves with child and household care, food-gathering in the jungle and on the reef and making coconut oil. They made pots and cooked in them. Much of the native medicine was also in the hands of the women. On the other hand, the men did most of the gardening and fishing, the house and canoe building, the stone and woodwork, the navigating and trading. They probably also made nets, as they did in modern prewar Guam, and cooked in the earth oven, usually men's work in the Pacific. Warfare, ceremonies and games consumed much of their energy. Labor was divided also by classes, according to Freycinet. The nobles monopolized professions like canoe building and the manufacture of certain types of shell 'money.' Warfare, fishing in the open sea and sailing in canoes were also controlled by them and forbidden to the lowest class, which was responsible for the menial work, especially gardening.

According to de Garcia's accounts (4), the Chamorro people were very robust and tall when compared to the European height at the time. They were also long-lived and astounding swimmers (5). In one account it was reported that a captured Chamorro male, with his hands bound behind his back, managed to jump overboard from the ship on which he was confined and swim more than one mile before he was caught and killed! The Chamorros were also lovers of parties, poetry, mind games, and trickery (5). From archaeological excavations, it has been determined that all of their tools were produced from local materials.

On the basis of the evidence at hand, it appears that the ancient Chamorro had developed a diversified economy. They were horticulturists, having brought most of their food

plants (including rice) along with them on their migration voyages across more than 1,000 miles of open ocean (3, 5). They were also fishers, hunters, and gatherers. There is also evidence that they, like other island people, "farmed" their reefs by feeding, husbanding, and harvesting the fish. Devices to attract fish are prevalent among the archaeological remains of this ancient culture.

They were engaged in long-distance trade with the peoples of other island archipelagos. They had local forms of "money" (5). As already indicated, they were also able to succeed for over 3,000 years in meeting the survival challenges provided by their small world of limited land resources and relatively dense population.

Not only were the original inhabitants of the Marianas able to subsist, but they were also able to construct structures on latte stones. Some of the foundations of these structures are still standing on Tinian and Rota. Many remains of latte pillars and capstones still remain on Guam. These impressive stone structures indicate that the ancient Chamorro economy created a surplus which enabled the culture to become elaborated.

Perhaps the most significant inference that can be made about the ancient Chamorro people arises from archaeological evidence. On the basis of less than a half dozen formal excavations, it has been determined that the first inhabitants of the Mariana Islands arrived more than 3,500 years ago. There is no archaeological evidence that would establish beyond doubt that there had ever been a break in the process of cultural evolution until the Spanish period. There is evidence of only one possible break in cultural continuity. Archaeologists acknowledge two fairly distinct forms of ancient Chamorro pottery: Early Marianas Red and Late Marianas Red. The early variety is thin-walled and is sometimes decorated with inlaid shell or finger nail sketches whereas the late variety is ponderous and undecorated. This change in pottery type may indicate a cultural break such as an invasion or a revolt sufficiently intense to effect the loss of the artistic technique seen in the early form or there may have been a degeneration in this one aspect of the on-going cultural pattern (3,6,7,8).

As with so many other relatively isolated societies that were based upon an oral tradition, the society of the ancient Chamorro people existed in a more or less constant state of internal stability. In other words, although the culture was evolving, it nevertheless must have been accomplished with a great deal of continuity and with a manageable degree of innovation. These people, then, were apparently the product of a society that had attained the skills of carefully husbanding its local resource base and of so controlling its own population growth that the people were able to experience over 3,000 years of cultural evolution on less than 500 square miles of the earth.

The ancient Chamorros attained an ecological balance that enabled them to survive in their environment. Many beliefs and practices preserved this balance. Even today, older Guamanians will not relieve themselves in the jungle or even enter the jungle without first asking permission from the taotaomona, the guardian spirits of their ecosystem. Such practices indicated a respect for the environment and discouraged unnecessary destruction of resources.

The ancient Chamorros were apparently rewarded with lengthy periods of socio-cultural stability. There is also evidence for multiple and diversified modes of subsistence in the archaeological record. Support for an inference of harmonious ecological practices is also found in the numerous subsistence activities and beliefs still evident among 20th century Guamanians.

Apparently the only real problem in the ancient Chamorro society was that there was no reason to design ways in which to cope with the Westerners who had begun to make contact with them as early as A.D. 1521.

PHASE II: EARLY CONTACT PERIOD AND THE COLLISION OF CULTURES

As with so many other small groups of isolated and ecologically adapted peoples, the Chamorros were obliterated after contacts with the West. Most of the wisdom within that culture died along with the people. Their isolation served merely to delay the

inevitable for the ancient Chamorro. Magellan landed in 1521; the priests and soldiers followed 147 years later in 1668 (5).

After more than 25 years of genocide, mass relocations, torture, and cultural repression, the Spanish-Chamorro wars were concluded by Major Jose de Quiroga in July 1695. The last stand was made on tiny Aguigan Island just south of Tinian (5). Today nothing more than a herd of wild goats and a WWII grass runway marks this silent place.

The ancient Chamorro must have become fearful of what those first encounters foreshadowed. From 1521 to 1668, four of the first eight landings made by ships bringing Westerners to the shores of Guam resulted in death, impressment, or destruction of the homes and property of the Chamorro, according to Carano and Sanchez (5) (Table 1).

This record speaks of the collision between a Pacific Island culture and Western culture. It was the collision between a culture based upon reciprocity and one based upon proprietary principles and the Divine Right of Kings. It was the interface between an isolated people and representatives of the economic, military, and religious forces which would change the face of the world.

To Magellan and his crew, it was justifiable to reward the Chamorros' hospitality by murdering seven men and burning 40 homes. The retaliation came about ostensibly as a reaction to the islanders' understandable wants for what must have been perceived by them as desirable and intriguing objects--clothing, metal, and glass--which, unfortunately, belonged to Magellan in the name of the King and the Queen of Spain. In the world as seen by Magellan, the Chamorros were thieves. In fact, he so named the islands: "Islas de Ladrones" (5). How was Magellan to comprehend the islander's law of reciprocity? How was he to know the mental complexities, subtleties, and cues involved in carrying out a successful reciprocal exchange with islanders?

From what is known about island-style reciprocity, this first encounter with the Westerners must have come both as a delight and as a shock to the Chamorro. To witness a shipload of such outstanding objects belonging to a crew of scurvey-ridden little men, some of whom even wore metal suits in the hot sun, probably served only to inflate the Chamorros' expectation that they would receive some of the objects. In that the Chamorros had already supplied the ship lavishly, had tended the sick sailors, and enjoyed their company during the recuperation period, it is logical to believe they would have expected something in return. In former times social prestige and power were obtained not by the accumulation of wealth, but by displays of generosity and hospitality. Such actions accomplished the redistribution of goods and property (5).

Like so many other similar situations throughout human history, this meeting (which was, in effect, a non-meeting) between the representatives of Western culture and the people of an isolated place was destined to fail from the very start. From this very first Pacific Islander-European encounter was to come a tragic chain of events. For from that day to this, the Chamorro were to be considered as somehow inferior. Their cultural ways were to be continually violated and their customs were to be treated as less valid than the customs of the ethnocentric outsiders.

By means of repeated contacts with Western cultures, the Chamorro soon developed a *modus-operandi* for handling these encounters. The subsequent exchanges between the Chamorro islanders and the Western sailors involved an increasing use of guile and caution on the part of the islanders. According to Carano and Sanchez (5), prior to 1525 and before 11 Chamorro men were forcibly impressed by the Loadsa expedition, the islanders would flock aboard the ships and deftly remove that which, from their previous experiences, they already knew would not be given to them regardless of their expressed desires or willingness to supply provisions and hospitality. After the impressment experience in 1525, the Chamorro seldom boarded a Western ship.

There is evidence that the islanders manifested an awareness of the value of the baubles and trinkets given in exchange for provisions or at least carried off some successful attempts to get even by outwitting their erstwhile guests. There are accounts of angry captains discovering that the provisions from the Chamorro were, in fact, nothing more than thinly disguised bags of coral stones (5). These same accounts also indicate the glee with which the islanders enjoyed the retaliatory anger of these men from the West who must have seemed to anger easily.

TABLE 1

A Chronological Record of Chamorro-Westerner
Contacts, 1521-1668

Source	Expedition Name	Date of Contact	Outcome of Contact with Chamorro
Pigafetta	Magellan/Spanish	March 6, 1521	Killed seven Chamorro men, burned 40 or 50 homes and several boats
Urdaneta	Loadsa/Spanish	July 29, 1525	Impressed eleven Chamorro men
Legazpi	Legazpi/Spanish	January 22, 1565	Claimed Chamorro islands for Spain; killed four Chamorro men, wounded many and burned many houses
Burney	Francis Drake/English	1579	Not known
Burney	Thomas Cavendish/English	January 3, 1588	Fired muskets at Chamorro sailors
	Van Noort/Dutch	September 15, 1600	Not known
	Spilbergen/Dutch	January 23, 1616	Not known
	L'Heremite/Dutch	January 25, 1625	Chamorros add stone and sand to bags of purchased rice
		June 15, 1668	Arrival of the Spanish colonial fleet with Jesuit missionaries

Source: (5)

By 1668 the Spanish had arrived in full force on Guam. It had been 147 years since the first Spanish landing on the island. After two years of ignorance and disrespect for the Chamorro way of life, the third and final war of cultural annihilation waged by the Spanish had begun. It ended only when there were no more Chamorros left to subdue. By the 1700s, then, the Chamorro people were very nearly wiped from the face of the earth. In the 1600s there had been more than 100,000 Chamorros; by 1740, there were less than 1000 of them left alive (5).

It seems, therefore, that the Chamorros had learned to accept and to cope with most of the strange ways of these foreigners only to discover that their own ways of life, which had served them and their environment long and well, were to be outlawed by these former guests from a distant land. By 1696, the Chamorro had become prisoners on their own soil, had been made victims of their own cultural patterns, and must have known then that they had completely miscalculated the ferocity with which these Westerners would defend even the most dubious of their ownership claims (5).

For the ancient Chamorro, it was a case of a very small society being in the wrong place at the wrong time in history. For the Spanish, however, it was a case of now determining what to do with a depopulated impoverished possession.

What began, therefore, with random death in 1521, ended in nearly total annihilation by 1700. What began as cultural collision ended as conquest. What for 3,000 years had been isolated was, in less than 30 years, forcibly and violently wrenched into an almost total dependence upon a European monarchy located on the opposite side of the earth. In terms of socio-cultural evolution every ending is simultaneously a beginning. With the extinction of the ancient Chamorro arose the new Chamorro. With the remains of the past were laid the foundations for the future, a future that is the Guamanian reality of today.

PHASE III: THE SPANISH COLONIAL ERA: ECONOMIC MANIPULATION AND CULTURAL CONTINUITIES

After conquest, the Chamorro problem was one of survival. This problem was aggravated by the necessity of learning how to cope with colonial rule. In terms of Chamorro economics, there is evidence for continuities as well as innovations at this time in their history. The colonial experience was the key to what would be retained from the past and what would be necessary to learn in order to insure survival.

The people continued subsistence patterns. As Thompson states (3), "After the Spanish conquest, the natives, by this time concentrated in villages, continued . . . to live off the land." However, there is also evidence to indicate that during the Spanish regime on Guam, the people were being forced into what for them must have been a radically new form of economic adaptation and innovation. In brief, it seems that by the late 1700s, each Guamanian-Chamorro family relied on its own subsistence efforts for purposes of day-to-day survival. As will be discussed later, they also used the newly introduced money of the Spanish, but used it mainly for prestige ranking and reciprocal exchange.

According to Thompson's review of the historical documentation on this point (3):

Practically all of the situado [an annual grant of about 20,000 pesos from the royal treasury in Mexico], however, went either directly in the form of salary or indirectly in the form of trade profits to the governor. According to Freycinet, almost half of the budget . . . was reserved for the governor's salary if he was appointed, as customary, by the viceroy of Mexico. If appointed by the king, however, he received more than two-thirds of the entire funds. The remainder was divided between the sargento mayor and other government officials (some of whom were also compensated with lodgings and daily rations) and the soldiers. The governor also had a monopoly on the importation of foreign goods. At Agana he kept a general store in which European goods were sold at high prices, and since other commerce was forbidden on the island, officials and natives were forced to buy all their imports here. Consequently the governor, in addition to his salary, made large profits by his trade monopoly, but the island itself did not benefit thereby.

Thus, during this period, the whole colony lived off the soil as far as food was concerned and off the situado for clothing, which was bought from the government store at fixed prices.

The small involuted economic system was continually manipulated so that most of the money ended up in the hands of the governor. This removed the incentive for the average person to attempt to acquire money. Money which was acquired was used for the enhancement of status and for satisfying obligations in the local system of reciprocity.

In a section of a report on the economic conditions on Guam in 1855, Felipe de la Corte, the new governor sent from Spain to clear up Guam's continuous economic problem, wrote the following (9):

The Marianas have no stores, and there are no carpenters, blacksmiths, tailors, shoemakers, or even a house servant who is really a house servant. Every man is everything and no man is anything. The natives which form the mass of the population, live isolated in their own homes; each one plants whatever he is going to eat, brings from the country what he needs, makes his own house, and clothing, raises his own animals or hunts and fishes those he needs; and if one of them begs for it as a favor he pays for it more dearly than if he had bought it, no matter whether the favor is done by his own father or brother. . . . Every imaginable effort is made not to buy that which in some way can be procured at home or in the Island; although the labor spent in getting it may be worth more than what the article would cost in money. This custom is so deeply rooted that from the highest to the lowest in the land everybody acts alike, because everybody thinks that money is only intended to buy finery, or to pay for masses, and that he who uses it to buy foodstuffs is lazy, no matter whether he works hard all day long in order to get a salary to pay for it.

From this account it is evident that sanctions against participation in the local wage economy were generally accepted by the Guamanians. Either they were boycotting the wage economy (perhaps because of the unscrupulous manipulation of the medium of exchange by the Spanish governors) or they were manifesting a high degree of cultural continuity from the economy of their past. It may have been a combination of both motivations that resulted in the economic situation in 1855 as described above by de la Corte.

De la Corte (9) continues to marvel over the obvious monetary wealth of the natives coupled with their equally obvious disdain for its value:

They are a sort of obstinate children, without any present needs, and without any accumulated wealth, since they scarcely own any animals, furniture or objects of value; and in the midst of this apparent poverty, they pay with the greatest indifference 10 pesos for a funeral, 50 for an ox which they do not use, 8 for a skirt, 30 for the image of a saint or for a poor necklace or for any similar trinket, so that in the midst of a poor community, it may be said comparatively speaking, that individual wealth exists. . . .

We may ask at this point, "How much was a Spanish peso really worth at that time?"; "Where did all the money come from?"; and "How much of the present-day Guamanian attitudes toward money and toward the work-wage exchange are a carry-over from this part of their cultural heritage?"

In answer to the first question ("How much was a peso worth at that time?"), in terms of the local economy on Guam, the value of the peso can be seen by examining the tax and wage records from that time. For instance, Thompson (3) reports that the labor tax for communal projects in 1863 was 156 days (or 2.4 pesos) per year for country dwellers and 40 days (or 1 peso) per year for residents of Agana. Hence, if we divide this value of the peso by its equivalence in labor time, we find that a day's worth of tax labor in 1863 amounted to no more than .025 peso per day, or only 7.8 pesos for a full year for country dwellers and to no less than .016 per day, or only 4.8 pesos per year for Agana residents.

In another comparison, if the annual situado from Mexico was 20,000 pesos per year and if one-half to two-thirds of that went directly to the Governor himself as salary, then the remainder must have sufficed to supply all the funds required for maintaining a non-mutinous garrison of 150 men plus at least one sargento mayor. Hence, during the time that Guam was administered from Mexico (up until 1808) and the annual situado was 20,000 pesos, the absolute maximum annual wage for the average Spanish soldier on Guam was less than 66 pesos. After 1808, when Guam was administered from the Philippines, a soldier's wage on Guam was, at most, less than 25 pesos per year (5).

Thompson (3) reports that in 1819 a day-laborer on Guam could earn approximately 15 pesos per year. A cook received 14.4 pesos per year and a maid received only her food, clothing, and instruction in the Christian doctrine. An unskilled mason or carpenter received 62.6 pesos per year.

From this data, then, it becomes clear that 10 pesos for a funeral, 50 for an ox that the buyer failed to use, and 30 for the image of a saint or some trinket represents monetary affluence among the Guamanians in the 19th century. Where, then, did all this money come from?

The historical record is also clear on this point. Other than the annual government appropriation, there was only one source of money available on the island: the officers, crews, and passengers on the galleons, whaling schooners, and supply ships that called on Guam during this time. In fact, for more than 20 years, Guam was virtually the only port of call for the well-heeled Pacific whalers. According to Carano and Sanchez (5):

At the end of each cruise, the whalers rested for two months or more at Apra Harbor and Umatac. While in port, they took on water, food, and provisions. Crew members bought, regardless of price, all the articles they could lay their hands on. Since their voyages lasted from two to four years, they had few opportunities for spending their money.

Although de la Corte complained there were no stores on Guam at that time, it is reported that every house had articles for sale. De la Corte estimates that while on Guam each ship spent over 600 pesos for provisions, gambling, and other recreational pursuits (9). During this time, then, the total estimated annual amount of non-governmental money flowing through the local economy amounted to more than the annual situado at its height and was 13,000 pesos more per year than the annual situado (Table 2).

TABLE 2
Estimated Annual Cash Flow into the Native Economy,
Guam Circa 1825-1850

Source of Income	Amount	Total
Thirty Whaling Schooners	600 pesos per ship	18,000
Two Supply Ships	600 pesos per ship	1,200
10% Monetary Accrual		1,920
		21,120 pesos

Source: (10)

Using the median population figure for Guam at that time (5,500), then the income for the Guamanians at the height of this 19th century "tourist" phase on the island was 3.66 pesos per person per year (2). Hence, if we use the extremely conservative measurement of 6.3 members per household (as indicated in the 1974 survey data), then, in the years from 1820 to 1855, we can very conservatively estimate a median family income of 23 pesos per year. Therefore, an extended-family on Guam in the 19th century would represent a considerable amount of money. Recall here that at that time on Guam, the average Spanish soldier was earning less than 25 pesos per year. Recall also that at that time it only took 600 pesos to provision a whaling schooner with an average crew size of 85 men for six months (11).

Although it is impossible to estimate from the foregoing data how much of the present Guamanian attitude toward demeaning low-paying work is a response arising from their experiences under the Spanish, nevertheless, their present unwillingness to farm commercially can perhaps be seen as a cultural carry-over from the lessons learned during the Spanish period. In addition, it would seem that the abandon with which some Guamanians spend money today has its roots deeply within this set of socio-economic circumstances from their own cultural experiences of the past. At least in some ways, therefore, the economic responses from the past seem to influence later adaptations.

Most of the 18th and 19th century governors on Guam utilized their political position to capitalize themselves. They owned the only stores and they charged what the local market would bear for outside goods, the importation of which they totally controlled. The Guamanian adaptation to this situation seems to have been, in part, the result of a carry-over of some cultural patterns associated with social reciprocity. Although they were earning some money, earnings did not come from salaried jobs. When they did earn some money, they spent it for other than practical necessities.

Whatever else might be inferred, at least one thing is clear: being Governor of Guam at that time could hardly have been considered as a banishment. More than likely it was viewed in Spain as a very lucrative, short-term assignment. In fact, it seems to have been Spanish policy to recall the Guam governors after only three and a half years. Don Mariano Tobias, who was Governor from 1771 to 1774 desired to return to Guam as a citizen but Spain forbade it. This case is doubly interesting because Tobias was one of the few governors whose honesty and devotion to the Guamanians earned him their love and appreciation. Of the 61 Spanish governors who ruled Guam from 1668 to 1898, the average stay was 3.6 years and the length of stay ranged from less than one month to 11 years (5).

Yet another economic side effect appears to have developed in the 19th century. Because of the artificially-induced inflation of the Guam economy, the Guamanians were excluded from participation in regional and world-wide economies. One can imagine the lean years that followed after the whalers began to provision in Hawaii instead of Guam. Numerous schemes were instituted in order to try to make the local economy viable, but all failed. According to Padre Palomo, the first Guamanian priest, when Governor Moscasí attempted to organize a company to export Guam products to the Philippines, it failed precisely because of the artificially inflated economy on Guam (3). According to Carano and Sanchez (5):

For the reason that wages in the Philippines being lower than that in the Marianas, the cost of production in the latter is necessarily higher than in the former, and consequently there is little incentive for the Chamorros to work in order to produce articles which, when sold in Manila, would bring them very little return.

Because of the unequal labor tax exacted from the rural people on Guam, there was during the Spanish era a consistent economic sanction against any large-scale or even family-based agricultural industry. As a cumulative result of Spanish gubernatorial decisions, each Guamanian family grew only its own things, lavishly spent worthless money, and were precluded from participation in regional and global economic schemes.

For the Guamanian of the time it was a case of progressive monetary devaluation and simultaneous exclusion from an economy that was something to which he was subjected and was not something he himself designed. For the Spanish officers, it was a matter of making the most of a lucrative situation. For the economy of Guam, the Spanish colonial era was a 150-year disaster which may still influence the local economy.

At least since the early 1800s, then, Guam was excluded from participation in whatever would have been its natural economic destiny had the Spanish not been present at all. The Guamanians, however, were a people who managed to survive simply because they were shrewd enough to use a meaningless medium of exchange in ways that proved functional for their own cultural evolution. The 19th century on Guam, then, represents a case of colonial expropriation and native adaptation to the conditions which resulted from that expropriation. Even the Chamorrita chants that have survived from that era consistently warn against the dangers of monetary richness.²

PHASE IV: EARLY U.S. ERA: A CASE OF PLANNED ECONOMIC INVOLUTION

The year 1898 marked the beginning of a new period of change for Guam. In that year Guam became a dependency of the United States when the island was captured from the Spanish by an American naval force during the Spanish-American War. The change-over created social tensions in that the new colonizing power proved to be more rigid and forthright than the rather lax Spanish. Decrees were issued banning public religious celebrations and saint's day processions. Cockfighting on Sunday was also forbidden. According to Thompson (3), Padre Palomo was instrumental in easing these transitional tensions.

This new power on Guam was to bring with it a host of other economic complexities. Under the Americans, the paradoxical subsistence-affluence economy that had developed under Spanish rule was to evolve into a highly involuted wage-based economy.

Elman Service (12) defines involution as involving a complication or an entanglement--a product of specialization. Clifford Geertz (13), in his excellent analysis of the economic situation of Java, defines economic involution as the process whereby colonized peoples attempt to solve economic problems by cumulative intensification of the already existing economic processes. In Indonesia, the Dutch colonial requirements for wet-rice cultivation established a process of economic involution that became ever more fragmented and imbalanced as the Javanese population increased. By the time of the Geertz analysis in 1952, the Javanese people had made such an investment in their mono-crop economy that for all intents and purposes it was impossible for them to diversify: they were trapped by the complex irrigation systems and the denuded paddy-tiered slopes of a physically-involuted environment and they were trapped by their social system which had evolved from the labor-intensive wet-rice economy. The web of social life on Java centered upon, reinforced, and legitimated the de facto economic reliance upon this economy. The original decisions were, of course, established by the outside colonial requirements, but it was the Javanese who carried out the processes of progressive involution.

In the Spanish era, the Guamanians were forced to boycott the work-wage exchange requirement of a fully functioning capitalistic economy. However, with the arrival of the Americans the conditions that supported the previous economy ceased abruptly and a set of new conditions was laid down.

The new policy on Guam was strictly military and the new economy was also going to be military. In order to implement this new scheme, the United States Navy closed the island to all outside economic development. Businesses were limited to those which received prior approval from the new Naval government (14).

Thus, shortly after the American arrival a situation for economic involution was created on the island of Guam. How then were the Guamanians going to cope with and adapt to this new set of constraints on their natural economic development? What were they going to learn that would add to what they had already learned about the West after more than 200 years of Spanish administration?

When the U.S. Navy assumed administrative responsibilities for Guam, three things were done that indicated their approach to the problem of establishing and maintaining a naval base on the island which, at that time, was inhabited and owned by nearly 10,000 people:

²Based upon this author's research and collection of Chamorrita chants.

1. A security closure over the entire island was established. This would serve to stifle much of the natural economic growth on Guam (14)
2. From 1898 until 1905 the island's schools were closed (ostensibly because of the lack of teachers to replace the Spanish). Therefore, except for the 100 or so students who were taught by the Spanish priests who remained for a short time, the other 2,200 children on the island received no formal education for seven years. When the schools were re-opened, they were staffed not by professional civilian teachers but by untrained marines and lower echelon naval personnel. The Naval administration's attitude toward the obligation to teach the people was largely the result of the fact that the Navy and the U.S. Congress were at that time in some conflict over the Guam situation (15).
3. The Naval governors promulgated a series of edicts designed to eliminate most forms of non-wage money sources such as stringent liquor laws, gambling prohibitions, and curfew regulations. In fact, Thompson describes the island under the U.S. rule in the following terms: "A military regime similar to that on a battleship or in a Navy yard was set up over the native population on the island" (3).

The professed need of the Naval governors was the maintenance of the Naval Station. All other considerations seemed to have been dominated by this military concern. It was primarily in order to maintain the Naval Station as efficiently and as cheaply as possible that the Naval governors set out to provide the appropriate incentives and minimal education necessary to induce Guamanians to enter the new, American-style, military-controlled wage economy. As Captain Dyer wrote (16):

No Americans can be induced to live here permanently. The continuing employees of the Naval Station must be natives. Under intelligent direction, they make efficient laborers and excellent artisans and fill subordinate positions faithfully and well. In fact, we have a sober, intelligent, virile, docile population of sufficient size to equip the Naval Station at all times and still leave enough to produce food for all.

The educational opportunities provided by the Americans in their first era on Guam were primarily for the purpose of efficient maintenance of the military installations. The following two quotes illustrate the types of rationalizations involved in the decisions and the actions of this time (17):

There is a lack of administrative material among the natives. They lead lives of Arcadian simplicity and freedom from ambition or the desire for change or progress. They are like children easily controlled and readily influenced by examples, good or bad. Therefore it is incumbent upon us for our self-protection and efficiency to see that . . . they are afforded practical instruction in their sole pursuit, agriculture, and to educate some of them to occupy such positions as clerks, mechanics, and intelligent laborers in the Naval station . . . the main dependence for continuing employees, clerical, mechanical, and laboring, will have to be the natives. The experiences of the engineer at the ice plant and saw mill, the plumber, the printer, the officer in charge of steam launches, the foreman of labor and of those Americans who have had the natives as servants has given little hope of developing any of them into skilled workmen, or even into laborers who can be relied upon for a continuous effort. . . . I hope to inaugurate shortly . . . an apprentice system by which . . . the younger generation may provide satisfactory material for our future needs.³

According to the 1905 Annual Report (16):

The location of Guam in the center of the Western Pacific, about equally distant from Manila to Yokohama on the direct route from Hawaii to the

Philippines and the fact of its possessing a fine harbor make it of great and recognized strategic value to the U.S., as a point to be occupied and held for naval purposes alone. It has neither present nor prospective economic value and should not, then, excite the interest of other than scientific and military men.³

With most other avenues of income closed to them, the Guamanians naturally looked to the Naval Station for employment. Thompson reports that by 1911, nearly one-fourth of all the able-bodied men of Guam were working as laborers under Naval employ. By 1919, about one-third of Guam's 3,000 able-bodied males were working for the government or in trade in town. The rest were still engaged in subsistence farming. Within 20 years after the American take-over on Guam, the problem was no longer how to lure laborers from their farms to work in town for money, but, rather, the problem was how to draw enough wage-earners back to the farm to supply the island with food. Thompson also reports that as early as 1905, importation of foodstuffs had already begun and that, by 1911, four-fifths of the population lived in part or wholly on imported food (3).

Within ten years after the Americans had assumed control of Guam, the peculiar economic problems associated with any involuted one-company town had already begun. These problems are related to problems that Guamanian economic advisors and planners must cope with in the 1970s.

By 1939, there were already signs of one way in which the eventual amelioration of this situation of economic involution was going to be solved. Thompson indicates that by 1939, native Guamanians already owned the following: a cold storage plant, a bus line, a sawmill, three soap factories, several importing and exporting firms, a movie theater, a bakery, and several other concerns (3). It would seem, then, that the primary industry (the U.S. Navy) coupled with the security closure, which served indirectly to exclude Asian businesses from competition with local businesses, soon generated a small but viable service industry that provided at least some of the essentials required by the wage-earning Guamanian families.

However, because of the fact that, by local military law, the federal employer paid an average wage 100 percent higher than that paid in the new civilian economy, the private sector of Guam's pre-war economy remained stifled by the problem of staffing for any proposed expansion (3). Thus, although the U.S. Navy indirectly aided the Guamanian drive toward economic development, it directly thwarted natural expansion.

On the Guamanian farms, copra production was slowly increasing under the aegis of the Naval government only to be destroyed later by the very nature of the colonial relationship itself. According to Thompson (3), in 1905 only 155 tons of copra were produced; however, by 1909 the output had increased to about 547 tons. By 1924, Guam exported 1,400 tons of copra, mainly to the U.S. In 1929, the highest recorded output was attained: almost 3,000 tons. Thereafter, until 1932, Guam continued to export between 2000 and 3000 tons annually. In 1932, the depression hit the copra market. Thus, the Guamanians learned a hard lesson in their first collective effort to enter the world of modern economics.

Despite increases in copra exportation from Guam, the balance of trade deficit fluctuated around half a million dollars. The trade deficit was partly the result of the Naval government's decision in 1912 to close the port of Guam to all foreign ships except for a few schooners from Yokohama, Japan. Previously, in 1909, the Naval Station ships and colliers had been granted permission to carry U.S.-made goods to Guam on a commercial basis. In 1910, United States transports were allowed to carry commercial goods duty free (3). These actions were taken ostensibly to break the Japanese trade monopoly on Guam, but what was actually accomplished was the rapid establishment of an economic link between a small colony and producers in the mother country over 6,000 miles across the Pacific Ocean.

To add to the economic woes of the Guamanians, in 1934 a three cents per pound tax was levied on the first processing in the United States of coconut and certain other

³Underlining is author's emphasis and does not appear in original.

³Underlining is author's emphasis and does not appear in original.

vegetable oils. This was done as a protection for competing oils that the U.S. produced. As Thompson points out, "This tax seriously affected the returns on the small export trade of the two United States Navy-controlled dependencies, namely Guam and American Samoa . . ." (3).

Hence, not only was the hand-labor agricultural industry on Guam dealt a final blow, but also the balance of trade deficits continued to climb due simply to policies favoring producers and shippers in the mother country. Coupled with the Guamanian movement into the wage economy, prices were very high because of distance and lack of business competition; wages were very low because of the lack of Guamanian civil rights under the Naval administration. The economic involution on Guam was intensifying.

In addition to the economic involution and the accumulating trade deficits, the first wide-scale, "brain-drain" of talent from the island occurred during this period. On July 1, 1938, to provide more funds for the Guamanian families, the Naval Governor succeeded in opening to enlistment the mess attendant branch of the Navy for Guamanian youths. Thompson reports that "By June 30, 1940, 358 of the healthiest and most intelligent youths of Guam had signed up for the required four-year period" (3).

Hence, as the rest of the world was girding once again for war, the Guamanians were officially being encouraged to leave their island. The Japanese invasion of Guam in 1941 temporarily stopped what was to prove to be only the beginning of an extensive Guamanian out-migration which continues unabated into the 1970s.

It is significant that just as these out-migrating Guamanians signalled a long-deferred and legitimate desire for a wider participation in world events, so the first Japanese bombs that struck Guam signalled the fact that, henceforward, the fate of the island as an integral component in modern-day global society had already been determined by and sealed in the loss of life to be brought by war. The obstacles to participation in modern-day society were a short period of military occupation by the Japanese, postwar expansion of the U.S. military presence, a continuing lack of Guamanian control over their own destinies, a highly-involutated economy, and a dearth of well-educated local people to run the civilian affairs of the island.

PHASE V: 1940-1949: REACCULTURATION AND MULTI-ETHNIC COMPLEXITIES

For the Guamanian, the war years brought personal trauma, cultural solidarity, and loss of most of their patiently-won economic footholds. However, the postwar years resulted in Americanization of the Guamanian culture.

The impact of this process might be viewed by an examination of demographic statistics for the decade of the 40s. For example, in 1940 the total population on Guam was 22,240. Of this number 20,177 (or 91%) were Guamanian. By 1949, however, the population had increased 168 percent from 22,240 to 59,498, or an average annual growth rate of 16.8 percent (18, 19). At the same time, the average annual growth rate for Guamanians was only 3.4 percent (from 20,177 to 27,124, or a 34 percent overall increase from 1940 to 1949). Despite the fact that for the three and one-half years of Japanese occupation only one American was on the island (Navy radioman George Tweed), the population of whites over the same period increased by an astounding 2819 percent (from only 785 in 1940 to 22,920 in 1949, or an annual average increase--adjusted for the period of enemy occupation--of 388 percent). From comprising 3.5 percent of the population in 1940, the percentage of whites on Guam by 1949 had increased to 38.5 percent of the total.

While the socio-economic situation on Guam was deeply affected by the war, in terms of the impact upon the Guamanian culture, the greater impact was made by this postwar influx of American outsiders whose numbers in less than five years had already equalled the Guamanian population growth over a period of 300 years.

During the war, virtually all of the Guamanian businesses were either destroyed or expropriated by the Japanese. Immediately after the war, the American Naval government assumed an almost despotic rule over all phases of island life. The influx of thousands of Americans was a direct result of American military decisions to build up Guam as one of America's front-line defenses against communism in China.

The economic impact this had on the people of Guam can be demonstrated by means of further analysis of the census data. For example, the total increase in occupations on Guam from 1940 to 1949 was 171 percent (from 6,885 in 1940 to 18,673 in 1949, or an average annual increase of about 17 percent). However, the increase in total Guamanian workers was only 10 percent (from 5,963 in 1940 to only 6,634 in 1949, or an annual average increase of only one percent). The difference between an average annual native population growth of 4 percent and this average annual Guamanian occupational expansion rate of only one percent results in an intriguing statistic: the annual statistical difference between Guamanian occupational expansion and population growth in the years 1940-1949 was 3 percent. It is logical to expect that in the situation of a 4 percent, indigenous population growth in a rapidly expanding economy, a concomitant or even greater expansion of the indigenous work force should also have occurred; however, this was not the case on postwar Guam. There are several possible explanations: 1) it might be inferred that the above statistic is an indirect measure of the rate of Guamanian out-migration during those years; 2) it might mean an indication of a new reluctance on the part of the Guamanians to enter the expanding job market; or 3) it might indicate a discriminatory hiring policy on the part of the federal government on Guam at that time.

The postwar job expansion on Guam had little immediate impact upon the Guamanians. It appears now to have been an economic situation that immediately benefited very few Guamanians. The questions at this point are: "Who were these Stateside in-migrants?" and "What effect did their presence have upon the local culture and the local economy?" A further analysis of the census data for this period reveals the peculiar impact this postwar in-migration of Americans had upon the economy of the island.

For example, if one were to examine the changes found in certain occupations in terms of ethnic background (Statesider or Guamanian), then it would be possible to develop a sketchy occupational profile of both the Guamanian and the "stateside" migrant at that time.

The occupational categories of 1) proprietors, managers, and officials, and 2) teachers were the only two in which there were any whites in 1940. There were, however, signs of a Guamanian upward movement in the occupational hierarchy in 1940: of a total of 238 persons in the top occupational categories of proprietors, managers, officials, and college academicians, Statesiders accounted for only 24 percent and Guamanians the rest. By 1949 the Stateside in-migrants accounted for 44 percent (or a 10 percent increase over 1940) of the total in those same categories. Similarly, of a total of 111 teachers in 1940, only seven (or 6 percent) were Statesiders. By 1949, 122 (or 33 percent) out of a total of 365 teachers were Statesiders, resulting in another relative gain over the indigenous Guamanians.

The economic impact of these outsiders on Guam was more far-reaching than indicated in any analysis of census data. Many of these outsiders were true migrants, or colonizers, coming to live in the last "Far West" territory of the United States. Most of the Americans who arrived on Guam after WWII were not colonial administrators; they were military personnel. These people had an untold economic and cultural impact upon the Guamanians. Since that time to this, at least 20,000 Americans have been present on Guam and the civilian Stateside population on Guam in 1975 is estimated to be nearly 25,000 (20). What kind of people were these postwar Americans who came to Guam?

The occupational categories in which no whites appeared in 1940 were the following:

1. cooks and domestic servants,
2. chauffeurs, teamsters,
3. carpenters and kindred, and,
4. fishermen

However, by 1949, the white newcomers had registered their greatest increase in these very same categories (19). In 1949, the percentage of whites in these four occupational categories were as follows:

- 1) cooks and domestic servants 10%
- 2) chauffers and teamsters 17%
- 3) carpenters and kindred 29%
- 4) fishermen 6%⁴

The indications are that the first postwar wave of American immigrants to Guam not only took jobs in all strata of Guamanian society but also were composed of three fairly distinct socio-economic classes. Approximately one-third of them were upper-middle class professionals, administrators, and officials; one-fourth were middle-class teachers and craftsmen; and the rest were skilled or semi-skilled workers

It would be understandably difficult for most non-Guamanians to comprehend what it must have meant for the Guamanian people to absorb such a migration of foreigners. Here is a people who for hundreds of years had lived relatively securely with their own customs and traditions. Then, within less than a decade (1940-1949), these same people were subjected first to two and one-half years of enemy occupation and then to five years of reorganization of their occupational structure. The juxtaposition of these two culturally traumatic experiences apparently served to lessen the impact of each. That is, the welcome return of the American armed forces in 1944 served to obliterate the harsh experiences of the three and one-half years of Japanese occupation. The socio-cultural impact of the American postwar colonization of Guam was apparently lessened by the fact that, at that time, anything was bound to be perceived as better than the Japanese occupiers.

The culture of this new migrant required another reintegration of the Guamanian cultural identity. Also, the migration served to acquaint the Guamanians with the world of postwar global politics and economics, for the new migrants to Guam were the products of a highly competitive, well-educated, and professionally-skilled society. In addition, these newcomers were conditioned, in terms of culture, to be individualistic. They found themselves among a group of people who experienced emotional difficulty and pain in most situations that required overt aggression or individualistic motivations and/or actions. Also, these migrants found themselves among a group of people who, because they had been denied the opportunities for higher education, found it difficult both to compete and to capitalize upon the postwar military development of their own island.

Personal fortunes were quickly amassed by some of the first postwar immigrants to Guam. In fact, the beginnings of many of the wholesale and retail enterprises on Guam today occurred at that time. To this day, a large portion of the private economy is still controlled by these former immigrants.

To summarize this phase of the Guamanian experience, the phenomenon of the postwar American military build-up and the simultaneous colonization of Guam dramatically altered the socio-economic patterns of the Guamanian people. Before the war, the American culture was for the Guamanian only an incidental nuisance at worst or an impossible dream at best. However, after the war, this outside cultural and economic influence became the prevailing pattern. The postwar military build-up of the island did not result in expanded job opportunities for the Guamanian; it resulted in yet another complexity in the economic involution already endemic within the local economy. Because Guamanians never had the type of political sovereignty that ensures control of immigration, more aggressive and educationally better-equipped outsiders assumed control of the economy and the cultural life of the island.

In addition, after WWII the American military command on Guam acquired more federal land on the island. By 1950, the Guamanians found themselves in actual possession of little more than one-half of their island. Whereas the Spanish had merely manipulated the local economy and had claimed for the Crown only lands on the northern plateau, the Americans, in less than 50 years, had completely dominated the local economy and culture and had taken more than one-third of the island. Most of the land was taken in the years 1944 to 1948.

⁴The number of Guamanian fishermen decreased from 1940 to 1949, from 91 in 1940 to only 34 in 1949, or a decrease of 73 percent.

When future analyses are made of their cultural history, the postwar period will probably be defined as one of the more trying times in Guamanian history. It was a time of reacculturation and of alienation of their only viable economic resource--land. It was a time that required a number of innovative adaptations on the part of a highly adaptive group of island people.

Within 20 years' time most of the Guamanian-Chamorros could speak and act as any State-side American. This period represents, therefore, a fascinating case study in what may well be the abilities of a small group of people to survive by means of a built-in ability to adapt.

PHASE VI: 1950-1962: THE GOVERNMENT OF GUAM AND CULTURAL REINTEGRATION

After WWII, a Guamanian push for political sovereignty reached new intensity. Not only had they been exposed to modern warfare and the practices of American eminent domain, Filipinos. Nearly 50 years of Guamanian lobbying and pressure for even a modicum of civil rights from the U.S. Congress finally resulted in the first grant of civil rights and quasi-independency to any Pacific island peoples. On July 21, 1950, the Guamanians became U.S. citizens and were allowed to establish their own civilian government. Although Guamanians view that day as the beginning of their citizenship rights, their island still lay under the direct control of the U.S. Navy. It would not be until 1963 that the military security closure over the island would be lifted. Although the Organic Act of Guam allowed for the establishment of a Guamanian civil government, the Guamanians were not allowed to elect their own governor until 1972. They still do not have control over many of the vital decisions that affect them socially and economically. Under the Organic Act, Guam became an "unincorporated territory" subject to 213 treaties, laws, and congressional acts of the U.S. What did the Organic Act accomplish?

In terms of economics and culture, the significance of the date, July 21, 1950, lay in one thing: the birth of the local civilian government, the Government of Guam. What the Government of Guam means to the Guamanians is economic survival in an age of wage economics.

The eventual economic significance of the inauguration of the Government of Guam (better known as "GovGuam") can best be seen by examining some of the more recent employment statistics on the island. For example, as recently as 1973, of a total of 30,365 persons employed on the island, 44 percent (13,350) were directly employed either by the federal government or by GovGuam. This represents a governmental employment rate which is seven times higher than that of the United States. Of the two agencies, the Government of Guam was the single largest employer on the island. In 1973, 6,087, or 20 percent of the total, worked for the federal government primarily in the numerous military facilities; 7,268, or 24 percent of the total, worked for GovGuam. GovGuam, therefore, in 25 years has become the single largest employer on the island and re-presents another adaptation of the Guamanians to the demands of the wage-based world economy.

By 1950 Guam had become, in effect, a two-company town. Since that time, the Government of Guam not only has provided a locally-controlled wage source for the Guamanians, but also, by 1973, it had replaced the federal government as the largest employer on the island. GovGuam has now become the only vehicle through which the Guamanian people can ever hope to cope with some of the problems of the last 15 years: modernization, increased immigration, corporate capitalism, and youthful alienation.

The Government of Guam is a rather elaborate but effective Guamanian bureaucracy that functions overtly to provide a wage income for at least one-half of the Guamanian households on the island. Its latent function seems to be as a collective island-style response to the postwar burst of Americanization and modernization.

Most of the tax revenue that is generated on Guam is administered by GovGuam and has gone into the development of the island's modern school system, into wages for Guamanian people, and into contracts with Guamanian-owned private businesses. It has been through this civilian government and through the practical experiences learned in

governing themselves that the latent seeds of Guamanian cultural pride and identity have been quietly germinating and searching for ever new expression. By 1972 the Government of Guam had gained de facto control over the economic development on the island, had initiated a bilingual educational program in their school system, and had been granted an injunction against further U.S. Navy acquisition of island real estate. GovGuam has developed according to the cultural biases of the Guamanians themselves: it is a bureaucracy that exercises minimal restraints upon and even outright support of Guamanian-owned business. The civilian government on Guam now functions as the only organization of Guamanians large enough to cope with the demands being made by corporate capitalism and with the vagaries of international economics in the 1970s. It would appear that GovGuam has already become the bastion of Guamanian cultural re-integration and the quiet source of an ever-increasing Guamanian control over their own destinies.

PHASE VII: 1962 TO THE PRESENT: KAREN, KENNEDY, AND AN ISLAND CULTURE IN MASS SOCIETY

The most recent era in the Guamanian economic experience represents another distinct stage in the evolution of the island's culture. The era began with two significant events--the devastation wrought by a typhoon in 1962 and the lifting of the naval security closure in 1963.

Typhoon Karen struck Guam on the night of November 11, 1962. Within hours, it had stripped the island. The man-made structures that remained standing presented a scene of crumpled and soggy impermanence and even the few concrete structures on the island suffered extensive damage. Thus, one of the forces that inaugurated this era was meteorological in nature, and as such, was a part of the way of life in this typhoon-generating region of the western Pacific Ocean.

The task of rebuilding began at once. The U.S. Congress appropriated \$15,644,000 in rehabilitation funds (21). Work commenced on building steel-reinforced poured-concrete homes, schools, government, and business buildings.

The second factor at the start of this seventh phase in the Guamanian economic experience was the lifting of the required security clearance to enter Guam. In 1962 President John F. Kennedy authorized that the security closure of Guam be terminated. This single act allowed the long-frustrated economic growth of the island to begin at last.

Of the two events, the lifting of the security closure proved to be the more significant. In terms of subsequent economic and cultural development, the result of that one decision has been the extremely rapid (some say uncontrolled) growth of the island's non-military and non-governmental economic base. Within five years after the lifting of the security closure, Guam was on its way to becoming a major travel destination for Japanese tourists. Hotels sprouted along Tumon Bay in rapid profusion. Today there are about 2,500 hotel rooms available on the island (22). Since 1963, therefore, an entirely new Guam economy (gross receipts of one billion dollars in 1974) has grown up around tourism.

By 1970, branch offices of some of the major international corporations had been established. By 1972, the first generation of high-rise buildings had begun to mark the landscapes of Agana and Tamuning. At the same time, federal urban-renewal programs were remaking the towns of Sinajana and Yona. By 1973, town house, condominium, and executive-style housing developments dotted some of the island's choice real estate. Since 1962, therefore, the people on Guam have witnessed a rapid changeover from military khaki to Golden Arches and from quonsets to high-rise hotels.

There have been indications that the economic involution of the immediate past were being modified. Whereas in 1963 only 25 percent of the island's workers were employed in the private sector of the economy, by 1974 more than 25,000 of a total of 37,000, or more than 68 percent, were in the private sector (23). In addition, many Guamanian family businesses have incorporated in order to take advantage of various protections afforded by corporate structures. Although the data from the 1974 household survey showed that half of the Guamanian households in the survey had wage-earners in the

employ of GovGuam, it is evident that there has been a remarkable increase in the movement of Guamanians into private business as well as into commercial farming ventures. Commercial farming has increased by 41 percent since 1970 (24). In the midst of this mass movement into the modern economy, most Guamanian households still manage to garden, or raise chickens and pigs, or fish, or gather some foods in the jungle.

In 1974, even though the U.S. military presence still made up 40 percent of the gross island product, the economy of Guam had become diversified and no longer represented a serious problem of involution. Thus, in 1975, a Guamanian economic adaptation has emerged that encompasses subsistence and computer programming, reciprocity and intense competition.

The economic changes also resulted in growth of the island's construction and service industries. Despite an energy crisis and recession, the dollar volume of 1974's federal and local governmental construction projects on Guam surpassed that of 1973 and, in 1973, contracts amounting to \$32,602,598 were awarded compared to \$31,199,441 in contracts awarded in 1963 (25).

This phase has also witnessed the rapid educational advancement of the Guamanian people. For example, whereas 1963 marked the year when the first Guamanian received a Ph.D. degree, in 1974, according to the household survey of 180 Guamanian families, there were six Guamanians with a Ph.D. or more. Therefore, if the survey data is representative of the Guamanian population as a whole, then by 1974 the problem of poor education among the Guamanians was already being ameliorated by a combination of the effects of the authorization to establish local governmental control over the island, the suppression of the security closure, and a cultural commitment on the part of the Guamanians to achieve higher educational statuses.

Over the past 12 years and more, Guamanians have been exposed to the full thrust of cultural influences from modern-day mass society. Beginning with youthful emulation of rock musicians and U.S. young people in the early 1960s and continuing through a period of ethnic-based confrontations and gang warfare in the mid-1960s, the young Guamanians in the 1970s now find themselves driving modified late-model automobiles and striving for more education. Their parents have lived in two different worlds and they now find themselves living in a world full of mechanical conveniences, processed life-styles, and modern-day "frontier" salesmen. As indicated in the opinion survey, most Guamanians were already beginning to see some of the contradictions between their own customs and those of mass society in 1974. The demand for scientific legitimation of their own cultural history has become one of the more crucial issues recognized by the people indigenous to Guam. Whereas a few years ago they heedlessly allowed much of the magnificent archaeological remnants from their own cultural past to be bulldozed and they eagerly sold their land to Japanese, Chinese, and U.S. investors, today the Guamanians possess some of the most rigid building codes and environmental protections found anywhere in the U.S. They are now demanding that the United States Congress open investigations into the manner in which Guamanian lands were taken by the U.S. military after WWII.

On the other hand, this new-found involvement with mass society has resulted in yet another predictable cultural adaptation. Crime rates on the island have soared astronomically since 1965. Cases of heroin addiction and over-dosages have become recurring problems for the harried staffs in the newly-established public and private mental health centers on the island.

For some observers of the local scene on Guam, these dilemmas posed by the recent modernization and rapid movement into mass-media culture seem finally to have placed the Guamanian culture in a position of jeopardy. Although some may believe that no Guamanian culture is left, one has only to live on Guam for a short time or to talk with young Guamanians who were born and reared in California and who have now come to Guam to know that there is still a marked socio-cultural difference between the U.S. and the Guamanian ways of seeing, feeling, and doing. Whatever the case may ultimately prove to be, most persons would agree that this phase in the Guamanian cultural evolution is once again testing the strength and resiliency of these people and their unique ways of coping with outside influences.

It is still too early to determine what the ultimate results of this recent overlay of modernization on an already hybridized culture will be. It is enough at this time to affirm that the Guamanians have never been in a more powerful position to affect the course of their own destiny.

SUMMARY AND IMPLICATIONS

An analysis of the economic profile of the Guamanian-Chamorro family interviewed in 1974, combined with an historical review of the economy, reveals a uniqueness in the adaptation these people have made to the world of modern economics. In 1974, the Guamanian families in the sample required 1.9 workers to earn a median income of only \$7,800 per year for 4.3 children and/or dependents. Eighty-three percent of the Guamanian families worked for either federal or local government agencies. Nearly half of these worked for the Government of Guam. Only 15 percent worked in the private sector. Fifty percent of the Guamanian wage-earners in the survey were in occupations categorized as "skilled labor" or "sales/clerical and kindred." This economic situation was associated with an educational disadvantage experienced by the Guamanian family.

There are indications in the survey data that the 1974 Guamanian population was composed of: 1) those with a lower status job, less education, and little or no outside income and 2) those with a professional status job, a great amount of education, and/or an independent source of wealth gained primarily from the rental, sale, or leasing of extensive land holdings.

Despite the apparent economic disadvantage of the average Guamanian family in such a low income, high-cost place as Guam, they manifest signs of a nearly complete adaptation to the worlds of modern media, modern consumer technology, and corporate capitalism. This adaptation is made analytically complex, however, by the information that in 1974 the Guamanian family still spent four times the amount spent by families from the other major groups for large-scale parties and fiestas and that nearly 50 percent still owned and used an outdoor cookhouse. Hence, the question once posed by Governor de la Corte in 1855 is still appropriate today (9): "How is it that these people not only can survive but even appear to prosper in spite of their low income, the exorbitantly high cost of living on Guam and their simultaneous commitment to mechanical conveniences and to extremely expensive parties for more than 150 people at a time?"

The answer to this question, for both the past and present, is to be found in the evolution process of the cultural patterns of the Guamanian-Chamorro. What would prove to be impossible for a comparable Stateside family is made possible for Guamanians (despite a 30 percent higher cost of living on Guam) because of the existence of the practice of reciprocity. First, the Guamanian family, by and large, pools some of the total family income. Even the children's earnings are viewed as belonging to the family as a unit. Second, the Guamanian extended-family, in most instances, functions as a reserve, or a backup, in the eventuality of either a planned or an unforeseen expenditure of a significant amount. In the case of the death of a family member, although the total expense for the lengthy funeral practices exceeds that of an average American funeral by \$1,600 (\$3,200 vs. \$1,400), the Guamanian family can expect about \$2,000 of reciprocal cash exchange in addition to the real wealth exchange that is measured in the form of donated foods and/or labor. Exact accounts of all exchanges are kept in extensive ledgers and are repaid in kind when any of the donors experience a similar outlay (26). The Guamanians, then, have developed an admirable no-interest loan system that functions to provide for the untoward expenses incurred in a money economy. This adaptation appears to be purely islander in origin and thus probably constitutes a cultural carry-over from their past. As many Guamanians would affirm, "You can do nothing without friends."

In terms of daily survival it would appear that the Guamanian family flourishes in the world of modern inflated economics. No one on Guam goes hungry. Every family interviewed in the 1974 survey had more than a respectable range of mechanical luxury appliances and entertainment components. Part of the Guamanian family's ability to cope can be found in their partial reliance upon subsistence patterns as well as upon

reciprocal exchanges. A Guamanian may earn \$18,000 per year as a GovGuam Director, but he may still tend his garden, care for his chickens and pigs, be on the lookout for new varieties of fruit and nut trees for his yard, and be ready to lend a helping hand to his family and friends. This is, in effect, the melding of some of the best aspects of two economic systems and such a person may be said to live in the best of two different worlds and in two quite contradictory economic systems.

The power in such an evolutionary adaptation can be reaffirmed by recalling that in 1974, 92 percent of the Guamanian families owned their own homes, 67 percent still owned some land, and 30 percent still built their own homes, usually with the help of relatives and friends. This constitutes evidence of the power of the Guamanian culture and demonstrates some of the advantages of being a Guamanian. The Guamanians apparently have been able to continue at least some of the culturally-unique economic patterns of their past and these patterns have probably survived because of their practicality.

Based upon the foregoing analysis, the following socio-economic problems appear to be the direct results of the lengthy history and development under colonialism:

1. Lack of local capital
The Guamanian attitude toward money is not only seen to be a function of ideas of reciprocity from the ancient Chamorro culture, but is also seen as a function of continuous economic manipulation of the people by colonial powers. These factors may have precluded the accumulation of locally-generated capital.
2. Unregulated profit and consumer acquiescence
The Guamanian ability to cope with and actually promote capitalism is attributable to the cultural non-assertiveness of the people and to their exclusion from control of their own economy for 300 years.
3. Guamanian exclusion from regional economic development
The artificially-inflated local economy automatically precludes Guamanian competition in regional economic plans. This economic problem is attributable to outside manipulation of the local economy.
4. Sanction against Guamanian participation in private business
The culture of the Guamanian still tends to inhibit entry into private business. This is not only the result of cultural values that stress group orientation and reciprocity, but also it is the result of the nature of the local economy which has continually been subjected to the whims of the outsiders.
5. Economic involution
The problem of occupational involution (reliance upon one or two major employers for most of the wage capital) on Guam is attributable to the predominance of military employment.
6. Lack of commercial agriculture
The Continuing lack of commercial agricultural development on Guam is attributable to the same forces which created an artificially-inflated economy and to high dependence upon military and government employment.
7. Unfavorable balance of trade
The high import, low export ratio is the result of the long period of colonial control of the economy of Guam.

There are also a number of implications that derive from this brief historical review of 450 years of colonial relationships. They are offered as working hypotheses and are, therefore, subject to revision as further analyses of the available materials are made. The implications are as follows:

1. The Guamanian culture is a unique adaptation to the colonial heritage on Guam. The local culture still exerts an influence over all who live on Guam.

2. Some of the characteristics of Guamanian culture are:
 - a. coynertness and secretiveness,
 - b. adaptability,
 - c. resiliency, continuity, and identification of participants in the culture as Guamanians.
3. The colonized have learned more than the colonizers. The colonial bureaucracy poses little or no problem for the Guamanian people who have learned how to infiltrate, maintain reticence, listen well, and keep their own socio-economic networks functioning and well-hidden.
4. In the mass society of the 1970s, the average person is "colonized" just as surely as the Guamanians. The difference is that the Guamanians have developed viable psychological patterns, familial networks, and cultural responses by which they are able to cope with and take advantage of the situation on Guam.
5. This isolated culture, based upon adaptability to the demands of a series of outside powers, shows that the concepts of adaptability and extinction can become confused. What may be viewed as "loss of culture" from the viewpoint of an outside observer could be, in reality, a set of survival mechanisms. Guamanians are the first Pacific Ocean peoples to bring together elements from the diverse cultures of the Pacific, the Orient, Europe, and America into a workable cultural unity.
6. We know less about the Chamorro islanders (ancient or modern) than perhaps any other island peoples in the Pacific. Not only were the Chamorros destroyed 300 years before there even was a discipline of anthropology, but also the 19th and 20th century social scientists unwittingly have overlooked the neo-Chamorro culture.
7. A cultural profile of the modern-day Chamorro would include the following:
 - a. A method of child-rearing that socializes people to respond to put social obligations before self, to expect capriciousness, and to mistrust verbal commitments.
 - b. Patterns of interaction which include 1) teasing as a social control mechanism, 2) ways of drawing out other people without making a commitment oneself, and 3) a tendency to agree with another person for the sake of harmony and then privately act otherwise.
 - c. A tendency to use money to further one's immediate social status and to create and discharge the obligations of friendship and kinship.
 - d. The maintenance of subsistence patterns and informal reciprocal exchange networks in the midst of the development of a sophisticated 20th century capital-intensive economy.
 - e. A psychological focus upon the immediate detail rather than upon the indefinite future.
 - f. A high degree of patience and emotional restraint which may be abandoned in the company of family and friends.
 - g. Withholding real agreement or commitment until advice is sought from trusted others or until a group decision is made.

In conclusion, the words of a 21-year old poet eloquently but simply epitomize the viewpoint of this chapter. She wrote:

That long lost Utopia
 Heard several years ago to be coming,
 Puzzled many.

"A Heaven on Earth?"
 Seemed impossible.

But the Heaven is in your mind and,
 Sure enough,
 It makes a lot of the broken pieces
 Of beatniks,
 Hippies,
 Flower children
 And love manics
 Fold
 And mold
 And create again another medium
 For the emerging generation
 Waiting eagerly to see what we've left them this time.

Maria Yatar, 1974 (27)

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CHAPTER VI-4

THE FAMILY ON GUAM

Ronald L. Klimek

INTRODUCTION

People in all societies make decisions about who will live together in a household; decisions are also made about who, outside the household, are close kinsmen and who are remote kinsmen, who in a family should work outside the home and who should stay at home, and other similar decisions that have something to do with family life. The family is seen as an important unit in societies and we as members are concerned with how it operates. This chapter presents what a sample of people on Guam have reported about their family life in a socio-cultural survey that consisted of a Household Questionnaire and an Opinion Questionnaire (see Appendices).

THE HOUSEHOLD

SIZE OF HOUSEHOLD

According to the 1970 U.S. census, there are 15,569 households on Guam and each household has, on the average, 4.8 persons. In comparison, the average number of persons per household in the U.S. is only 3.1, or 1.7 fewer persons per household than Guam. The number per household on Guam, then, is high when compared with the U.S.

WHO LIVES IN A HOUSEHOLD

What does the larger number of persons per household on Guam reflect? Does it mean 1) that there are more children per family on Guam, 2) that households on Guam have more "extended" family relatives included as members, or 3) that the proportion of single-member households on Guam is smaller? All three of these factors are reflected in the larger number of persons per household on Guam. According to the 1970 census, each household on Guam has, on the average, 2.6 children. For the U.S., the average number of children per household is 1.2, or 1.4 fewer children per household than on Guam. The number of extended-family relatives per household is .41 on Guam, but only .14 in the States. Finally, the percentage of single-member households on Guam is eight percent as compared to 20 percent for the States (1, 2).

In comparing two populations, if there are more children in one population and the children do not live in households separate from their parents, then the average number of persons in each household will be higher in that population. Similarly, if one population has more extended-family persons living with relatives rather than alone, then the average number of persons in each household will be greater in that population. On the other hand, single-member households lower the average household size because they are considered as separate households. The total number of these households is divided, along with the total number of larger size households, into the total population to obtain the average number of persons per household.

Among these three factors that account for the larger number per household on Guam, the first factor is the most prominent. Guam, in comparison to the U.S., has more than double the number of children per household and this, more than the presence of extended-family members or the existence of fewer single-member households, accounts for the larger size of the average Guam household. Thus, in terms of who the members are, the typical household on Guam is similar to the typical household in the States, except that the average Guam household has more children.

What is meant by a typical household in the U.S. is a household that is organized along the nuclear family model, that is, husband and wife and any children they may be rearing. A nuclear family may also consist of a single parent and children. It does not mean

a household organized along an extended-family model, that is, husband, wife, children, and other relatives. As already indicated, the size of the average household on Guam differs significantly from the average household size in the States because there are more children per household; but it differs only somewhat because there are more extended-family members. The usual household on Guam, then, is a nuclear household and not an extended-family household. As in the States, husbands, wives, and their pre-adult children (if there are any) live together under one roof and other relatives are not typically included.

Still, more Guam households include extended-family relatives than is the case in the States. This indicates that, on Guam, an unattached relative such as one's widowed mother-in-law or a grandchild whose parents are deceased or gone is more likely to be added to nuclear households than is the case in the States. This accounts for the fact that there are more extended-family persons per household on Guam and it accounts in part for the fact that on Guam there are fewer single-member households. Instead of forming their own households, unattached persons on Guam frequently reside with relatives. For example, a widow will reside with one of her daughters and sons-in-law. The usual pattern in the States is for the unattached relative to reside alone, thus increasing the proportion of single-member households.

In terms of who lives where, Guam maintains more of an extended-family orientation than is the case in the States. It appears that on Guam the widowed, the orphaned, and the otherwise unattached person is fairly frequently included as a member in the home of a relative while this happens less often in the States. In the U.S. such persons are more likely to live alone or be taken care of by the government. However, in both settings--Guam and the States--family life is primarily and strongly oriented toward the nuclear household pattern and the inclusion of extended-family relatives is not the typical pattern; or in other words, on Guam the nuclear pattern has more of an extended-family overlay than is the case in the States. There apparently is more of a feeling that unattached persons should be included in the home of a relative and should not be left to live alone.

That there is this feeling toward including unattached relatives in family households on Guam is supported by the fact that, in response to the Opinion Questionnaire statement that, "Children should take care of their parents when they get old," 126 respondents agreed, or 75% of the 168 who answered the statement. A large percentage of each of the cultural groups for which there is sufficient data agreed with this statement. The figures are 88% for Micronesians, 83% for Filipinos, and 73% for both Guamanians and Statesiders. The data does not indicate whether children are actually willing to add an elderly parent to their own household, but it does indicate a strong overall attitude that persons should care for their elderly parents. Linking this to the extended-family evidence above, it can be stated that this attitude often means taking care of an elderly parent, or a similar such relative who needs looking after, in one's own home.

In the Household Questionnaire, respondents were asked to record and classify all the members of their households. Of the 301 households for which there is family data, 57 households, or 19%, had extended-family relatives as members (Appendix D). The remaining 81% had single individuals, couples, or parents and children exclusively as members. The pattern is the nuclear family; however, almost one-fifth of the families have at least one extended-family member. Thus, the survey reveals the same facts as the census--a nuclear family pattern with an extended-family overlay.

The socio-cultural survey data goes beyond the census information, however, for the census as printed gives only the average number of extended-family relatives per household. It does not give the actual percentage of households with extended-family relatives. The census figure is .41 extended-family relatives per household. If these relatives were distributed among the households of Guam in such a way that no household had any more than one extended-family relative, then 41% of the households would have extended-family relatives. However, the survey shows that extended-family relatives are found in only 19% of the households. This means that the households who do have extended-family relatives typically have more than one such relative. In fact each of these households has, on the average, just slightly more than 2 extended-family relatives. This indicates that the extended-family overlay on the basic nuclear orientation of families on Guam is not randomly distributed, but is concentrated in certain family households.

The various cultural groups on Guam differ in the percentage of households that have extended-family relatives (Table 3). The figures are 20% for the Guamanian population, 11% for the Statesiders, 23% for the Filipino population, and 8% for the Micronesians. Including extended-family relatives in one's household, then, is noticeably more the pattern for Guamanians and Filipinos than it is for Statesiders and Micronesians. Part of this can probably be accounted for by the fact that Guamanians and Filipinos have more extended-family relatives living on the island than do Statesiders and Micronesians. However, observations reveal that many Statesiders and Micronesians do have extended-family relatives residing on the island. This suggests that choice is also part of the answer to why there are proportionately fewer Statesiders and Micronesian households with extended-family relatives.

Of the total of 1,843 persons residing in the 301 households, 107 were extended-family relatives and, as indicated, the 107 relatives reside in 57, or 19%, of the households. It is interesting to note who the 107 extended-family members are and that the percentage of extended-family relatives, when compared to all household members in the sample, is very small. One-hundred seven is only 6% of 1,843 and, therefore, in terms of the total number of people in households, there are only a limited number of extended-family relatives. Almost all household members, unless they live alone, are couples or parents and children. This indicates even more strongly than the census data or the previous presentation of the household survey data that the household pattern on Guam is basically a nuclear pattern. If one does not live alone (and few people on Guam do), then having a mate and, usually, the rearing of children are primarily what makes up a household. The presence of extended-family relatives in households is clearly a secondary pattern.

Extended-family relatives, then, represent 6% of all household members and they reside in 19% of the island's households. How are these relatives related to the heads of the households in which they reside? The 107 are related to the household heads as follows: 15 mothers-in-law, 10 fathers-in-law, 14 brothers-in-law, 7 sisters-in-law, 1 mother's cousin, 10 sons-in-law, 8 daughters-in-law, 9 grandsons, 8 granddaughters, 6 mothers, 5 fathers, 1 brother, 3 sisters, 1 aunt, 6 nephews, and 3 nieces.

Almost all the household heads in the survey were males (282, or 94% of 301) and almost all households included a married couple (271, or 90% of 301). This means that the extended-family relatives listed above are, in almost all cases, living in households where the head is a married male.

The composition of the extended-family relatives reveals a number of patterns. In discussing these patterns all the relatives are being treated as though they were living in households headed by married males. It is not possible at this time to sort out the few relatives who are in households where a female or an unmarried person is the household head.

The extended-family members typically fall into two basic categories: first, 47 relatives, or 44% of the total 107, are in-laws of the household head, or husband. That is, in reference to the husband, 44% are mothers-in-law, fathers-in-law, brothers-in-law, sisters-in-law, or mother's cousin. Second, 35 relatives, or 33%, are equally related to both the husband and the wife. Included here are sons-in-law, daughters-in-law, grandsons, and granddaughters. The remaining 23% of the extended-family relatives are either in-laws of the wife--i.e., mother, father, brother, sister, or aunt of the husband--or they are nephews and nieces who, because of the lack of specificity of these kinship terms, can be in-laws of either the husband or the wife and, therefore, cannot be classified as either the husband's or wife's in-laws.

Extended-family relatives on Guam, then, when they reside in another relative's household are most often in-laws of the husband. This indicates that it is the wife's responsibility to look after unattached relatives. She takes her consanguineous, or blood, relatives into the household much more often than the husband does. Apparently, his sisters or other female relatives handle that responsibility. Thus, the evidence is that it is more a woman's job than a man's job to find homes for the unattached consanguineous relatives.

In the analysis of this data, all sons and daughters regardless of their ages were classified as nuclear rather than extended-family relatives. However, an inspection of

TABLE 3

Extended Family Relatives
(Number and percentage of Guam
households with extended-family
relatives, by cultural group)

Cultural Group	Total House- holds	Households ^a with Extended-Family Relatives	
		Number	(Percent)
<u>All Groups</u>	<u>300</u>	<u>57</u>	(19)
Guamanians	199	39	(20)
Statesiders	27	3	(11)
Filipinos	62	14	(23)
Micronesians	12	1	(8)

^aOnly those households inhabited by Guamanian, Statesider, Filipino, or Micronesian families (300 in all) are included in this and all subsequent tables. The remaining families in our household survey of 302--1 Japanese family and 1 household for two households in our household survey of 302--1 Japanese family and 1 household for which we have no family or ethnic data--are not included. The Japanese family had no extended family members present in the household. Whether this family is counted or not, the percentage of households with extended family relatives remains at 19 percent.

the household data shows that where there are daughters-in-law and sons-in-law reported as household members, there are usually adult sons and daughters also reported as members. Similarly, where there are grandsons and granddaughters, there are often adult sons and daughters, although sometimes grandchildren are unattached relatives who are being cared for by the grandparents. Thus, the second pattern is representative of the extended-family system that existed on Guam in former times when different generations often lived in the same household: a person married and had children but remained in the parental household.

This is not the typical extended-family pattern today. The addition of unattached relatives is now the more usual pattern and it is generally the wife who takes in one or more of her consanguineous relatives. Overall, however, most families include no extended-family relatives; the basic pattern is the nuclear family pattern.

In summary, the typical household on Guam is the nuclear household of one or two parents and any children they may be rearing. In addition, almost one-fifth of the households include one or more extended-family relatives. In terms of total numbers, the number of extended-family relatives is few and, basically, they appear to be relatives who would otherwise be living alone. Usually it is the wife who adds her consanguineous relatives to the household. This suggests that taking care of unattached relatives is primarily a woman's responsibility. Overall, however, most households include no extended-family relatives. The number of persons per household is high on Guam, but this is primarily accounted for by the large number of children per household.

THE PLACE OF THE EXTENDED FAMILY

To say that the family household on Guam is basically a nuclear family household does not mean that extended-family relationships and contacts are not important. It has already been shown that unattached relatives are sometimes included in family households and that this is one way in which relatives aid one another. The household and opinion surveys reveal other ways in which extended-family members assist one another and the surveys also show that the attitude on Guam is that the extended family is important.

In the household survey, 279 persons answered the question about who built the house in which they live. Of this total, 70 persons, or 25%, said that they, their family, and friends constructed the house. Another 5 persons, or 2%, stated that they, a contractor, and their family and friends did the constructing. Family and friends, then, were involved in the construction of 27% of the houses (Table 4). This figure is the highest for Micronesians, of whom 67% received help from relatives and friends, and the lowest for Statesiders, of whom only 15% received help. The figures for the Guamanian and Filipino populations are 26% and 28% respectively.

In over 25% of the cases, Micronesians, Guamanians, and Filipinos rely on extended-family relatives and friends for house construction. This is very high in an age when construction companies are usually the builders of houses. Particularly Micronesians turn to relatives and friends for assistance in housebuilding, which is an apparent continuation on Guam of a home-island practice. The Statesider most often follows the typical U.S. pattern of having a construction company build his home. This would be expected because Statesiders were born in the U.S. and, as among the Micronesians, they follow the pattern of their home culture. The percentage of persons getting assistance for house construction from relatives and friends is high for the Micronesian, Guamanian, and Filipino populations and this is evidence that, at least for these populations, extended-family ties are important.

It is often heard on the island that the Guamanian population produces a lot of its own food by means of local cultivation. The household survey reveals that this is an accurate perception, although the degree of accuracy depends on how "a lot" is interpreted.

Respondents from 300 of the households surveyed answered the question about how food is obtained. Of this 300, 102 households, or about one-third, obtain some of their food from ranching or gardening (Table 5). Among Guamanians the figure is 41%, while among Statesiders, Filipinos, and Micronesians it hovers around 20%. In accordance with the

TABLE 4

House-Building
(Number and percentage of Guam
houses built with the help
of relatives and friends,
by cultural group)

Cultural Group	Total House- holds ^a	Houses Built with the Help of Relatives and Friends	
		Number	(Percent)
<u>All Groups</u>	<u>278</u>	<u>75</u>	(27)
Guamanians	188	48	(26)
Statesiders	20	3	(15)
Filipinos	58	16	(28)
Micronesians	12	8	(67)

^aThe questionnaire item about house-building did not apply to the few families who are renting their houses. Therefore, the total sample size here is smaller than the 300 of Table 3.

TABLE 5

Obtaining Food
(Number and percentage of Guam households that
obtain food from 1) ranching or gardening,
2) fishing, and 3) relatives or friends,
by cultural group)

Cultural Group	Households ^a Obtaining Food Through:					
	Ranching or Gardening		Fishing		Relatives or Friends	
	Number	(Percent)	Number	(Percent)	Number	(Percent)
<u>All Groups</u>	<u>102</u>	(34)	<u>84</u>	(28)	<u>56</u>	(19)
Guamanians	82	(41)	62	(31)	43	(22)
Statesiders	6	(22)	4	(15)	5	(19)
Filipinos	12	(19)	13	(21)	5	(8)
Micronesians	2	(17)	5	(42)	2	(17)

^aSample size is 300. See Table 3 for a breakdown of the sample by cultural group.

popular perception on the island, Guamanians do more often obtain food from ranching and gardening than do the other cultural groups, although a significant proportion of all groups obtain some of their food this way.

In addition to the 102 households that engage in ranching or gardening, 84 households obtain some of their food from fishing. Thus, along with ranching or gardening, fishing represents another source for food other than the grocery store. Fishing is done more by Micronesians and Guamanians and less by Filipinos and Statesiders (Table 5).

What does ranching, gardening, and fishing have to do with extended-family relatives? Another look at the data shows that in addition to the households engaged in these subsistence activities, there are 56 households that receive food directly from relatives and friends. This indicates that the households engaged in cultivation and fishing not only obtain food for themselves from these activities but also transfer some of what they harvest to relatives and friends. Roughly 20% of the Guamanian, Statesider, and Micronesian households receive some food from relatives and friends. The exact percentages are 22, 19, and 17 respectively. For Filipinos, however, the figure is only 8% (Table 5).

Thus, as with house construction, there is evidence of extended-family ties. Housing and food are basic essentials of life and, on Guam, one can often expect help from relatives and friends. Statesiders receive the least help with house construction, but fare well in terms of receiving food from relatives and friends. The opposite is the case for Filipinos. Guamanians and Micronesians do well in both categories.

In the Opinion Questionnaire, respondents were asked if they felt their responsibilities to other members of their extended family were more or less than they were in the past (Appendix C and Appendix E). Most respondents felt their responsibilities were now greater. Of the 176 persons who answered the question, 96, or 55%, said their present responsibilities were greater. Thirty-five (20%) indicated they were the same and 45 (25%) felt they were less (Table 6). This question does not indicate what is considered a responsibility, nor does it indicate why responsibilities would be considered greater now than in the past. It could be because the respondents are now adults and adults have more extended-family responsibilities than children. Or it could be because there has been a change in the society and extended-family relatives now feel more responsible toward one another. Whatever the explanation, the response to the question does indicate that there is no waning of the attitude that one is responsible for one's extended family. Respondents generally are not claiming that responsibilities are now less than they were in the past.

There are differences among the responses of the cultural groups, but in all cases at least half the respondents saw extended-family responsibilities as the same or greater than in the past. The number of respondents who saw their responsibilities as the same or greater is 75% for Guamanians, 88% for Statesiders, 70% for Filipinos, and 50% for Micronesians. Extended-family responsibilities in Micronesia are extensive, but Micronesians who migrate to Guam would be freed of some of these responsibilities. Therefore, it is understandable that they might respond by saying that responsibilities are now less. The reason Statesiders overwhelmingly responded by saying responsibilities are now greater or the same is difficult to explain. As for the Micronesians, many of their extended-family relatives would be residing off-island. Possibly Statesiders responded to the question more in terms of their age, and meant that responsibilities are greater now than when they were children. Now they have to send gifts, worry about deaths in the family, and other matters they did not have to concern themselves with when they were children. Whatever the situation, extended-family ties are generally seen as important. The attitude that one is responsible for others in one's extended family is not waning and this is a fact for all the cultural groups.

In the opinion survey, the respondents not only indicated that they felt responsible for other members of their extended family, but also they selected family connections as the second most important consideration in getting ahead in life. Each respondent was asked to rank three items from a list that was titled, "Getting Ahead in Life." The list included these 7 items: land ownership, family connections, job or profession, education, type of house, morality, and amount of money. Of the 174 persons who responded to the question, 66, or 38%, ranked "education" as the most important in getting ahead in life. Thirty-six respondents (21%) ranked "family connections" as the most important. "Land

TABLE 6

Extended Family Responsibilities
(Opinion as to whether extended family responsibilities
are now less, the same, or more than in the past,
by cultural group)

Cultural Group	Present Extended Family Responsibilities						Totals ^a	
	Less		Same		More			
	Number	(Percent)	Number	(Percent)	Number	(Percent)		
<u>All Groups</u>	<u>45</u>	(25)	<u>35</u>	(20)	<u>96</u>	(55)	<u>176</u>	(100)
Guamanians	29	(25)	19	(16)	70	(59)	118	(100)
Statesiders	2	(12)	6	(38)	8	(50)	16	(100)
Filipinos	9	(30)	8	(27)	13	(43)	30	(100)
Micronesians	4	(50)	1	(12)	3	(38)	8	(100)
Others	1	(25)	1	(25)	2	(50)	4	(100)

^aThese responses are taken from the opinion survey. The total sample size is 180, but only the 176 persons who responded to the "extended-family responsibilities" question are included in the table.

ownership" and "job or profession" were each ranked first by 25 respondents. Finally, 16 respondents ranked "amount of money" as the most important item, while only 5 ranked "morality" first, and one ranked "type of home" first. Thus, among the many factors on Guam that are seen as important for getting ahead, family connections are far from slighted. Only education is seen as more important. Again there is evidence indicating that extended-family ties are viewed as important on Guam.

Both Guamanians and Statesiders listed "family connections" as important in getting ahead. Guamanians listed it after "education" as the second most important, while Statesiders listed it as the third most important after "education" and "job or profession." In contrast, the Filipinos and Micronesians on Guam do not see family connections as important for getting ahead. Among these two groups only one respondent listed "family connections" as most important. All the other Filipinos and Micronesians saw other items as most important, although, as with Guamanians and Statesiders, the item most often ranked first was "education." Thus, while family connections are generally seen as important on Guam for getting ahead, this is not the viewpoint among the Filipino and Micronesian populations.

In summary, while extended-family members on Guam seldom live in the same household, they do still assist one another and do view family ties and responsibilities as important. They frequently help one another with house construction; food from cultivation and fishing is often shared. Responsibilities toward the extended family are still viewed as a requirement and family connections are seen as important for getting ahead. The Guamanians do well in terms of all these measures of family ties, while each of the other three cultural groups are weak on one or, in the case of the Filipinos, two of the measures. Statesiders do not get family help in house construction and Micronesians do not view family connections as important for getting ahead. Filipinos also do not link family connections with getting ahead. In addition, they are the cultural group least likely to get food from relatives and friends.

HUSBANDS AND WIVES AND THEIR OCCUPATIONS

Knowing that the typical household is a nuclear household reveals much about the composition of family on Guam, but it does not tell us about the roles of family members. In this and the remaining sections data is presented on the activities of family members. This section explores the employment patterns of husbands and wives.

The household survey shows that 267, or 89%, of the households in the sample have a married couple as their base unit and that the husband is usually the household head. The remaining 11% are single-member households or households headed by adults who do not have a spouse living with them. The 267 households that have a couple as their base unit are referred to here as husband-wife households. Of the 267 husband-wife households, 23 are households in which neither the husband nor the wife have outside employment. There are, therefore, 244 households which can be considered in determining who is employed outside the home: husband, wife, or both.

In a near majority of these 244 husband-wife households, both the husband and wife are employed outside the home. The actual number of these households is 113, or 46%, of the 244 total (Table 7). In the remaining 131 households only one of the couple works. This person is almost always the husband; in only 6 cases (3%) is it the wife.

On an overall basis, then, husbands appear to be the main breadwinners. They are almost always employed in occupations that take them outside the home; however, it appears that wives also contribute substantially to the family earnings, since a near majority of them are employed.

The pattern is fairly similar for all the cultural groups, although the actual percentages vary from 41% to 60% (Table 7). In 41% of the Guamanian households both the husband and wife work, while for Statesiders the figure is 50%. For the Filipino and Micronesian populations the figures are 57% and 60% respectively. The only households that have the wife rather than the husband working are 3 Guamanian, 1 Filipino, and 2 Micronesian households. For all the groups, if only one of the couple works, it is nearly always the husband.

TABLE 7

Employment of Husbands and Wives
(Number and percentage of husband-wife households
where the husband and/or wife are employed
outside the home, by cultural group)

Cultural Group	Employed Outside the Home						Totals ^a Number (Percent)	
	Both husband and wife		Husband only		Wife only			
	Number	(Percent)	Number	(Percent)	Number	(Percent)		
<u>All Groups</u>	<u>113</u>	(46)	<u>125</u>	(51)	<u>6</u>	(3)	<u>244</u>	(100)
Guamanians	63	(41)	88	(57)	3	(2)	154	(100)
Statesiders	11	(50)	11	(50)	0	(0)	22	(100)
Filipinos	33	(57)	24	(41)	1	(2)	58	(100)
Micronesians	6	(60)	2	(20)	2	(20)	10	(100)

^aIn addition to the 244 households where the husband, wife, or both were working, there were 23 households in which neither the husband nor the wife were employed outside the home.

The types of jobs held by the husbands is typically very different from the types held by the wives. There is data for 224 of the husbands who work. Of this total, 60% hold transportation, craftsman, foreman, or skilled and semi-skilled laborer jobs, while only 7% of the wives who work and for whom there is data have these occupations (Table 8). In contrast, 65% of the wives are employed in sales (typically as sales clerks in stores), clerical, or teaching positions, while this is the case for only 12% of the husbands. Except for teaching jobs, the husbands also hold proportionately more of the professional and managerial positions. Sixteen percent of husbands are managers or professionals outside of teaching, while 13% of the wives hold such positions.

Thus, division of labor follows the typical American pattern--males (husbands in the sample) represented heavily in transportation, craftsman, foreman, and skilled or semi-skilled laborer occupations and women (wives in the sample) represented heavily in teaching, sales, and clerical jobs (3). Also, the most prestigious occupations--the non-teaching professional and the managerial jobs--are more likely to be held by males than by females, although in terms of proportions, females on Guam are not drastically underrepresented in these occupations. Possibly on Guam there is more equality in terms of these high-status occupations than is generally the case in the United States, though if a breakdown of the professional category into specific professions were possible, it is conceivable that what would be found is that many of the women classified as professional are nurses, a traditionally female occupation. Overall, women on Guam are clearly relegated to certain occupations and men to others, and this follows the U.S. pattern.

Type of job held by husbands as compared to wives follows the same pattern with all the cultural groups. In fact, the few differences are so minor that nothing would be added to this report by including them. Whether Guamanians, Statesiders, Filipinos, or Micronesians are considered, wives are typically employed in teaching, sales, or clerical jobs. On the other hand, husbands are usually employed as transportation workers, craftsmen, foremen, or skilled and semi-skilled laborers.

Do men or women hold the higher-status jobs? The occupational categories used in Table 8 cannot easily be ranked, although the professional and managerial positions may be considered the highest ranking. Proportionately more men than women hold these positions and, therefore, it can be stated that men find themselves in higher-status jobs more often than women do. However, most people employed on Guam, whether male or female, are not professionals or managers and, thus, in terms of one another remain unranked in this study. Also, if teachers are considered as part of the professional group, the result is that proportionately more women than men fall into the professional or manager category. As with the other categories (sales or clerical, transportation, etc.), the professional-manager-teaching category is too broad to be used as an "occupation" for ranking purposes. What is needed is some criteria other than general occupation to assess the rank or value of one's work and then it can be determined who fares better: women or men.

There is such a criteria in annual earnings. Each respondent was asked to report the amount of yearly earnings for each worker in the household. The differences for husbands and wives are striking (Table 9). In 45% of the cases, the annual earnings for husbands were more than \$10,000, while this was the case for only 7% of the wives. Also, none of the wives appeared in the \$20,000 or more income category. Clearly women on Guam are paid considerably less for their work than men. To the extent that income represents rank of job, men hold the higher ranked jobs. This pattern on Guam is the same pattern that exists for the U.S. (4).

The jobs men hold, then, pay more than the jobs women hold. The typical working woman on Guam is employed in a teaching, sales, or clerical position, while men are more often non-teaching professionals, managers, transportation workers, craftsmen, foremen, and skilled or semi-skilled laborers. The men's jobs pay better and because they do, it is suggested that the jobs and the men in those jobs have higher rank in the world of employment. Women on Guam represent a large proportion of the work force--as is evidenced by the fact that in 46% of the husband-wife households both the husband and wife work; however, women are not paid as much for their work as men. That men rather than women on Guam have the better paying jobs is the pattern for all the cultural groups.

TABLE 8
Occupations of Husbands and Wives
(Number and percentage of husbands and wives
employed outside the home,
by occupational category)

Occupational Category	Husbands		Wives		Total	
	Number	(Percent)	Number	(Percent)	Number	(Percent)
<u>All Occupations^a</u>	<u>224</u>	<u>(100)</u>	<u>116</u>	<u>(100)</u>	<u>340</u>	<u>(100)</u>
Professional or Managerial	36	(16)	15	(13)	51	(15)
Transportation	17	(8)	0	(00)	17	(05)
Craftsman or Foreman	47	(21)	2	(02)	49	(15)
Skilled or Semi-Skilled Laborer	70	(31)	6	(05)	76	(22)
Teacher and Related Occupations	9	(04)	16	(14)	25	(07)
Sales or Clerical	25	(11)	59	(51)	84	(25)
Other Occupations	20	(09)	18	(15)	38	(11)

^aThe figures in this table show fewer workers than the figures in Table 7. This occurs because workers for whom there is no occupational data, 17 in all, are not included in this table.

TABLE 9

Income of Husbands and Wives
(Number and percentage of husbands and wives
employed outside the home,
by annual earnings)

Annual Earnings	Husbands		Wives		Total	
	Number	(Percent)	Number	(Percent)	Number	(Percent)
Total Number of Earners ^a	<u>222</u>	<u>(100)</u>	<u>111</u>	<u>(100)</u>	<u>333</u>	<u>(100)</u>
\$ 1,000 - \$ 5,000	13	(06)	30	(27)	43	(13)
\$ 5,000 - \$10,000	108	(49)	73	(66)	181	(54)
\$10,000 - \$20,000	98	(44)	8	(07)	106	(32)
\$20,000 - \$50,000	3	(01)	0	(00)	3	(01)

^aThe figures in this table show fewer workers than the figures in Table 7. This occurs because workers for whom we do not have income data, 24 in all, are not included in this table. However, we do know whether they work or not and, therefore, they do appear in Table 7.

HOUSEHOLD WORK--WHO DOES WHAT?

In addition to paid employment there are many household chores that have to be performed. In this section we explore who does what around the house.

As part of the opinion survey, respondents were asked to indicate who in the household--men, women, boys, or girls--did various tasks. The question was as follows: "Here is a list of the common tasks done around the house. Would you tell me whether or not the people in your household do these things and who usually does each job: men, women, boys or girls?"

1. Daily cooking
2. Feast and fiesta cooking
3. Washing dishes
4. Washing clothes
5. Sweeping the floor
6. Punishing children
7. Gardening
8. Shopping for food
9. Grating coconuts
10. Fishing
11. Driving the car
12. Changing diapers
13. Bathing children
14. Gathering firewood
15. Managing the money

It would be too cumbersome to list the 15 tasks separately and then indicate which person perform them in every case, especially because in many households some tasks are performed by various combinations of persons. For example, in many households both women and men drive the car and in many households both men and boys fish. These are not tasks that are done almost exclusively by one category of persons; however, other tasks are, on the whole, the exclusive domain of one category. Daily cooking, for example, is most often done by women only.

This report concentrates on which sex does each task, although age groups are also considered at times, such as which tasks are performed by boys and girls versus which are performed by men and women. The order of consideration is, first, those tasks which are primarily male tasks, then those which are done mostly by females, and finally those usually done jointly by the sexes. The figures appear in Table 10.

For those households in which the tasks are performed, it is men, boys, or men and boys together who are most often the ones who fish, gather firewood, and grate coconuts. For the 117 households that responded "yes" to "fishing," it is exclusively a male task in 84% of the cases. The corresponding figures for "gathering firewood" and "coconut grating," which are done in 122 and 153 households, respectively, are 79 and 61%. Thus, few tasks around the house are the exclusive work of males; those which are exclusively male tasks are outdoor tasks, for that is the one thing fishing, gathering firewood, and coconut grating have in common. Fishing and gathering firewood are often done by men and boys together. Coconut grating is something both men and boys do, but they seldom do it jointly.

It is primarily women, girls, or women and girls together who have the responsibility for most of the tasks on the list (Table 10). Females have the responsibility for 8 of the 15 tasks. In 86% of the households, only they do the clothes washing; in 74 to 79% of the households, they handle the daily cooking, diaper changing, bathing of children, floor sweeping, and dish washing; in 56% of the households, they alone do the food shopping. In 49% of the households they manage the money, which is more than is the case for males alone or for males and females together.

Females, then, do most of the work around the house. They are primarily responsible for the care of the children, for the washing and cleaning, and for food shopping and meal preparation.

TABLE 10

Household Tasks
(Number and percentage of households in which males, females, or both sexes perform designated home task. Only households where task is done are considered.)^a

Household Task	Number and Percentage of Households Where Task is Performed by:				Task Performed but Unknown by Whom		Total Number of Households Doing Task	
	Males Only		Females Only		Number	(Percent)	Number	(Percent)
	Number	(Percent)	Number	(Percent)				
Fishing	98	(84)	4	(3)	15	(13)	0	(0)
Gathering firewood	97	(79)	7	(6)	17	(14)	1	(1)
Grating coconuts	94	(61)	17	(11)	42	(28)	0	(0)
Washing clothes	3	(1)	153	(86)	21	(12)	2	(1)
Daily cooking	6	(3)	142	(79)	31	(17)	1	(1)
Changing diapers	1	(1)	75	(77)	20	(21)	1	(1)
Bathing children	2	(2)	84	(76)	23	(21)	1	(1)
Sweeping floors	5	(3)	137	(76)	37	(20)	1	(1)
Washing dishes	5	(3)	134	(74)	41	(23)	0	(0)
Food shopping	11	(6)	100	(56)	69	(38)	0	(0)
Managing money	20	(11)	87	(49)	72	(40)	1	(1)
Feast and fiesta cooking	4	(3)	26	(17)	119	(80)	0	(0)
Punishing children	12	(8)	27	(18)	114	(74)	0	(0)
Driving car	40	(22)	11	(6)	124	(70)	3	(2)
Gardening	42	(27)	26	(17)	84	(55)	1	(1)
							149	(100)
							153	(100)
							178	(100)
							153	(100)

^aData is from the opinion survey. Total number of households included in the opinion survey was 180.

As part of their responsibilities, females typically manage the family money, but this task more than any other is also done frequently by both sexes together. In 40% of the households, both males and females manage the family money. The second of the predominantly female tasks that males and females are most likely to share is food shopping. This task is done by both sexes in 38% of the households. Managing the money is a task that gives females some control over family matters, whereas food shopping allows them to perform a household task away from the home itself. The other tasks--washing clothes, daily cooking, changing diapers, bathing children, sweeping floors, and washing dishes--are not tasks that allow for much family decision-making and they tie the female to the household. It is these tasks, more than managing the money and food shopping, that are overwhelmingly female work.

Thus, it can be concluded that most of the household jobs are not only done by females, but also that females are most typically assigned those tasks which tie them to the household and which are devoid of important family decision-making. In that females more than males shop for the food and manage the family money, this conclusion may seem unjustified; however, in proportion to all the household work done by females, food shopping and managing the money are the least likely to be their exclusive domain. Also, it has already been shown that household work away from the home is primarily a male domain. It is they, and not the females, who fish and gather firewood.

The tasks which are primarily done only by the women of the household are clothes washing, daily cooking, food shopping, and managing the family money. For these tasks, women get limited help from their daughters or other girls in the household; however, the girls do help substantially with diaper changing, bathing of children, floor sweeping, and dish washing.

In a majority of the households, four of the 15 tasks are performed by both males and females. In 80% of the 149 households that do feast and fiesta cooking, both sexes participate. Similarly, both males and females typically punish the children, drive the car, and do the gardening. These tasks are performed by both sexes in respectively, 74, 70, and 55% of the households (Table 10).

Punishing the children is an interesting category, for although females almost exclusively take care of the children (change their diapers and bathe them), it is not their exclusive role to punish them. That task is shared by both sexes, typically by the husband and wife.

The most all-around shared activity is feast and fiesta cooking. Not only is it done jointly by both sexes in 80% of the households, but also all age groups are actively involved. The respondents for 63 of the households said that all members become involved. Also, in another 7 households either boys or girls (but not both) as well as men and women participate. Adding these 7 households to the 63 reveals that 70, or 47%, of the 149 households that give feasts and fiestas have adults and children helping with the cooking. This suggests that cooperation between the younger and older generations, at least in terms of feast and fiesta giving, is greater than is sometimes thought to be the case on Guam. The weekly "Village Studies," for example, which appeared in Guam's *The Sunday News* during 1974 and 1975 often included comments by older people claiming that younger persons no longer cared about family affairs.

There are some differences by cultural group in who performs what household task. The differences are small compared to the similarities. The Guamanian population follows the patterns presented in this section exactly and the percentage figures are in all cases the same or very close to those shown for the total sample in Table 10). This would be expected, since the Guamanian group (representing approximately two-thirds of the sample) influences the overall data more than any other cultural group.

Statesiders, Filipinos, and Micronesians generally follow the overall pattern. The differences for Statesiders are in terms of food shopping and managing money. For them, these are activities done somewhat more by males and females jointly than is the case for the total sample. In the Filipino population, women and men do the same tasks as in the total sample, except that girls help women less and women manage the money in nearly two-thirds of the households, a figure much higher than the 49% figure for the total sample. Micronesians vary from the pattern in that males help significantly with changing diapers and bathing children. They, rather than the females, usually manage

the family money, and they almost always shop for food with the females, both very different situations from the overall sample.

In summary, women do most of the household tasks and are particularly relegated to those tasks which keep them tied to the household: child care, cleaning house, washing clothes, and daily cooking. Men find themselves engaged primarily in tasks which take them away from the home, or if not away, tasks which are at least outdoor work: fishing, gathering firewood, and coconut grating. A number of tasks are shared by the sexes: feast and fiesta cooking, punishing children, driving a car, and gardening. Women more than men manage the family money, which is especially the pattern for the Filipino population. The different cultural groups typically follow the same general pattern, suggesting that there is a basic division of labor by sex on the island that holds for all cultural groups. This division of labor is not surprising in that it is the traditional pattern followed in the United States--women relegated to child care and other work inside the house, while men do outdoor household work. As a group, the Micronesians are the most atypical since, in most of their households, men help with child care, almost always shop for food with the women, and usually manage the money.

CONCLUSIONS AND RECOMMENDATIONS

On Guam, the typical family pattern for households is the nuclear family of husband, wife, and children; however, in a number of households, 19% according to this survey, there are extended-family persons as members. Typically, these extended-family members are persons who would otherwise be living alone (e.g. widowed parents, brothers and sisters who have not yet married, orphaned grandchildren).

The number of households on Guam having extended-family persons who would otherwise be living alone was probably higher in the past. Nineteen percent is a small number compared to the claim people on the island make about the past which is that, in the past and even up to 15 years ago, a majority of households had extended-family persons as members. If this claim is even roughly correct, then there has been a decline in the willingness of nuclear-family households to include unattached relatives.

A decline in such willingness means that each year increasing numbers of unattached individuals will have to live alone or live with persons other than their relatives. In some instances, the Government of Guam will have to intervene and assist individuals. Especially elderly persons who cannot care for themselves and orphaned children will need help. Concern about creating homes on the island for the elderly and the orphaned is realistic. Social services will have to be extended to these people, including the building of institutional facilities to house them.

Guam is fast becoming like the States in terms of family household type. Individuals increasingly want separate nuclear-family households in which they are relieved of the responsibility of having to care directly for other relatives. These other relatives, to the extent they will not be able to care for themselves, will need help from the Government of Guam.

The number of women in the work force on Guam is high. The household survey shows that nearly half of the wives on the island are working. They are, however, paid much less for their work than are their husbands, although the jobs they hold are comparable in status to the jobs their husbands hold. Forty-five percent of the husbands earn over \$10,000 annually while only 7% of the wives have earnings that exceed this figure.

In addition to working outside the home, the wives have to do most of the household work. This puts a heavy burden on them. In fact, it means they have two jobs to perform: they have to work and earn money outside the home and also raise the children and manage the household.

Women on Guam are not likely to endure this double burden for very long. Because they won't, there will be changes in what men and women will be doing. Both will eventually be doing work around the house and both will be employed in the work world. This is already beginning to emerge as a pattern. In addition, women on Guam will demand and eventually receive more pay for their effort in the work world. They will demand the same level of earnings that men receive.

Changes in sex roles will not occur on Guam without some conflict. There will be confrontations between husbands and wives, family arguments between the generations, an increase in divorce, and the filing of equal pay suits.

Traditional sex roles still prevail on Guam but the future will bring changes in these roles. Knowing that such changes will most assuredly come about should make the actual transition easier in that we can be ready to solve the problems that will occur with social change.

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HIERARCHY OF ETHNIC GROUP PERCEPTIONS ON GUAM

Ann Q. Lynn

How do people on Guam perceive the way various ethnic groups feel toward one another and themselves? To measure this factor, 179 people chosen at random from the files in the Commissioners' offices of the nineteen villages were shown the following chart:

FIGURE 1

Ethnic Chart

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
Filipinos						
Guamanians						
Japanese						
Koreans						
Palauans						
Statesiders						

Then the interviewer read these instructions:

Here is a sheet with an alphabetical list of some of the different kinds of people who live on Guam. We'd like to get an idea of how you think people feel about each other (HAND RESPONDENT ETHNIC SHEET). Looking at the first box in the upper left hand corner, (POINT TO BOX), you'll see that it is labeled Filipino-Filipino. If you think the Filipinos on Guam have good feelings about other Filipinos on Guam, put a plus sign (+) in the box. If you think the Filipinos dislike or have bad feelings about other Filipinos here, put a minus (-) sign in the box. (CONTINUE TO POINT TO THE BOXES ON THE SHEET AS YOU COMPLETE YOUR EXPLANATION.) Then go across to the next box to the right which is Filipino-Guamanian and put a plus or minus in that box according to whether you think Filipinos on Guam have good feelings for or dislike Guamanians here. If you don't know how the Filipinos might feel about the Guamanians, then put a zero. Keep going across each line, filling in a plus, minus, or zero, until you have completed all the squares.

An analysis of all the positive (+) and negative (-) responses indicates many consistencies in thinking by the various groups. These consistencies occur whether analysis of data is according to nationality: 117 Guamanians (both parents born on Guam); 30 Filipinos (two parents born in the Philippines); 17 born in the U.S.; 8 born in Micronesia; 2 born in Japan;¹ according to age: 14 who were under twenty-one years; 29, ages 21-30; 49, ages 31-40; 53, ages 41-50; 31 who were over 50 years; or according to sex: 113 males and 64 females. (See Tables at end of this Chapt.)

In regard to the breakdown by sex, the theory that in times of social change women tend to be more conservative than men seems to be borne out by the results of this study. For example, a breakdown of 177 responses according to sex reveals that, on the whole, the 113 males think that each group accepts every other group more often and rejects every other group less often than do the 64 females. The females, on the other hand feel that the Koreans, Palauans, and Statesiders accept their own groups even more often than the males perceive this acceptance; the females perceived rejection in these same three groups as either the same as or lower than the rejection perceived by the male respondents. (See Tables 11 and 12)

In the total sample, Table 13, it was perceived that each group liked members of its own group in this order:

Guamanian-Guamanian	87%
Filipino-Filipino	83%
Statesider-Statesider	81%
Palauan-Palauan	75%
Japanese-Japanese	71%
Korean-Korean	71%

Among the different ethnic groups sampled, Table 14 shows that Guamanians perceived that Guamanians have positive feelings about each other by the highest percentage (91%). Next highest were Filipino perceptions about themselves (90%), (Table 17), followed by Statesiders (88%), (Table 20), Palauans (74%), Japanese (70%), and Koreans (69%).

Of the 17 U.S. respondents, 16 perceived that Guamanians had good feelings toward other Guamanians while one was uncertain; 15 perceived Statesiders had good feelings toward Statesiders and 2 were uncertain. The U.S. respondents also perceived Filipinos as having good feelings toward other Filipinos in 15 cases, one indicated a negative choice and one was uncertain (Table 20). The Japanese and Palauans were perceived by the Statesiders as having positive feelings toward themselves in 14 cases; there were 3 uncertain choices. The Koreans followed with 13 (+) choices and 4 uncertain choices.

When the tables are analyzed according to the 30 Filipino respondents (Table 17) the plus choices are as follows:

Filipino-Filipino	90%
Statesider-Statesider	77%
Japanese-Japanese	73%
Korean-Korean	73%
Palauan-Palauan	73%
Guamanian-Guamanian	63%

The table is interesting in that a breakdown by every ethnic group, every age group (under 20 years of age; 21-30, 41-40; 41-50; and over 50), and a breakdown by sex in all other instances ranked Guamanian-Guamanian either first or second in plus choices. It is only those who were born in the Philippines, or whose parents were born in the Philippines, who perceived that, in ethnic acceptance, the Guamanians rank last in liking other Guamanians.

¹Sub-sample size is extremely small for a good comparative analysis beyond that of Guamanian and Filipino. However, the comparative data on the other four ethnic sub-groups are cited in order to illustrate the perceived ethnic stratification hierarchy on the island of Guam.

What is the rank order of acceptance (+ choices) and rejection (- choices) of each ethnic group by each of the ethnic groups in the study? As would be expected, most groups were perceived as liking members of their own group best.

The 117 Guamanians in the sample perceived that the Japanese liked the Guamanians and, to the same extent, liked other Japanese (Table 14). There were only two Japanese included in the total sample and they both perceived the Japanese as liking the Guamanians, Japanese, Palauans, and Statesiders and one each indicated the Japanese like the Filipinos and Koreans and one each checked that Japanese dislike Filipinos and Koreans.

On the whole, the various groups perceived positive feelings by the Guamanians for the Statesiders by a higher percentage than for any other group except themselves. If we put the percentages in descending order, the Japanese rank about ten percentage points below the Statesiders as being liked by the Guamanians, and the Koreans rank about ten percentage points below the Japanese as being liked by the Guamanians. The Palauans are ranked very closely to the Filipinos and Koreans, being only slightly below them (Table 13).

Most groups perceived that the Guamanians liked or had good feelings about the Filipinos in a smaller percentage of cases. Again, the 30 Filipinos gave answers which were greatly different from the other groups. They were the only group that gave Guamanian-Filipino and Guamanian-Guamanian relationships the same number of plus responses--63% in both cases. All responses of groups other than Filipino, whether by sex, age, or birthplace, indicated a perception that Guamanians have positive feelings about other Guamanians by a figure at least 15% higher than any percentage for Guamanian-Filipino positive responses.

While different groups varied slightly in percentage ratings, nearly every age, nationality, and sex group gave the Koreans, Palauans, and Filipinos a lower percentage of (+) than they gave to the Guamanians, Statesiders, and Japanese.

Since the instructions were to put a minus to indicate dislike or bad feelings, minuses have been interpreted as rejections. Once again, a breakdown by various ethnic, age, and sex groups shows that the Filipinos have the highest percentage of rejection by the Guamanians. Those born in the Philippines, however, perceived that the Guamanians reject the Koreans more than they reject Filipinos. Most of the other groups gave the Koreans a lower percentage of minuses than any other group and the Koreans alternated with Statesiders and Japanese in relatively low percentage of rejection by the Guamanians.

Some groups were perceived as rejecting another group more frequently than they accepted them. This is the way the fourteen respondents under 21 years of age perceived Filipino attitudes regarding Guamanian, Japanese, Koreans, and Palauans, Table 23. Those under 21 years in the sample perceived that likes exceed dislikes by the Filipinos for only the Filipinos themselves and Statesiders. The under-21 group responded that Guamanians in turn reject Filipinos and Palauans. The Palauans, were perceived by those under 21 as rejecting the Filipinos and Japanese more than they accept them and the Palauans are perceived as being rejected by the Filipinos, Guamanians, and Japanese in higher percentages than they are accepted by these groups.

RECOMMENDATIONS

In order to have a greater appreciation of the contributions of the many ethnic groups on Guam it is recommended that:

1. Beginning in the elementary school and continuing through secondary school and college that courses be given in social studies which show the contributions of the various groups to Guam and to the world.
2. That language courses in Chamorro, Tagalog, Ilocano, Japanese, Chinese, Korean, and perhaps others, be made available, even on the elementary level, for those interested in learning them.

3. That population and migration studies be emphasized in the Sociology Department at the University of Guam to place in perspective the population growth in the rest of the world and the migration patterns to and from Guam. What is the calibre of Guamanians who leave Guam? What is the calibre of the various racial and ethnic groups who come to Guam?

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TABLE 11

Tabulation for 113 Males
in Number and Percent

		Filipinos		Guamanians		Japanese		Koreans		Palauans		Statesiders	
Filipinos	+	94	83	72	64	40	35	29	26	33	29	75	66
	-	10	9	34	30	24	21	18	16	20	18	20	18
	0	9	8	7	6	49	44	66	58	60	53	18	16
Guamanians	+	69	61	99	88	72	64	63	56	63	56	84	74
	-	37	33	5	4	19	17	16	14	27	24	15	13
	0	7	6	9	8	22	19	34	30	23	20	14	13
Japanese	+	43	38	78	69	82	73	46	41	35	31	67	60
	-	17	15	15	13	5	4	19	17	8	7	9	8
	0	53	47	20	18	26	23	48	42	70	62	36	32
Koreans	+	31	28	64	57	48	42.5	80	71	25	22	61	54
	-	12	11	13	12	17	15	4	3	7	6	8	7
	0	69	61	35	31	48	42.5	29	26	81	72	44	39
Palauans	+	35	31	54	52	40	36	28	25	80	71	67	59
	-	18	16	24	21	7	6	6	5	4	3	7	6
	0	60	53	30	27	65	58	78	70	29	61	39	35
State-siders	+	68	60	78	69	66	58	60	53	64	57	89	79
	-	21	19	16	14	8	7	8	7	10	9	3	3
	0	24	21	19	17	39	35	45	40	39	34	21	18
		#	%	#	%	#	%	#	%	#	%	#	%

Note: a few categories do not total 113 because of a varying no-response rate.

TABLE 12

Tabulation for 64 Females
in Number and Percent

	Filipinos		Guamanians		Japanese		Koreans		Palauans		Statesiders	
Filipinos	+	53 83	37 58	17 27	17 27	16 25	35 55					
	-	6 9	20 31	8 12	8 12	16 25	14 22					
	0	5 8	7 11	39 61	39 61	32 50	15 23					
Guamanians	+	34 53	54 84	36 56	29 45	29 45	45 70					
	-	24 38	5 8	11 17	8 13	14 22	10 16					
	0	6 9	5 8	17 27	27 42	21 33	9 14					
Japanese	+	16 25	39 61	45 70	24 38	16 25	28 43					
	-	10 16	8 12	2 3	11 17	10 16	8 12					
	0	38 59	17 27	17 27	29 45	38 59	29 45					
Koreans	+	20 31	32 49	25 39	46 72	16 25	31 48					
	-	9 14	6 9	8 13	1 1.5	6 9	8 13					
	0	36 55	27 42	31 48	17 26.5	42 66	25 39					
Palauans	+	15 23	29 45	18 28	19 29	53 83	32 50					
	-	12 19	16 25	10 15	4 6	2 3	6 7					
	0	39 58	19 30	37 57	42 65	9 14	26 41					
State-siders	+	37 58	40 63	32 50	28 44	35 55	55 86					
	-	9 14	15 23	7 11	10 15.5	6 9	1 2					
	0	18 28	9 14	25 39	26 40.5	23 36	8 12					
	# %	# %	# %	# %	# %	# %	# %					

Note: a few categories do not total 64 because of a varying no-response rate.

TABLE 13

Tabulation for 179--Total Sample
in Number and Percent

		Filipinos		Guamanians		Japanese		Koreans		Palauans		Statesiders	
Filipinos	+	148	83	110	62	59	33	48	27	51	29	112	63
	-	16	9	54	30	32	18	26	14	36	20	34	19
	0	15	8	15	8	88	49	105	59	92	51	33	18
Guamanians	+	105	59	155	87	110	61	94	53	92	51	130	73
	-	61	34	10	5	30	17	24	13	41	23	25	14
	0	13	7	14	8	39	22	61	34	46	26	24	13
Japanese	+	59	33	118	66	128	71	70	39	52	29	96	53
	-	28	16	23	13	7	4	31	17	18	10	17	10
	0	92	51	38	21	44	25	78	44	109	61	65	37
Koreans	+	52	29	97	54	73	41	127	71	42	24	93	52
	-	21	12	19	11	26	14	5	3	13	7	16	9
	0	105	59	62	35	80	45	47	26	124	69	70	39
Palauans	+	51	28	89	50	58	32	47	26	134	75	99	55
	-	30	17	40	22	17	10	10	6	6	3	14	8
	0	98	55	50	28	104	58	122	68	39	22	66	37
State-siders	+	105	59	118	66	99	55	88	49	99	55	145	81
	-	31	17	32	18	15	9	19	11	17	10	4	2
	0	43	24	29	16	65	36	72	40	63	63	30	17
		#	%	#	%	#	%	#	%	#	%	#	%

Note: Two categories do not total 179 because of a varying no-response rate.

TABLE 14

Tabulation for 117 Guamanians
in Number and Percent

		Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders		
	+	92 79	79 68	36 31	27 23	32 27	68 58		
Filipinos	-	12 10	32 27	19 16	17 15	16 14	24 21		
	0	13 11	6 5	62 53	73 62	69 59	25 21		
	+	72 61	106 91	82 70	71 61	70 60	93 80		
Guamanians	-	37 32	5 4	14 12	9 8	21 18	13 11		
	0	8 7	6 5	21 18	37 31	26 22	11 9		
	+	33 28	84 72	79 72	47 40	30 26	64 55		
Japanese	-	18 15	13 11	4 11	16 14	8 7	8 7		
	0	66 57	20 17	34 17	54 46	79 67	44 38		
	+	30 26	72 62	48 41	81 69	26 22	61 52		
Koreans	-	11 9	8 7	12 10	2 2	4 4	7 6		
	0	75 65	36 31	57 49	34 29	87 74	49 42		
	+	31 27	63 54	34 29	30 26	86 73	65 56		
Palauans	-	13 11	23 20	8 7	3 3	3 3	6 5		
	0	73 62	31 26	74 64	83 71	28 24	46 39		
	+	69 59	81 69	67 57	59 50	69 59	95 81		
State- siders	-	16 14	16 14	8 7	7 6	6 5	3 3		
	0	32 27	20 17	42 36	51 44	42 36	19 16		
		# %	# %	# %	# %	# %	# %		

Note: a few categories do not total 117 because of a varying no-response rate.

TABLE 15

Tabulation for 79 Guamanian Males
in Number and Percent

		Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders		
	+	62 79	53 67	26 33	19 24	21 27	51 64		
Filipinos	-	9 11	24 30	15 19	12 15	11 14	14 18		
	0	8 10	2 3	38 48	48 61	47 59	14 18		
	+	50 63	72 91	57 72	52 66	49 62	63 80		
Guamanians	-	25 32	3 4	10 13	7 9	16 20	10 13		
	0	4 5	4 5	12 15	20 25	14 18	6 7		
	+	25 32	58 74	57 72	34 43	20 25	48 61		
Japanese	-	12 15	9 11	3 4	11 14	5 6	5 6		
	0	42 53	12 15	19 24	34 43	54 69	26 33		
	+	21 27	50 63	35 44	56 71	16 20	43 55		
Koreans	-	7 9	6 8	9 12	2 2	3 4	5 6		
	0	50 64	23 29	35 44	21 27	60 76	31 39		
	+	21 26	44 56	24 31	19 24	55 70	47 59		
Palauans	-	10 13	15 19	5 6	3 4	2 2	3 4		
	0	48 61	20 25	49 63	57 72	22 28	29 37		
	+	48 61	55 69	48 61	41 52	47 59	63 80		
State- siders	-	13 16	10 13	5 6	4 5	6 8	2 2		
	0	18 23	14 18	26 33	34 43	26 33	14 18		
		# %	# %	# %	# %	# %	# %		

Note: a few categories do not total 179 because of a varying no-response rate.

TABLE 16

Tabulation for 39 Guamanian Females
in Number and Percent

	Filipinos	Guamanians	Japanese	Koreans	Palaunas	Statesiders
	# %	# %	# %	# %	# %	# %
+	31 79	27 69	10 26	7 18	11 28	19 49
Filipinos -	3 8	8 21	4 10	5 13	5 13	10 25.5
0	5 13	4 10	25 64	27 69	23 59	10 25.5
+	23 59	35 90	26 67	20 51	22 56	31 79
Guamanians -	12 31	2 5	4 10	2 5	5 13	3 8
0	4 10	2 5	9 23	17 44	12 31	5 13
+	8 21	27 69	24 61	13 33	9 23	18 46
Japanese -	6 15	4 10	1 3	5 13	3 8	3 8
0	25 64	8 21	14 36	21 54	27 69	18 46
+	9 23	23 59	13 33	25 64	10 26	19 49
Koreans -	4 10	2 5	3 8	0 -	1 2	2 5
0	26 67	14 36	23 59	14 36	28 72	18 46
+	10 25	20 51	10 25	11 28	31 79	19 49
Palauans -	3 8	7 18	3 8	0 -	1 3	3 8
0	26 67	12 31	26 67	28 72	7 18	17 43
+	22 56	27 69	20 51	18 46	23 59	33 85
State-siders -	3 8	6 15.5	3 8	3 8	0 -	1 2
0	14 36	6 15.5	16 41	18 46	16 41	5 13

TABLE 17

Tabulation for 30 Filipinos
in Number and Percent

	Filipinos	Guamanians	Japanese	Koreans	Palaunas	Statesiders
	# %	# %	# %	# %	# %	# %
+	27 90	17 57	10 33.3	8 27	9 30	23 77
Filipinos -	3 10	10 33	7 23.3	6 20	9 30	5 17
0	0 -	3 10	13 43.4	16 53	12 40	2 6
+	19 63	19 63	10 33	8 26	10 33.3	19 63.3
Guamanians -	9 30	5 17	9 30	11 37	10 33.3	7 23.3
0	2 7	6 20	11 37	11 37	10 33.4	4 13.4
+	12 40	13 43.3	22 73	9 30	7 23	12 40
Japanese -	4 13	7 23.3	3 10	7 23	9 30	7 23
0	14 47	10 33.4	5 17	14 47	14 47	11 37
+	9 30	11 37	14 47	22 73	6 20	15 50
Koreans -	7 23	7 23	5 17	3 10	7 23	7 23
0	14 47	12 40	11 36	5 17	17 57	8 27
+	10 33	13 43.3	10 33	5 17	22 73	18 60
Palauans -	8 27	7 23.3	6 20	6 20	2 7	4 13
0	12 40	10 33.4	14 47	19 63	6 20	8 27
+	22 73	18 60	15 50	13 43	16 53	23 77
State-siders -	5 17	9 30	4 13	6 20	5 17	1 3
0	3 10	3 10	11 37	11 37	9 30	6 20

TABLE 18

Tabulation for 15 Philippine Males
in Number of Responses

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
+	14	10	6	3	5	11
Filipinos -	1	3	5	3	5	4
0	0	2	4	9	5	0
+	11	10	6	3	5	11
Guamanians -	3	2	4	6	5	3
0	1	3	5	6	5	1
+	7	8	10	2	4	8
Japanese -	3	4	2	4	3	3
0	5	3	3	9	8	4
+	3	6	6	10	2	8
Koreans -	3	5	3	2	4	3
0	9	4	6	3	9	4
+	6	7	6	2	9	10
Palauans -	4	3	2	3	2	2
0	5	5	7	10	4	3
+	11	11	8	7	9	10
State-siders -	3	3	2	3	2	1
0	1	1	5	5	4	4

TABLE 19

Tabulation for 15 Philippine Females
in Number of Responses

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
+	13	7	4	5	4	12
Filipinos -	2	7	2	3	4	1
0	0	1	9	7	7	2
+	8	9	4	5	5	8
Guamanians -	6	3	5	5	5	4
0	1	3	6	5	5	3
+	5	5	12	7	3	4
Japanese -	1	3	1	3	6	4
0	9	7	2	5	6	7
+	6	5	8	12	4	7
Koreans -	4	2	2	1	3	4
0	5	8	5	2	8	4
+	4	6	4	3	12	8
Palauans -	4	4	4	3	0	2
0	7	5	7	9	3	5
+	12	7	7	6	7	13
State-siders -	2	6	2	3	3	0
0	1	2	6	6	5	2

TABLE 20

Tabulation for 17 U.S. Respondents
in Number of Responses

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
+	15	9	6	7	4	10
Filipinos -	1	6	3	1	6	3
0	1	2	8	9	7	4
+	8	16	9	7	6	10
Guamanians -	8	0	5	2	6	2
0	1	1	3	8	5	5
+	8	11	14	7	8	11
Japanese -	2	1	0	3	0	1
0	7	5	3	7	9	5
+	6	7	6	13	4	9
Koreans -	2	2	4	0	1	0
0	9	8	7	4	12	8
+	6	6	9	8	14	8
Palauans -	4	6	1	0	0	0
0	7	5	8	10	3	9
+	9	13	9	9	8	15
State-siders -	5	2	2	2	2	0
0	3	2	6	6	7	2
	#	#	#	#	#	#

Note: 2 categories do not total 17 because of a varying no-response rate.

TABLE 21

Tabulation for 12 U.S. Males
in Number of Responses

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
+	11	7	4	4	3	8
Filipinos -	0	3	2	1	3	1
0	1	2	6	7	6	3
+	6	11	5	4	5	7
Guamanians -	5	0	4	2	4	0
0	1	1	3	6	3	5
+	5	6	9	4	5	7
Japanese -	1	1	0	2	0	1
0	6	5	3	6	7	4
+	3	4	3	8	3	6
Koreans -	1	1	3	0	0	0
0	8	7	6	4	9	6
+	5	5	7	4	9	6
Palauans -	2	3	0	0	0	0
0	5	4	6	8	3	6
+	6	9	6	6	6	10
State-siders -	3	1	1	1	0	0
0	3	2	5	5	6	2
	#	#	#	#	#	#

Note: 1 category exceed 12 because of a varying no-response rate.

TABLE 22

Tabulation for 5 U. S. Females
in Number of Responses

		Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
Filipinos	+	4	2	2	3	1	2
	-	1	3	1	0	3	2
	0	0	0	2	2	1	1
Guamanians	+	2	5	4	3	1	3
	-	3	0	1	0	2	2
	0	0	0	0	2	2	0
Japanese	+	3	5	5	3	3	4
	-	1	0	0	1	0	0
	0	1	0	0	1	2	1
Koreans	+	3	3	3	5	1	3
	-	1	1	1	0	1	0
	0	1	1	1	0	3	2
Palauans	+	1	1	2	3	5	2
	-	2	3	1	0	0	0
	0	2	1	2	2	0	3
State-siders	+	3	4	3	3	2	5
	-	2	1	1	1	2	0
	0	0	0	1	1	1	0
		#	#	#	#	#	#

TABLE 23

Tabulation for 14 Under 21 Years of Age
in Number of Responses

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
	+	11	5	1	1	6
Filipinos	-	1	6	2	4	5
	0	2	3	11	9	3
	+	3	12	8	4	7
Guamanians	-	9	0	3	4	3
	0	2	2	3	6	4
	+	1	9	11	9	2
Japanese	-	2	1	0	1	4
	0	11	4	3	4	8
	+	4	6	8	11	3
Koreans	-	3	2	1	0	2
	0	7	6	5	3	9
	+	1	6	3	4	10
Palauans	-	4	5	4	1	1
	0	9	3	7	9	3
	+	6	8	5	3	5
State-	-	3	3	3	3	1
siders	0	5	3	6	8	8
	#	#	#	#	#	#

TABLE 24

Tabulation for 29 Between Ages 21-30
in Number and Percent

		Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
		# %	# %	# %	# %	# %	# %
Filipinos	+	18 17	15 52	10 34	9 31	7 24	11 38
	-	6 21	11 38	4 14	3 10	8 28	7 24
	0	5 62	3 10	15 52	17 59	14 48	11 38
Guamanians	+	13 45	22 76	13 45	13 45	11 38	19 65
	-	13 45	4 14	5 17	4 14	8 28	6 21
	0	3 10	3 10	11 38	12 41	10 34	4 14
Japanese	+	8 23	16 55	18 62	11 38	6 21	11 38
	-	5 17	4 14	2 7	3 10	4 14	2 7
	0	16 55	9 31	9 31	15 52	19 65	16 55
Koreans	+	11 38	11 38	10 34	18 62	8 28	11 38
	-	2 7	4 14	2 7	1 3	1 3	4 14
	0	16 55	14 48	17 59	10 35	20 69	14 48
Palauans	+	7 24	11 38	8 27	8 28	20 69	12 41
	-	4 14	7 24	4 14	1 3	1 3	4 14
	0	18 62	11 38	17 59	20 69	8 28	13 45
State-siders	+	14 48	17 59	11 38	11 38	13 45	21 73
	-	7 24	7 24	1 3	3 10	2 7	3 10
	0	8 28	5 17	17 59	15 52	14 48	5 17

TABLE 25

Tabulation for 49 Between Ages 31-40
in Number and Percent

		Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
		# %	# %	# %	# %	# %	# %
Filipinos	+	44 90	28 57	17 35	9 18	12 24	35 72
	-	4 8	19 39	10 20	14 29	14 29	8 16
	0	1 2	2 4	22 45	26 53	23 47	6 12
Guamanians	+	27 55	43 88	27 55	24 49	21 43	31 63
	-	21 43	4 8	12 25	9 18	12 24	10 21
	0	1 2	2 4	10 20	16 33	16 33	8 16
Japanese	+	18 37	26 53	35 72	15 31	16 33	29 58
	-	10 20	12 25	5 10	11 22	6 12	5 10
	0	21 43	11 22	9 18	23 47	27 55	16 32
Koreans	+	13 26	27 54	18 37	37 76	14 29	29 59
	-	10 20	6 12	8 16	3 6	3 6	4 8
	0	27 54	17 34	23 47	9 18	32 65	16 33
Palauans	+	13 26	21 43	16 33	12 25	42 86	31 63
	-	16 33	16 33	5 10	4 8	3 6	4 8
	0	20 41	12 24	28 57	33 67	4 8	14 29
State-siders	+	31 63	29 59	26 53	26 53	27 55	42 86
	-	10 21	16 33	8 16	6 12	8 16	1 2
	0	8 16	4 8	15 31	17 35	14 29	6 12

TABLE 26

Tabulation for 53 Between Ages 41-50
in Number and Percent

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
	# %	# %	# %	# %	# %	# %
+	47 89	38 72	22 42	16 30	17 32	39 74
Filipinos -	2 4	11 21	8 15	2 4	8 15	10 19
0	4 7	4 7	23 43	35 66	28 53	4 7
+	38 72	46 87	38 72	28 53	34 64	45 85
Guamanians -	12 22	2 4	7 13	6 11	11 21	3 6
0	3 6	5 9	8 15	19 36	8 15	5 9
+	22 42	42 79	40 75	20 38	17 32	32 61
Japanese -	7 13	6 11	0 -	11 21	3 6	4 8
0	24 45	5 10	13 25	22 41	33 62	16 31
+	14 27	31 60	25 47	38 72	10 19	29 55
Koreans -	3 6	5 10	10 19	0 -	6 11	4 7
0	35 67	16 30	18 34	15 28	39 70	20 38
+	19 36	30 57	20 38	15 29	38 72	35 66
Palauans -	5 9	9 17	3 6	3 6	0 -	2 4
0	29 55	14 26	29 56	34 65	15 28	16 30
+	32 60	40 75	35 66	29 55	34 64	42 79
State-siders -	8 15	3 6	3 6	6 11	3 6	0 -
0	13 25	10 14	15 28	18 34	16 30	11 21

Note: a few categories do not total 53 because of a varying no-response rate.

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TABLE 27

Tabulation for 31 Over Age 50
in Number and Percent

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
	# %	# %	# %	# %	# %	# %
+	26 84	22 71	7 22	11 35	12 39	19 61
Filipinos -	3 10	7 23	8 26	3 10	2 6	4 13
0	2 6	2 6	16 52	17 55	17 55	8 26
+	21 68	29 94	21 68	22 71	20 64	26 84
Guamanians -	6 19	0 -	3 10	1 3	4 13	3 10
0	4 13	2 6	7 22	8 26	7 23	2 6
+	10 32	23 74	22 71	15 48	10 32	18 58
Japanese -	3 10	0 -	0 -	4 13	1 3	2 6
0	18 58	8 26	9 29	12 39	20 65	11 36
+	9 29	20 65	12 39	21 68	6 19	17 55
Koreans -	3 10	2 6	4 13	1 3	1 3	1 3
0	19 61	9 29	15 48	9 29	24 78	13 42
+	10 32	19 61	11 34	8 25	22 71	15 48
Palauans -	1 3	3 10	1 3	1 3	1 3	1 4
0	20 65	9 29	20 63	23 72	8 26	15 48
+	21 68	23 74	20 65	18 58	19 61	25 81
State-siders -	2 6	2 7	0 -	0 -	2 7	0 -
0	8 26	6 19	11 35	13 42	10 32	6 19

Note: 2 categories do not total 31 because of a varying no-response rate.

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THE ARTIST IN GUAM

David Robinson

In traditional societies the artist is purely functional. He creates objects to fulfill a need within the society. Depending on the exact circumstances of a traditional society, the artist produces religious objects, as in Australia; or ancestor figures, as in New Guinea; or bowls, traps, and canoes, as in Micronesia.

In the Western World, we long ago began to make a distinction between functional crafts and what came to be called "the fine arts"; that is, a distinction is made between functional arts and decorative arts. Traditional Chamorro arts included pottery, basketry, canoe-building, production of fishing tools and traps, and a limited form of architecture. The anthropologist might say that these arts are part of the "material culture"; however, such a statement implies a distinction between functional arts and decorative ones--a distinction that is not valid.

With the exception of some basketry and singing, traditional arts have largely vanished from Guam. Why is the artist no longer a functioning member of society? The reason is a shifting of the artist's role from that of a functional artist to that of a decorative artist. The Chamorro artist maintained an important place in the ancient society--he was included among the higher orders of the ancient caste system (1). The Western artist, on the other hand, is on the periphery of society--"a social gadfly" is the term used by Marshall McLuhan.

For a variety of reasons the traditional artist has been forced into the Western artist's role, but the traditional artist lacks the survival skills that Western artists acquire as members of a sub-culture which has developed in Western society over a thousand years. These skills allow the Western artist to maintain his integrity, his economic and cultural worth, as he occupies his place at the edge of society. During the last fifty years, the respect shown the traditional artist, as well as his ability to contribute to his society, have disappeared. Government work has been made financially rewarding for unskilled and semi-skilled workers; the importance of imported, manufactured goods has been emphasized over locally-made goods; and the respectability of white collar work may have been over-emphasized. These forces tend to erode the artist's original status and function, to push him from an important place in society into the Western artist's role at the edge of society.

We tend even now to think of traditional arts as "handicrafts," or souvenir items--as the quaint products of an underdeveloped people. The West has introduced this attitude everywhere Western influences have been exerted in the Pacific and elsewhere. The tragedy of this is the failure to understand that the traditional artist's importance is much more significant than the production of useful objects: the artist and his work are also a repository of the heritage and traditions of a people. Whether he is a storyteller, dancer, canoe builder, or carver, whether he is a part-time artist as in Micronesia or a full-time artist as in ancient Hawaii, he provides a link with the heritage of a people. The ancient Chamorro understood this, but the colonizers did not. The latter assumed that the artist's role was the same as in their own societies and, proceeding on that assumption, literally made it come true.

This is not to say that it is possible or desirable to prevent progress. That could lead only to deadly stagnation. Culture is alive; it is constantly being modified by a variety of outside forces. However, unless progress incorporates a sense of cultural identity, unless progress preserves the cultural heritage of a people, it does not improve the quality of life, but only the quantity of it, thus giving a higher material standard of living without a corresponding cultural enrichment. Examples of this sort of progress are illustrated by the plights of the uprooted American Indian, by the Alaskan Eskimo, and by the Australian Aborigine. The attendant feeling of loss and of not belonging is well documented in these cases.

To some extent cultural identity has been maintained in the villages of Guam, but it

is nevertheless disappearing and will continue to do so unless efforts are made to restore cultural knowledge and identity to the society. The arts are fundamental to this. But where are the museums, the repositories of the tangible artifacts of a civilization, the proof that the past did exist? Where are the museum programs which make the past come alive? Where are the officially sanctioned programs to promote and publicize the indigenous music, dance, and other arts? Where are the programs to train artists to create locally produced and culturally inspired work of economic and cultural value to Guam and the Marianas?

There is the assumption that the local artist is capable only of reproducing the arts of a hundred years ago, arts which are now considered only souvenirs, or handicrafts, for tourists. This assumption is faulty when we realize that 'artist' is an occupation just as 'auto mechanic' or 'government worker' are occupations. However, the auto mechanic is retrained in the ever-changing technology of automobiles and, as a matter of course, the government worker is retrained to keep him abreast of the advancing technology of government. It has been forgotten that the technology of art changes as a culture changes and the local artist has not been kept abreast of the available technology. As a result, there are no local artists who can design and supervise murals, sculpture and paintings for public and private commissions. Instead, artists from other areas, such as the Philippine Islands, Japan, and Hawaii, receive the commissions for art works on Guam. The results are that such works may sometimes not be as relevant to Guam's cultural and historical background as they might be if they were created by local artists trained in new technologies. Frequently, architecture and interior decoration also fail to reflect the life styles unique to Guam.

There are no training programs that allow Guam's artists to compete with artists of other countries. There are few musical groups with the training and versatility to match those imported from Japan, the Philippines, or the States. Guam's commercial artists, designers, painters, jewelers, ceramicists, are also unable to compete. The tourist industry could benefit from the development of arts and styles that truly reflect Guam's character in the way those of Hawaii reflect its unique character. This can happen only when artists who are intimately familiar with Guam begin to produce its arts, when it is generally recognized that the artist is an important repository of Guam's cultural identity, and when artists can be trained in the technology of art through educational programs that emphasize Guam's cultural heritage.

What is the status of such programs and what is the outlook for the immediate future? Training programs at the University of Guam offer very little. The University's music and drama programs do not provide sufficient training even to constitute a major in those fields. Where will the trained musicians and the creative people for radio and television come from? The University's first commercial art course was offered with the beginning of the spring semester of 1974. A program in commercial design began in the fall semester of 1974. However, it will be several years before the fruits of the programs will be seen. The crafts program for textile designers, weavers, jewelry designers, ceramicists, is extremely understaffed and under-funded. The programs for training painters and sculptors are more substantial but are also under-funded and under-equipped. In large part, the market is still untapped and, unfortunately, Guam's artists are poorly equipped to tap it. This leads many of Guam's most talented young people to desert the arts for occupations in government and business. What a waste of a very precious resource!

The island's programs for generating public awareness of the arts are generally without overall direction and are often of low quality. The only museum has no effective philosophy concerning its collections. Articles are often exhibited because of their sentimental value, and not because they illuminate the human processes of the past. Programs to utilize the collections in dynamically educational ways do not exist.

A museum is a community's basic link with its heritage. It affords the visitor a link with the past in a tangible manner. It was estimated that museum attendance in the United States would reach 350 million in 1974, a sevenfold increase over the last 30 years. Throughout the world people are flocking in record numbers to the museums in search of tangible evidence of their past. Do our children learn the meaning of Guam history? Do our University of Guam students have a chance to touch and examine the tangible history of Guam? Do our elderly people give concerts of the old music? The answer can only be an emphatic no. It will soon be too late, and we can then look back and talk about the lost arts of Guam.

REFERENCE

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CHAPTER VI-7

THE POLICE COMMUNITY RELATIONS CONCEPT

Keith A. Ritchie

INTRODUCTION

The primary purpose of this report is to present recommendations for an effective and structured working relationship between the residents of Guam and their police officers so that together they can provide greater security from those serious crimes that reduce an individual's sense of personal security. This report will also suggest methods of bringing about the greatest possible cooperation between the residents of Guam and their police by identifying problems of mutual concern and by designing some cooperative solutions.

As a preliminary to recommendations, the police mission and the concept of community relations will be discussed. The community relations concept will be presented in a way that will provide a conceptual framework for a partnership relationship between the police and the community.

As part of establishing this conceptual framework, the role of the police in implementing values in a free society will be discussed. Ideally, the police function contributes to public order, but in the process of creating and maintaining order, the police must also be concerned with the values expressed in the Bill of Rights and those which are implicit in dignified human relationships.

After discussion of this philosophical background, more specific comments will be made about:

- 1) preparing an organization for effective community relations;
- 2) placing of organizational responsibility for community relations;
- 3) program recommendations to establish communication and effective working relationships between community and police;
- 4) police role-perceptions and the importance of these perceptions on the relationship between the police and the community.

A word of caution about the concept of programming: emphasis on "program" sometimes causes department personnel who are not directly connected with a specific program to conclude that responsibility is compartmentalized and that they therefore bear no responsibility in the program. While it is clear that responsibility must be fixed for specific tasks, the program concept refers here to the need for planned, structured, goal-oriented activities.

An attempt is made in some of the program proposals presented here to use a modular concept. Many of the ideas can be implemented in part without sacrificing all of the benefits. Furthermore, some elements of the proposals can be undertaken with very little cost. When taken comprehensively, these elements can be used as the basis for a grant proposal.

DETERMINING GUAM'S NEEDS

Because Guam is a complex community, it has police-service needs that require diverse and imaginative responses from the police. The island has a metropolitan concentration of business, and both urban and rural villages. Although a conventional police patrol can serve the metropolitan area, the same style of police service does not meet the needs of villages such as Merizo. Some villages are geographically isolated from police

services; telephone communication is uncertain and delays are usual. While it is assumed that all residents, both urban and rural, want to be secure in their homes and to be able to use the streets without fear, the methods of meeting these needs must be somewhat different, depending on whether a community is urban or rural. Also, assignment of police personnel on the basis of traditional criteria, such as reported crime, fails to provide an appropriate response to identified needs. There is no rule of thumb that provides a ready answer.

Local government is relatively new on Guam and is in the process of maturing. This provides a rare opportunity to design police services that are truly responsive to the needs of any particular village.

Guam, like any other community, has some unique qualities as well as some qualities that are shared with other communities. There is much that can be learned from the experiences of police departments in other communities and there are some leadership principles that have universal application. Policemen and those everywhere who face danger and who are required to exercise authority have some problems in common; however, discernment is required to distinguish which experiences and principles are applicable to Guam from those which are not.

An organized, scientific approach should be developed for the design of a police service that is responsive to the needs of each village. The term "scientific" refers here to the design of a new way of bringing about community involvement; it is meant to include accurate identification and assessment of needs so that a realistic, step-by-step plan can be developed by the community and the police, a plan that can be tested and evaluated.

WHAT IS "COMMUNITY RELATIONS"?

In the U.S., the emphasis upon police-community relations in the 1960s was an outgrowth of riots involving Blacks. As a result of this emphasis and ensuing reactions to it, police-community relations came to be thought of as synonymous with race relations. The use of the term has stimulated emotional reactions that have interfered with the establishment of constructive relationships with the community. Therefore, when we plan to engage in so-called Police-Community Relations we must take these factors into consideration. This writer prefers to use the term Community Resource Development because it avoids the negative connotations and is in fact a more accurately descriptive title.

Before further discussion of police-community relations, it is necessary to specify the nature of the police mission in bringing about social order.

THE POLICE MISSION

A rudimentary but sound statement of the police mission is that the police are a form of social control over the unlawful, antisocial behavior of some individuals so that all the other members of a society may enjoy that degree of social order necessary to pursue rewarding personal goals. Some of the order produced by law provides safety, predictability, and convenience, and is brought about by imposing some constraints on noncriminal behavior, such as legal controls on the operation of motor vehicles. Social order also includes security in one's home. This kind of security is ideally accompanied by a belief that one is secure. Security that is fortified by a feeling of security is vital if a person is to use the streets without fear.

Social order results from the interaction of many forces; the law is only one of them. The law deals essentially with the more extreme forms of antisocial behavior and is capable of producing only a minimally acceptable level of social order. Law enforcement reduces symptoms--it cannot produce cures. The extent to which the police can prevent crime depends upon deterrence, upon producing a belief in the mind of the potential lawbreaker that the risks of his apprehension by the police are greater than the probability of success. Crime prevention at its best depends upon the desire of individuals to comply voluntarily with society's rules.

RESOURCE IDENTIFICATION AND MOBILIZATION

The police, if their mission is to be most effective, must identify all of the community resources that can help them to minimize the impact of crime by preventing crime. Using this as a basic assumption, Police-Community Relations can be defined as the identification by the police of those influences which can prevent crime and the mobilization and coordination of such influences by the police. This requires that the police assume a broader kind of function, one in which they initiate new kinds of relationships. This process can be described as the mobilization of those community resources which can assist the police in accomplishing their mission, as discussed above. The resources that will be most meaningful are the people in a community who, because they share police goals and have trust in their police, serve as eyes and ears for the police.

The "systems" concept can be usefully applied. In terms of this concept, the police are a subsystem within the total process that produces social order. The use of this concept suggests that the police play a key role in the coordination of that system.

TRUST AS A BASIS FOR A PARTNERSHIP BETWEEN POLICE AND COMMUNITY

A partnership relationship is indispensable to the above definition of community relations because in the final analysis we are talking about people working together. The ultimate test is the quality of this relationship: the focus must be on those conditions which produce the most effective personal partnership.

One of these conditions is trust. Trust connotes a sharing of values that include not only long-term goals such as public order but also those implementing values which determine the methods by which that order is achieved. Trust is not a guarantee of universal agreement, but it can be said to exist when one person is willing to entrust his welfare to another person. Thus, it is possible for a citizen to accept a police decision on a basis of confidence regardless of whether or not the citizen agrees with or understands the decision.

Trust can produce realistic expectations. The public usually expects a great deal more of the police than the police are capable of producing. The public also expects more of the police than of other governmental decision makers. This expectation applies especially to the behavior of off-duty policemen, and it includes almost impossible expectations of a policeman's ability, when in the performance of his duties, to withstand verbal abuse and other kinds of influences that can reduce his self-esteem. Trust provides an allowance for any discrepancy between the expected level of behavior and what actually occurs.

Lack of trust is one ingredient in a condition that is described as alienation. Persons who are alienated fail to identify with an organization or with other individuals. A feeling of alienation arises from a variety of causes. Included in these is a person's feeling of powerlessness, or an inability to exert influence over important happenings around him.

The police must assume the initiative in identifying sources of mistrust, in aggressively remedying the basic causes of mistrust, and in communicating information about their efforts.

Trust is essentially a relationship between individuals, although today we frequently speak about the growing lack of trust in our political institutions. In the final analysis it is the behavior of individuals within the political system that determines feelings and beliefs about the system.

VALUES, POLICE DECISION MAKING, AND TRUST

Individual behavior can be shaped to some extent by the values of decision makers such as police administrators and policemen. When a decision maker relies upon a set of values, he introduces consistency and hence, predictability, into his choice of alternatives. This is desirable because residents of a community may then know what to

expect from policemen. When this is reinforced by the introduction of other values, such as fairness and respect for the dignity of the individual, a foundation for trust is established.

The values of our free society, and our ordering of them, provide the most significant contrast between those of our political system and those of the closed or totalitarian systems. The police, who implement these values on a daily basis, are being subjected to more scrutiny and criticism than ever before. There are those who would translate individual failure into evidence of fatal systemic disorders. They seek to distort the perspective of those citizens in our society who, in many respects, feel left out and, in a very real sense, there is competition for their loyalty. The police, who have no choice in the matter, have been made the representative of the political system. The police personify the system and are the system's most conspicuous, 24 hour per day representatives.

Although Guam has not had the social disorder experienced on the mainland, it cannot separate itself from those influences which have produced confrontation with the police. Some of those persons who have produced such conflict have done so deliberately because they believed the police to be a partisan extension of a corrupt political system. Hence, they say the police are not to be improved because that would merely delay substitution of another political system for the present system.

One of the values most characteristic of a free society is that of openness. It is not merely coincidental that openness is indispensable for the establishment of trust. The experience of this author, during the period of the Watts riot, was that self-serving protestations by the police about their professionalism and their trustworthiness did not serve ipso facto to create trust between the police and the community. People had to discover police professionalism and trustworthiness for themselves, and they can never do so unless the police accept the responsibility for exercising initiative in developing a variety of methods for creating trust. This does not mean that such efforts should be confined to formal communication accomplished through a public information operation in conjunction with the news media. More specific observations will be made elsewhere in this report, but for the moment it is sufficient to recommend that the department provide opportunities for the public to observe various phases of department operations. Open communication is the process whereby the values of openness and accountability are implemented.

SOME INTERNAL ASPECTS OF POLICE COMMUNITY RELATIONS

PREPARATION FOR EFFECTIVE POLICE COMMUNITY RELATIONS

An indispensable phase of planning for an effective police-community relationship is preparing an organization for that relationship. The police intra-organization phase consists of engaging in self-examination to make sure that the organization deserves public confidence and cooperation. An effective partnership requires openness. As a consequence, an organization will be scrutinized by the public more than ever before.

Reference is made in another section of this report to the values of openness and accountability in a free society. Historically, the police have had some trouble with the notion that the public should have access to substantially more information than the public has traditionally received. (Reference is not being made to confidential records.)

Perhaps the greatest single barrier to openness has been police uncertainty concerning the degree of public support they have. Because the public does not realize the complexity of the police task, the police tend to feel that the public would not understand or would not make adequate allowance for mistakes. Like others, the police have been reluctant to acknowledge their own shortcomings publicly. However, they have been reassured by increasing public support and by evidence that the public indeed understands the difficulty of the police task. One influence in this change has been an increased public scrutiny of all governmental agencies. The police are becoming increasingly professional and are also beginning to demonstrate that they recognize an obligation to be accountable for the exercise of authority and the expenditure of resources.

The following sections of this chapter deal with various aspects of the intra-organization phase of Community Resource Development.

Discipline

An indispensable part of the internal phase of Community Resource Development is a disciplinary system that provides open channels of communication through which complaints against police officers can be registered. Once a complaint has been registered, it should be followed by a proper investigation by the department; then, appropriate action should be taken; finally, the disposition should be discussed with the complainant.

Discipline is a normal part of a supervisor's responsibility. For this reason, among others, discipline should not be shifted to persons attached to the Community Resource Development unit. If this were done, the internal credibility of the Community Resource Development unit would be reduced and the ability of a supervisor to motivate his personnel would be adversely affected. Although there is a certain logic in fixing responsibility upon Community Resource Development personnel in that they would eventually have the most effective communication with the residents of a village, it must be recognized that properly-conducted investigations of complaints against personnel demand time-consuming, first-class investigations.

This report is not intended to describe all of the elements of a disciplinary system. The emphasis here is upon the absolute necessity of a formalized system that protects the department's integrity while permitting the department to develop a deserved reputation for integrity.

It is recommended that the department provide a more formal structure for its disciplinary procedures, which includes policy statements regarding the reception of complaints against police officers, a method of ensuring an internal control over the processing of complaints, and a quality investigation of those complaints.

Organization

An essential view in this report is that every officer, in his daily person-to-person relationships with the public, has a responsibility to establish the conditions that are prerequisite for a partnership between the public and the police. The establishment of an organizational unit within the department is not a substitute for this; that unit must serve other purposes. Unless this distinction is understood, especially by department personnel, the public may view such a unit as a subterfuge, as pure window-dressing. The usual approach has been to appoint effective communicators to such specialized units. These are persons who are not perceived by the community as typical of department personnel. It is this approach that has created the impression that the unit is a form of deception.

Nevertheless, there are some compelling reasons for establishing a Community Resource Development unit within the department even though it would create some collateral, although not insurmountable, problems. Some of the problems are common to specialization, but are aggravated by considerations described elsewhere in this report. Among them is the reaction by other department personnel that they no longer have responsibility in this area, as pointed out in the Introduction. Reference to community relations "programs" has somewhat the same effect. Such specialization and "programs" create a feeling of compartmentalization that provides a convenient basis for personnel outside a Community Resource Development unit to conclude that someone else is responsible for satisfactory relationships with the community.

Each Commander must share in a sense of responsibility for the implementation of community resource development. A sense of obligation to the success of the unit and the goal must pervade the entire organization; however, if essential functions are to be performed, then responsibility must be fixed.

The level at which this obligation is fixed is critical to success. The unpopularity of the function, as perceived by most police officers, requires that the person to whom

the responsibility is delegated be given the same rank as other persons responsible for major police functions. In the Guam Department of Public Safety this would be the rank of Captain. Not only must he have internal administrative "clout," but also the Department must indicate to the public its awareness of the importance of the function.

The person to whom this responsibility is delegated needs the organizational prestige and influence that come from being assigned to the personal staff of the Director. Such a positioning informs not only the department but also the community that the Director considers the function to be one of primary importance. In order to accomplish this, it is recommended that an Office of Community Resource Development be created and attached to the Office of the Director.

The scope of functions assigned to this particular office depends upon the Director's desires. However, it is strongly recommended that the present public relations function be redesignated as public information and placed under the Office of Community Relations.

The term "public relations" has a self-serving connotation in that in many cases its purpose is to manufacture an institutional image that may not reflect reality. This is not the purpose of the police public information function. It is true that the police need the kind of positive image that encourages public trust and support; it is mandatory, however, that this perception be based upon a reality that is accurately and effectively communicated to the public. Therefore, the primary function of those now engaged in what is presently called public relations should be to serve as candid sources of information about the department--its services, problems, needs, and opportunities for public support--and, on occasion, admissions of failure.

It is further recommended that the responsibilities for the direction of police information programs in the schools and for the development and coordination of the village officer concept be placed within the Office of Community Resource Development.

The final section of this chapter deals with role perceptions of police, with the conflict between the official and working roles, and with the importance of the ways these influence the police-community relationship.

ROLE PERCEPTION: ITS RELATIONSHIP TO THE STYLE OF POLICE BEHAVIOR

The behavior of police personnel is determined by their perceptions of their role as police officers. If an officer perceives his task to be that of a law enforcer who has an obligation to make an arrest for every infraction, his decisions are likely to differ from those of an officer who perceives himself to be primarily a peacekeeper. If an officer perceives himself as functioning in a hostile community in which the residents are perceived as the 'enemy', his behavior will be different from one who perceives himself as a public servant who functions within a supportive community. It is commonly known that a police officer has multiple tasks and that he performs a host of activities in order to perform them. These comments are intended to focus attention on just one of the important influences on the relationship between the policeman and the residents of the community: the perception a policeman has of his role.

The distinction between the working, or informal, role and the official, or formal, role needs to be understood. The latter is what the rule books define and what the officer is officially taught. We know that in every occupation there are differences between the official role and the working role and that workers develop a working role, many details of which do not correspond precisely with the official role. Whether we are considering policemen, doctors, business executives, or members of any other occupation, we find that there is never complete correspondence between formal training and on-the-job behavior.

Very little has been written about a policeman's official role. He therefore relies primarily upon department policy, his training, and daily supervision in formulating his conception of what his official role should be. There seems to be an assumption that the policeman somehow already understands his official role. However, his role perception is more likely to result from unofficial influences, such as the police culture within which he works. As a consequence he develops a working role that to

some degree does not coincide with his official role. From this he learns to exercise discretion, much of which is appropriate, but some of which may reflect improper considerations.

Nevertheless, if we are to understand the role of the policeman, it is essential that we understand the working, or informal, role conceptions that he carries around with him. Anyone who studies police behavior by paying attention only to the official role will be seriously misled, just as anyone who studies any other occupation in this way would be misled. This is so because the working role is a guide in situations not covered by the formal rules, and also because the working roles themselves make up a code by which police officers interpret their own and other officers' behavior. It is very important to be able to tell the difference between a slight departure from the official role, one which is in accordance with accepted compromise, and a deviation from the official role, one which doesn't have this general acceptability.

Almost every role is overloaded with possible tasks, but there are always some tasks that are viewed in practice as more the essence of the role than other tasks. For many roles, attending to all the possible things to be done would be humanly impossible. Much of what a person does is likely to be regarded as busy-work or as chores. Working-role definitions provide a way of determining priority.

If the purpose of police work is seen as the enforcement of the law, situations that have no relationship to this aim will be ignored in conditions of choice. If the purpose is to maintain order, perhaps other tasks such as settling disputes will be seen as reasonable requirements. Whichever the purpose, persons in police work, as in any other occupation, have an idea of which tasks fit into the core of the role. For example, attempts to increase police training in the area of handling domestic disputes will in some cases be met with the reaction, "That's not our job--we're not social workers."

However, training, particularly in the orientation of recruits, with its emphasis on the enforcer role in a hostile world and its use of "stress" procedures, is being modified so that a new officer is more likely to perceive his task and his relationships with the community in a broader, more supportive context.

Policemen must be prepared to face danger and must be trained to defend themselves; however, they must also realize that danger is presented by relatively few individuals who, unfortunately, are not identified for the officer. It is quite natural that this needed preoccupation with survival may distort the officer's view of the entire community. The policeman becomes a professional cynic who views every new situation and unknown person as a threat to his personal safety. This is fortified by the police culture within which he exists, as well as by some recruit training that emphasizes a policeman's need to be physically tough if he is to survive. Consequently, there is constant stress and strain between the official role and the working role.

GUAMANIAN VALUES AND MODERN LIFE

Walter Scott Wilson

INTRODUCTION

Education, government, religion, technology, land ownership, and the family on Guam all appear to be patterned on Western models. However, modern Guamanian attitudes and behavior within these institutional forms are shaped by Guamanian values and culture. Laura Thompson's analysis (1) of Guamanian culture " . . . suggests the persistence of indigenous culture and character patterns through four centuries of outside influences, including a long period of alien domination."

To study the underlying cultural values of modern Guam, 42 questions were designed and included in an opinion survey that was administered to a sample of people in households on Guam. The 42 questions were split into two sets and placed in different parts of the questionnaire in order to maintain high respondent interest. The method of answering the questions was slightly different in the two sets to avoid respondent fatigue and boredom.

The first set of questions contained thirty statements. Each statement was printed on a 1" x 2½" card. Interviewers handed all thirty cards to each respondent and asked that the cards be sorted according to whether the respondent strongly agreed, agreed, agreed a little, disagreed a little, disagreed, or strongly disagreed with each statement. A sorting envelope with six pockets labeled strongly agree, agree, agree a little, disagree a little, disagree, and strongly disagree was also handed each respondent. Then the interviewer instructed the respondent to place a statement card in the 'strongly agree' pocket if he agreed strongly with the statement, in the 'strongly disagree' pocket if he disagreed strongly, or somewhere in between according to any other feelings. After the interview, the responses were recorded on a tally sheet by each interviewer. The thirty statements in the first section are listed below:

- 1. There is too much discipline in Guam schools.
- 2. There would be less crime if the schools were better.
- 3. Too much education can be a bad thing.
- 4. Young people should always obey their elders.
- 5. Children who are employed should turn their paychecks over to the family.
- 6. It seems that families on Guam are not as strong and close as they once were.
- 7. The Government of Guam has too much power.
- 8. The rise of crime is the fault of the government.
- 9. The government is doing a good job in improving Guam's environment.
- 10. What the government does is of little concern to me.
- 11. We can trust the government to solve our problems.
- 12. The government should control the use and sale of land.
- 13. People should not sell their land.
- 14. The military has the best land on Guam.
- 15. Land ownership is one of the most important things in life.
- 16. The military on Guam has too much power.
- 17. Airmen and sailors cause many of the crimes on Guam.
- 18. The presence of the U.S. military on Guam has helped Guam's economic growth.
- 19. What the military does on Guam does not affect me personally.
- 20. The military is good for Guam.
- 21. People should do what their religious leaders tell them to do.
- 22. People on Guam should contribute more money to their church.
- 23. Religion is a very important part of my life.
- 24. The people of Guam are becoming less religious than they used to be.
- 25. Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in.
- 26. New machines and modern ways of doing things are changing my life.
- 27. Modern changes have made Guam a better place.

- 28. The government should put limits on the growth of tourism on Guam.
- 29. Tourism has brought crime to Guam.
- 30. Tourism brings money to Guam.

The second set of questions contained twelve statements. The following list of statements and scales was handed each respondent:

	strongly disagree						strongly agree
1. Tourism is destroying Guam's environment.	☐	☐	☐	☐	☐	☐	☐
2. What goes on in the tourist business has very little effect on me.	☐	☐	☐	☐	☐	☐	☐
3. Tourism is good for Guam.	☐	☐	☐	☐	☐	☐	☐
4. The government should place more limits and controls on business operations on the island.	☐	☐	☐	☐	☐	☐	☐
5. Guam has enough good jobs.	☐	☐	☐	☐	☐	☐	☐
6. Older children should have authority over younger children.	☐	☐	☐	☐	☐	☐	☐
7. On the average, the schools on Guam are just as good and as effective as stateside schools.	☐	☐	☐	☐	☐	☐	☐
8. Chamorro as well as English should be used in the schools of Guam.	☐	☐	☐	☐	☐	☐	☐
9. Immigration to Guam should be controlled.	☐	☐	☐	☐	☐	☐	☐
10. Guam is losing many good customs.	☐	☐	☐	☐	☐	☐	☐
11. Guam should have more 8 and 10 story office buildings.	☐	☐	☐	☐	☐	☐	☐
12. Children should take care of their parents when they get old.	☐	☐	☐	☐	☐	☐	☐

Then the interviewer read the following instructions:

Would you please place a check on each scale according to whether you strongly disagree or strongly agree with each of the statements. If your opinion is not strong either way, you can put a check somewhere between the opposite ends of the scale. For example, if your opinion is close to but not quite in strong agreement with the statement, you would place your check close to but not at 'strongly agree' end of the scale.

TABULATION OF STATEMENTS

The responses to the 42 statements are listed below. Each statement is reported in percentage figures for: 1) the total number of respondents (180), 2) the number of Guamanian respondents (121), and 3) the number of U.S. respondents (16). There were 43 responses that belong to other groups which are not discussed here.

FAMILY LIFE

	TOTAL AGREE	STRONGLY AGREE	AGREE A LITTLE	DISAGREE A LITTLE	STRONGLY DISAGREE	TOTAL DISAGREE	NO RESPONSE
It seems that families on Guam are not as strong and close as they once were.							
Total	75.0	10.0	37.8	27.2	14.4	6.8	21.7
Guam	75.2	5.8	38.0	31.4	16.5	5.8	23.1
U.S.	81.3	18.8	43.7	18.8	12.5	6.2	18.7
Children should take care of their parents when they get old.							
Total	70.0	31.1	13.3	25.6	9.4	6.1	23.3
Guam	67.8	24.8	14.9	28.1	11.6	7.4	25.6
U.S.	68.8	18.8	18.8	31.2	6.2	12.5	24.9
Young people should always obey their elders.							
Total	78.9	25.6	27.2	26.1	12.2	5.0	19.4
Guam	82.6	25.6	28.1	28.9	13.2	.8	16.6
U.S.	62.5	18.8	31.2	12.5	25.0	6.3	37.5
Children who are employed should turn their paychecks over to the family.							
Total	67.8	8.3	20.6	38.9	15.0	9.5	28.9
Guam	73.6	8.3	24.8	40.5	14.0	7.4	23.9
U.S.	31.3	0	12.5	18.8	31.2	18.8	68.7
Older children should have authority over younger children.							
Total	57.7	15.5	18.3	23.9	19.4	6.8	35.1
Guam	59.5	10.7	21.5	27.3	23.1	5.0	33.1
U.S.	62.5	25.0	12.5	25.0	12.5	18.8	31.3

EDUCATION

Too much education can be a bad thing.							
Total	33.3	2.2	8.9	22.2	19.5	23.3	62.8
Guam	35.5	2.5	9.9	23.1	19.9	27.3	62.9
U.S.	18.8	0	0	18.8	18.8	18.7	81.2
Chamorro as well as English should be used in the schools of Guam.							
Total	63.7	21.6	21.6	20.5	16.7	6.8	29.1
Guam	67.0	18.2	24.0	24.8	16.5	5.8	25.6
U.S.	68.8	18.8	37.5	12.5	18.8	0	25.0
There is too much discipline in Guam schools.							
Total	38.3	3.9	11.1	23.3	24.4	21.7	58.9
Guam	45.5	3.3	12.4	29.8	23.1	18.2	52.0
U.S.	18.8	0	0	18.8	25.0	31.2	81.2
There would be less crime if the schools were better.							
Total	56.1	9.5	23.3	23.3	20.0	17.8	40.0
Guam	57.8	9.1	21.5	27.2	21.5	16.5	39.7
U.S.	56.3	6.2	31.3	18.8	12.5	18.8	37.5

EDUCATION--Continued

	TOTAL AGREE	STRONGLY AGREE	AGREE A LITTLE	DISAGREE A LITTLE	DISAGREE	STRONGLY DISAGREE	TOTAL DISAGREE	NO RESPONSE
On the average, the schools on Guam are just as good and as effective as stateside schools.								
Total	53.3	12.8	17.2	23.3	20.0	6.1	33.6	11.1
Guam	54.6	9.9	18.2	26.5	22.3	4.1	33.8	11.6
U.S.	50.1	12.5	18.8	18.8	18.8	6.2	43.7	6.2

RELIGION

The people of Guam are becoming less religious than they used to be.								
Total	72.8	12.8	28.3	31.7	16.7	5.5	24.4	2.8
Guam	76.0	14.0	27.3	34.7	17.4	4.1	23.2	.8
U.S.	75.0	12.5	37.5	25.0	12.5	6.3	25.0	0
Religion is a very important part of my life.								
Total	75.0	22.2	30.0	22.8	15.0	2.8	21.1	3.9
Guam	75.2	22.3	30.6	22.3	18.2	3.3	23.1	1.7
U.S.	68.7	12.5	37.5	18.7	18.8	0	31.3	0
People should do what their religious leaders tell them to do.								
Total	42.8	5.0	12.8	25.0	29.5	17.2	52.8	4.4
Guam	45.4	4.1	14.0	27.3	31.4	14.9	52.1	2.5
U.S.	18.7	0	6.2	12.5	31.2	25.0	75.0	6.3
People on Guam should contribute more money to their church.								
Total	58.9	6.7	19.4	32.8	22.8	12.2	37.8	3.3
Guam	61.2	5.0	22.3	33.9	25.6	9.9	37.1	1.7
U.S.	31.2	6.2	6.2	18.8	25.0	31.3	68.8	0

LAND

People should not sell their land.								
Total	65.6	18.3	25.6	21.7	20.6	9.4	31.1	3.3
Guam	71.8	20.6	26.4	24.8	16.5	8.3	26.5	1.7
U.S.	37.5	6.2	12.5	18.8	50.0	12.5	62.5	0
Land ownership is one of the most important things in life.								
Total	78.9	23.9	31.7	23.3	12.2	5.0	19.4	1.7
Guam	81.0	25.7	32.2	23.1	13.2	3.3	18.2	.8
U.S.	56.2	18.7	12.5	25.0	18.8	18.8	43.8	0

The government should control the use and sale of land.								
Total	50.0	10.6	18.9	20.5	25.0	15.5	47.2	2.8
Guam	55.3	10.7	19.0	25.6	26.5	12.4	43.9	.8
U.S.	50.0	6.2	25.0	18.8	18.7	12.5	50.0	0

GOVERNMENT

We can trust the government to solve our problems.								
Total	54.4	5.0	18.3	31.1	23.4	13.3	42.3	3.3
Guam	65.3	5.8	19.0	40.5	19.0	14.1	33.9	.8
U.S.	12.5	0	6.2	6.3	37.5	25.0	87.5	0

GOVERNMENT--Continued

	TOTAL AGREE	STRONGLY AGREE	AGREE A LITTLE	DISAGREE A LITTLE	DISAGREE	STRONGLY DISAGREE	TOTAL DISAGREE	NO RESPONSE
What the government does is of little concern to me.								
Total	31.7	3.9	5.6	22.2	22.8	24.4	63.9	4.4
Guam	37.2	3.3	7.4	26.5	25.6	20.7	60.3	2.5
U.S.	18.7	6.2	0	12.5	18.8	37.5	81.3	0

The Government of Guam has too much power.								
Total	58.8	8.9	18.3	31.6	22.8	12.8	37.3	3.9
Guam	60.3	8.3	19.8	32.2	25.6	11.6	38.0	1.7
U.S.	62.5	31.2	12.5	18.8	18.8	12.5	37.5	0

The government should place more limits and controls on business operations on the island.								
Total	56.1	20.0	13.9	22.2	20.6	8.3	36.7	7.2
Guam	57.0	15.7	15.7	25.6	25.6	6.6	35.5	7.5
U.S.	62.6	31.3	12.5	18.8	0	25.0	31.2	6.2

The government is doing a good job in improving Guam's environment.								
Total	66.1	10.0	25.5	30.6	18.3	5.6	27.2	6.7
Guam	67.8	9.1	28.9	29.8	21.4	4.1	27.2	5.0
U.S.	62.5	6.2	6.3	50.0	6.2	18.8	37.5	0

The rise of crime is the fault of the government.								
Total	5.28	8.9	13.9	30.0	23.2	19.5	45.0	2.2
Guam	50.5	8.3	14.1	28.1	24.8	23.1	48.7	.8
U.S.	50.0	6.2	0	43.8	43.8	6.2	50.0	0

MILITARY

The military is good for Guam.								
Total	72.8	12.2	31.1	29.5	18.3	2.2	21.6	5.6
Guam	72.7	11.6	25.6	35.5	18.2	2.5	22.3	5.0
U.S.	75.0	6.3	37.5	31.2	25.0	0	25.0	0

What the military does on Guam does not affect me personally.								
Total	41.6	4.4	17.8	19.4	27.2	21.7	52.8	5.6
Guam	45.4	4.1	19.0	22.3	26.5	21.5	50.5	4.1
U.S.	25.0	0	18.8	6.2	31.2	31.3	75.0	0

The military on Guam has too much power.								
Total	54.0	6.8	18.3	28.9	20.6	16.1	40.0	6.0
Guam	54.6	6.6	14.9	33.1	19.8	19.0	41.3	4.1
U.S.	37.5	6.2	18.8	12.5	25.0	12.5	56.3	6.2

The military has the best land on Guam.								
Total	78.3	17.2	31.1	30.0	14.4	2.8	17.8	3.9
Guam	79.4	18.2	30.6	30.6	14.0	3.3	18.1	2.5
U.S.	75.0	18.8	31.2	25.0	18.8	6.2	25.0	0

The presence of the U.S. military on Guam has helped Guam's economic growth.								
Total	75.5	16.1	31.1	28.3	15.0	3.4	18.4	6.1
Guam	74.4	14.0	26.5	33.9	16.5	4.1	20.6	5.0
U.S.	81.2	18.7	43.8	18.7	18.8	0	18.8	0

Airmen and sailors cause many of the crimes on Guam.								
Total	35.5	2.2	8.3	25.0	19.4	31.7	60.0	4.5
Guam	37.2	.8	7.4	29.0	22.3	30.6	59.5	3.3
U.S.	31.2	0	6.2	25.0	18.8	18.8	68.8	0

TOURISM

	TOTAL AGREE	STRONGLY AGREE	AGREE A LITTLE	DISAGREE A LITTLE	DISAGREE	STRONGLY DISAGREE	TOTAL DISAGREE	NO RESPONSE
Tourism is good for Guam.								
Total	62.2	22.8	18.9	20.5	16.7	8.9	30.6	7.2
Guam	58.7	15.7	18.2	24.8	19.0	11.6	33.9	7.4
U.S.	75.0	31.2	25.0	18.8	18.8	0	18.8	6.2

What goes on in the tourist business has very little effort on me.								
Total	33.9	8.9	12.2	12.8	26.7	20.5	59.4	6.7
Guam	33.9	7.5	9.9	16.5	32.2	19.8	59.5	6.6
U.S.	37.5	6.2	18.8	12.5	18.8	25.0	56.3	6.2

The government should put limits on the growth of tourism on Guam.								
Total	56.7	7.8	21.7	27.2	17.8	16.7	38.9	4.4
Guam	59.5	8.3	23.1	28.1	22.3	12.4	37.2	3.3
U.S.	62.5	6.2	12.5	43.8	12.5	18.8	37.5	0

Tourism is destroying Guam's environment.								
Total	21.6	5.5	5.5	10.6	21.7	30.0	70.6	7.8
Guam	25.6	5.0	6.6	14.0	21.5	31.4	67.0	7.4
U.S.	25.0	6.3	6.2	12.5	18.8	31.2	68.8	6.2

Tourism brings money to Guam.								
Total	78.3	17.8	35.5	25.0	10.5	5.6	16.7	5.0
Guam	78.5	14.0	33.1	31.4	12.4	5.8	19.0	2.5
U.S.	93.8	25.0	50.0	18.8	6.2	0	6.2	0

Tourism has brought crime to Guam.								
Total	35.1	2.8	10.6	21.7	22.2	28.3	59.9	5.0
Guam	38.0	2.5	12.4	23.1	26.4	24.0	58.7	3.3
U.S.	50.0	0	6.2	43.8	12.5	25.0	50.0	0

MODERNIZATION AND CHANGE

Guam should have more 8 and 10 story office buildings.								
Total	39.4	8.3	6.1	25.0	19.5	16.1	53.4	7.2
Guam	38.9	5.0	8.3	25.6	22.3	13.2	53.7	7.4
U.S.	25.0	0	0	25.0	25.0	37.5	68.8	6.2

Modern changes have made Guam a better place.								
Total	65.0	6.7	26.1	32.2	16.1	9.5	26.7	8.3
Guam	67.7	6.6	23.1	38.0	14.1	11.6	26.5	5.8
U.S.	43.7	6.2	25.0	12.5	43.8	6.2	50.0	6.3

New machines and modern ways of doing things are changing my life.								
Total	72.2	12.8	26.1	33.3	15.6	7.2	23.9	3.9
Guam	74.4	14.0	24.0	36.4	18.2	5.8	24.0	1.6
U.S.	56.2	12.5	12.5	31.2	18.8	18.8	43.8	0

Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in.								
Total	60.0	15.0	21.7	23.3	23.3	10.0	36.1	3.9
Guam	63.7	14.9	19.0	29.8	23.1	9.9	33.8	2.5
U.S.	56.2	31.2	18.8	6.2	25.0	12.5	43.8	0

Guam has enough good jobs.								
Total	56.7	12.8	17.2	26.7	16.1	8.9	35.0	8.3
Guam	58.7	10.8	19.0	28.9	19.8	8.3	33.9	7.4
U.S.	37.5	12.5	6.2	18.8	12.5	25.0	56.3	6.2

MODERNIZATION AND CHANGE--Continued

	TOTAL AGREE	STRONGLY AGREE	AGREE A LITTLE	DISAGREE A LITTLE	DISAGREE	STRONGLY DISAGREE	TOTAL DISAGREE	NO RESPONSE
Immigration to Guam should be controlled.								
Total	69.5	26.7	18.3	24.5	12.2	5.0	6.1	23.3
Guam	71.9	26.4	18.2	27.3	13.2	5.0	3.3	21.5
U.S.	62.6	18.8	18.8	25.0	12.5	6.2	6.2	24.9
Guam is losing many good customs.								
Total	72.8	26.1	21.1	25.6	11.1	5.6	3.3	20.0
Guam	72.8	20.7	21.5	30.6	13.2	5.8	.8	19.8
U.S.	75.0	25.0	31.2	18.8	12.5	6.3	0	18.8

INSTITUTIONS

FAMILY LIFE

Both Guamanian and U.S. informants agreed that, "It seems that families on Guam are not as strong and close as they once were." This may represent a feeling in both groups that modern changes are affecting family life on Guam. Although a high percentage of people (75%) agreed with the statement, only a small percentage (5.8%) agreed strongly. The lack of strong agreement may indicate a feeling that the family is still strong on Guam.

Both Guamanians and U.S. born respondents tended to agree that, "Children should take care of their parents when they get old." That the Guamanian response is not appreciably higher may be an indication of a shift to dependence upon institutions other than the family to provide for security in old age. Some possible substitutes for care of aging parents are savings, insurance, retirement plans, and government welfare.

Guamanians tended to agree with the statement that, "Young people should always obey their elders." This statement had the second highest agreement among Guamanians of all the 42 items. This item was ranked 13th highest in the responses of the U.S. born informants. The response indicates that there is still a strong feeling of authority in the family.

One of the greatest differences between Guamanian and U.S. informants was in response to the statement, "Children who are employed should turn their paychecks over to the family." The Guamanian respondents agreed with this statement by a proportion of 73.6%, whereas only 31.3% of U.S. born respondents agreed. This shows a difference in culture and family organization. It also indicates that individualism and independence are less emphasized than the family unit in Guamanian culture.

EDUCATION

Although both Guamanian and U.S. born respondents put a high value on education, the U.S. respondents were in stronger disagreement with the statement, "Too much education can be a bad thing." This difference may reflect a feeling on the part of some Guamanian respondents that education may cause alienation.

Both Guam and U.S. born respondents agreed that, "Chamorro as well as English should be used in the schools of Guam."

There was sharp disagreement in the responses to the statement, "There is too much discipline in Guam schools." Guam respondents were split--half agreed and half disagreed. U.S. respondents disagreed with the statement, which indicates they felt there was not too much discipline in the schools and maybe not enough. The contrast

in responses reflects both a difference in concepts of discipline and dissimilarities in the perception of the Guam schools.

A slightly larger percentage of Guamanians than U.S. born agreed that, "There would be less crime if the schools were better." The U.S. response tended to be only slightly in agreement.

About as many respondents disagreed as agreed to the proposition, "On the average, the schools on Guam are just as good and as effective as stateside schools." There was a tendency toward greater disagreement on the part of U.S. respondents, which shows that they are somewhat less positive than Guamanians are about the local school system.

RELIGION

Both Guamanian and U.S. respondents tended to agree to the statement, "The people of Guam are becoming less religious than they used to be." This indicates that both groups see a loss of traditional values.

Both groups of respondents inclined to agree with the statement that, "Religion is a very important part of my life." Guamanians tended to be more positive toward this statement. There may be a difference in the meaning of religion in the two cultures. It appears likely that Guamanians emphasize the social aspects of religion.

Although both groups tended to disagree with the statement that, "People should do what their religious leaders tell them to do," the U.S. group disagreed to a greater extent. This apparent resistance to religious leadership may be due to a resistance to authority, a feeling that religious leaders set impossibly high standards of behavior, or a belief that religious leaders should confine themselves to religious matters.

There was divergence on the statement that, "People on Guam should contribute more money to their church." Guamanians tended to agree, while U.S. respondents tended to disagree. It appears that the Guamanians have a more positive view than U.S. respondents do of their religious institutions.

LAND

There was a sharp difference between U.S. and Guamanian respondents regarding the statement, "People should not sell their land." Guamanians agreed with the statement while U.S. informants disagreed. This is an indication of the different kind of importance land has in Guamanian and U.S. cultures. To the Guamanian, land spells security.

The value placed upon land by Guamanians is also reflected in responses to the statement, "Land ownership is one of the most important things in life." Eighty-one percent of the Guamanians agreed with the statement as opposed to only 56.2% of U.S. respondents.

Both Guamanian and U.S. respondents were just about as much for as against the statement, "The government should control the use and sale of land."

GOVERNMENT

Guamanian and U.S. respondents contrasted most in the response to the statement, "We can trust the government to solve our problems." The Guamanian response of 65.3% in agreement contrasted sharply with the U.S. response of 87.5% in disagreement. This indicates an expectation on the part of Guamanians that the government will act to solve problems of Guamanians. The U.S. respondents, on the other hand, do not have a positive image of the Government of Guam and do not have an unqualified acceptance of government in general.

This difference in attitude toward government also appears in reactions to the statement, "What the government does is of little concern to me." In this case, both groups disagreed with the statement, but there was sharper disagreement by U.S. respondents. The U.S. respondents felt that government decisions were of great concern, but that the government could be threatening, whereas the concern on the part of Guamanians was more positive.

Surprisingly, there was a very close agreement between Guamanians and U.S. respondents in their reactions to the statement, "The Government of Guam has too much power." About 60% of both groups agreed. However, a higher percentage (31%) of U.S. respondents were in strong agreement.

The response to the statement, "The government should place more limits and controls on business operations on the island" was very similar to the response to the previous statement about government. This shows that business is perceived by both Guamanian and U.S. groups as needing control.

Both groups tended to agree that, "The government is doing a good job in improving Guam's environment."

There was no pattern of agreement to the statement, "The rise of crime is the fault of the government." The U.S. respondents tended to agree or disagree a little; 87.6% were in the middle two groups as opposed to 52.9% of the Guam respondents.

MILITARY

About three-fourths of respondents in both groups agreed that, "The military is good for Guam."

The U.S. respondents were more in disagreement than Guamanians were with the statement, "What the military does on Guam does not affect me personally." The difference was 75% to 50.5%. The U.S. respondents felt more affected than the Guamanians did by what the military does on Guam.

A little over half of the Guamanians (54.6%) and only 37.5% of the U.S. respondents agreed with the statement, "The military on Guam has too much power."

The statement, "The military has the best land on Guam" was agreed to by three-fourths of both the U.S. and Guamanian informants.

Both U.S. and Guamanian respondents tended to agree with the statement, "The presence of the U.S. military on Guam has helped Guam's economic growth."

Neither the U.S. nor the Guamanian respondents tended to agree with the statement, "Airmen and sailors cause many of the crimes on Guam." This shows that the military men on Guam are not generally perceived as the cause of crime.

TOURISM

The Guamanians were less in agreement than U.S. respondents with the statement that, "Tourism is good for Guam." Although both tended to agree, only 58.7% of the Guamanians agreed, while 75% of U.S. respondents agreed.

Both groups were equally in disagreement with the statement, "What goes on in the tourist business has very little effect on me." Almost 60% of both groups disagreed.

Guamanian and U.S. groups tended to agree that, "The government should put limits on the growth of tourism on Guam."

Tourism was not perceived by either group as a threat to Guam's environment. Almost 70% of both groups disagreed with the statement that, "Tourism is destroying Guam's environment."

The statement, "Tourism brings money to Guam" was agreed to in high proportions by both groups. It was the statement with which the highest percentage (93.8%) of U.S. respondents were in agreement. The percentage of Guamanians who agreed with the statement was 78.5%.

Neither group tended to agree with the statement that, "Tourism has brought crime to Guam."

MODERNIZATION AND CHANGE

The statement that, "Guam should have more 8 and 10 story office buildings" tended to be disagreed to by Guamanians and U.S. informants alike. U.S. respondents inclined to be slightly less in agreement than Guamanians.

Guamanians tended to agree (67.7%) and U.S. respondents tended to be noncommittal in reaction to the statement that, "Modern changes have made Guam a better place."

An even larger percentage of Guamanians (74.4%) agreed with the statement that, "New machines and modern ways of doing things are changing my life." Although U.S. respondents also tended to agree, the percentage in agreement (56.2%) was significantly lower.

There tended to be agreement to the statement, "Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in." Guamanians were inclined to be more in agreement (63.7%) than U.S. respondents (56.2%).

There was a tendency for Guamanians to agree (58.7%) that, "Guam has enough good jobs," while only 37.5% of U.S. respondents were in agreement.

Both groups tended to agree that, "Immigration to Guam should be controlled." Guamanians, however, agreed by a greater proportion (71.9% to 62.6%) than the U.S. respondents.

U.S. respondents were as much in agreement as Guamanian respondents with the statement, "Guam is losing many good customs." Both groups are apparently agreed that some good aspects of the local culture are being lost.

SUMMARY

VALUES

Guamanian respondents put a high value on religion, family life, and land. They have a favorable attitude toward government and the military. Guamanians feel that modernization is a good thing and that most changes are for the better. Guamanians are not completely in favor of tourism.

IDENTITY AND SELF-INVOLVEMENT

Guamanians identify closely with their land and their religion. They feel affected by and have positive feelings toward the government of Guam. What the military does is felt to have some effect upon them, and the tourist industry is similarly perceived. Despite the fact that present-day living appears to be better in some ways, there is still a feeling that many good customs are being lost. There seems to be a positive attitude toward the Chamorro language in that it is agreed Chamorro should be used in the schools.

The Guamanians have a strong feeling of respect for elders and for authority in general. However, responses to statements indicate that authority figures are not always to be obeyed. Although religion is important, Guamanians feel that people should not always do what their religious leaders tell them. They do not have strong feelings one way or the other about discipline in the schools. The government, although perceived as working in the interest of the people, is seen as having too much power. The military on Guam is seen as having too much power by fewer respondents than those responding that the government has too much power.

Guamanians tended to agree that business, tourism, and immigration should be controlled and appear to look to the government to exercise these controls.

ECONOMICS

The family is still looked on as an economic unit, with children turning their paychecks over to the family, and children having an obligation to take care of their parents in old age. The church is seen as deserving financial support. Land provides emotional as well as economic security and is not yet considered by Guamanians as something to be bought and sold. The military and tourism are both seen as having economic benefits.

ENVIRONMENT

There does not appear to be much concern about Guam's environment. Guamanians tend to trust the government to protect the environment. Although the military is seen as holding the best land, it is still looked on in a favorable light. Tourism is not perceived as a threat to the environment.

The general process of modernization is seen as a threat to the beauty of Guam. At this stage, the threat of modernization to Guam's environment is perhaps thought of in terms of the appearance of the land rather than as a threat to the air or water.

CRIME

None of the institutions on Guam is blamed by the Guamanians for crime. The military and tourism are not perceived as contributing to crime. The government is not seen to be the cause of crime either. There is a slight tendency to agree that there would be less crime if the schools were better.

REFERENCE

1. Thompson, L. 1969. The Secret of Culture: Nine Community Studies. Random House. New York.

A DESCRIPTIVE ANALYSIS OF SOCIO-CULTURAL DIFFERENCES BETWEEN NORTHERN AND SOUTHERN GUAM

Jane Jennison-Nolan

INTRODUCTION

Despite a remarkable persistence of cultural patterns and traditions among the Chamorro people of Guam (1), there also persists an assumption that, even on an island as small as Guam, there are some socio-cultural differences between Chamorros of northern Guam and Chamorros who live in southern Guam. The purpose of this research was to determine if an assumption of regional differences could be substantiated. A survey of some of the relevant literature on Guam and an opinion survey of Guam-born residents were made to determine whether evidence of regional differences could be found.

SURVEY OF LITERATURE

The geologic history of Guam created markedly different topographies in northern and southern Guam. While the northern portion of the island is a limestone plateau with no perennial streams, the southern part of the island is of volcanic origin with many streams and rivers (2). According to Fosberg (3), much of the northern plateau has been cleared of forestation for military establishments and civilian communities; the mountainous southern portion of Guam is composed of grassland, forest, occasional cultivated clearings, and relatively fewer and smaller communities.

The mountainous and remote qualities of southern Guam, as well as its lack of a large sheltered harbor, probably contributed to some isolation of the South in post-contact times. Guam's first church was begun in Merizo in 1672, but because of poor communications with Agana due to the distance between the two villages, construction was abandoned and another location closer to Agana was chosen (4). Umatac, Guam's capital ca. 1693 (5), was considered a good port for supplying ships with water because the cove had no reef; however, the exposure to the winds and the remoteness of Umatac were drawbacks and, once the ships had taken on water at Umatac, they sailed north to Apra for a safe harbor, trade and business. In the middle of the last century, Umatac was described as, "... the most wretched village, scarcely surviving from the boats that go there to water" (4). The village of Inarajan was at that time difficult to reach by land and, as now, there was no seaward access (4).

At the turn of this century, the vicinity of Talofofo was visited by Lt. William Safford, a scientist who was the first Lieutenant Governor in the new United States Naval Administration of Guam. His records indicate that he and others perceived the people of Talofofo as being different from other villages. He noted in his diary that, "... Talofofo was inhabited by the proudest and bravest of all the natives. More than all the rest they clung to the customs of their forefathers and refused to accept the teachings of the missionaries" (6). Safford's visit to Talofofo was but one stop on a tour of the southern villages. His account of this tour indicates that he found a quite different picture of living in these southern villages, which contrasted sharply with his impressions of Guam gained from life in Agana.

In 1900, certain rural areas of Guam were given a 20 percent reduction on land taxes because these areas lacked facilities for transportation of cattle and produce to reach the Agana market. The villages that were given special consideration because of their isolation were Umatac, Merizo, Inarajan, Talofofo, Ylig, and Pago (Yona) (6).

Jesus Barcinas (7), a Merizo resident who kept a diary in 1938-39, made occasional references to his village as being "out here" and noted that Merizo residents sometimes went to mid-island by boat. These comments indicate real and perceived isolation.

In May of 1939, Department of Agriculture employees visited Merizo to hold discussions with villagers on the formation of a farmers' cooperative that would help cut down on transportation expenses to market--the same problem that tax relief was designed to meet 40 years earlier (7).

According to Oliver (8), during the 40 years of Naval Administration the government attempted to foster an agricultural movement because the wage-earning opportunities were not sufficient to absorb all the people who wanted work. The result was that family subsistence and the barter economy prevailed, especially in rural areas--a condition applicable to all the South and to some areas of the North as well.

Neither Talofofo nor Inarajan could use boat transportation to Agana because of their windward locations and lack of access and safe harbors. These two villages probably experienced even more isolation than others because, according to Beaty (5), it was not until after World War II that paved roads linked Inarajan and Talofofo with Agana, the oldest community on the island.

In addition to transportation problems, southern Guam has experienced other problems related to its geography. Except for Talofofo, Yona, and Santa Rita, the southern villages are located in narrow coastal strips, which leaves little room for expansion to meet the demands of a growing population. There is also little room for septic-tank leaching field systems (Chapt. V-4, p. 43).

The South's water problems have been acute; yet in 1968 the Guam Water Quality Standards (9) placed priority on constructing sewer facilities on the northern plateau. The southern villages were to be provided with facilities later. While sewage planning for the North seemed to promote the far-flung linear growth patterns, it appeared that government planners seemed to prefer the quiet, more rural nature of the southern villages and systems for these villages were designed so that they would not foster immediate growth (Chapt. V-3, p. 23). After years of sewer construction being deferred in the South, Governor Bordallo announced on April 21, 1975, that top priority would be given to southern villages in development of the islandwide sewer system (10).

A study done in Merizo (11) concluded that the major complaints of the villagers focused on inadequate public services and utilities--a complaint likely shared by other southerners and some northerners as well. The study also revealed that Merizo residents were in favor of an electoral redistricting that would allow the villagers more direct representation in the Guam Legislature; most of the population resides in the North and most of the senators in the Legislature are typically from the North.

There are some linguistic differences between people of northern and southern Guam. Umatac residents are most distinctive in that their spoken Chamorro more closely resembles Chamorro spoken on Rota than the way in which it is spoken anywhere else on Guam. Generally, the southern speech can be distinguished from northern speech in terms of pitch. There are also some lexical differences between the two regions (Juanita Cruz, Lolita Huxel: pers. comms.).

In summary, there is some evidence that the populations of northern and southern Guam have had experiences that are different. There is evidence that the southern villages have been treated as "special cases" from time to time. There is also evidence that southerners may even have perceived themselves as being different from northern residents. There are geologic and topographic differences that divide the island and which may have exerted some influence in the generation of socio-cultural differences between the northern and southern populations. There are linguistic differences. Whether there has been a contrast between the two regions in opinions and attitudes is too subjective a determination to make from a review of pertinent historical documents and other literature. To this end, an analysis of some of the data from an opinion survey conducted by the University of Guam in 1974 is undertaken in the following sections.

THE OPINION SURVEY

The same portion of the Opinion Questionnaire that was analyzed in the preceding chapter is discussed in the following section. (See Chapt. VI-8 and Appendix C.) The 42 statements were designed to reflect the underlying values and attitudes toward education,

government, religion, modernization, land ownership, the family, the military, and tourism.

TABULATION OF STATEMENTS

The responses to the 42 statements are listed below. Each statement is reported in total agree and total disagree percentage figures for:

1) the total number of Guam-born respondents who resided in the northern villages of Tamuning (13), Dededo (14), Barrigada (6), Mongmong/Toto/Maite (6), Sinajana (6), Mangilao (7), Chalan Pago/Ordot (3), Yigo (8), Agana Heights (9), Agana (4), Asan (6), and Piti (3), for a total of 85;

2) the total number of Guam-born respondents who resided in the southern villages of Agat (18), Santa Rita (3), Yona (3), Inarajan (6), Merizo (4), and Umatac (2), for a total of 36¹; and

3) the total number of Guam-born respondents in the entire sample (121 of 180).

It is to be noted that the number of interviews per village is not in accordance with each village's proportion of the total population; nevertheless, it is felt that the data derived can be interpreted in terms of general trends in northern and southern opinions.

	Total Agree	Total Disagree	No Response
FAMILY			
It seems that families on Guam are not as strong and close as they once were.			
North	76.5	22.3	1.2
South	72.2	25.0	2.8
Total	75.2	23.1	1.7
Children should take care of their parents when they get old.			
North	64.7	29.5	5.9
South	75.0	16.7	8.3
Total	67.8	25.6	6.6
Young people should always obey their elders.			
North	82.4	17.6	0
South	83.3	13.9	2.8
Total	82.6	16.6	.8
Children who are employed should turn their paychecks over to the family.			
North	71.8	25.9	2.3
South	77.8	19.4	2.8
Total	73.6	23.9	2.5
Older children should have authority over younger children.			
North	65.9	27.0	7.1
South	44.5	47.2	8.3
Total	59.5	33.1	7.4

¹The village of Talofofo is not represented in the southern sample because there were no interviews with Guam-born residents conducted in that village.

	Total Agree	Total Disagree	No Response
EDUCATION			
Too much education can be a bad thing.			
North	35.3	63.5	1.2
South	36.1	61.1	2.8
Total	35.5	62.9	1.6
Chamorro as well as English should be used in the schools of Guam.			
North	71.8	21.2	7.0
South	55.6	36.1	8.3
Total	67.0	25.6	7.4
There is too much discipline in Guam schools.			
North	49.4	49.4	1.2
South	36.1	58.3	5.6
Total	45.5	52.0	2.5
There would be less crime if the schools were better.			
North	64.7	34.1	1.2
South	41.7	52.8	5.5
Total	57.8	39.7	2.5
On the average, the schools on Guam are just as good and as effective as state-side schools.			
North	57.6	30.6	11.8
South	47.2	41.7	11.1
Total	54.6	33.8	11.6
RELIGION			
The people of Guam are becoming less religious than they used to be.			
North	76.5	23.5	0
South	75.0	22.2	2.8
Total	76.0	23.2	.8
Religion is a very important part of my life.			
North	76.5	22.3	1.2
South	72.2	25.0	2.8
Total	75.2	23.1	1.7
People should do what their religious leaders tell them to do.			
North	48.2	49.4	2.4
South	38.9	58.3	2.8
Total	45.4	52.1	2.5
People on Guam should contribute more money to their church.			
North	67.0	31.8	1.2
South	47.2	50.0	2.8
Total	61.2	37.1	1.7

	Total Agree	Total Disagree	No Response
LAND			
People should not sell their land.			
North	76.5	22.3	1.2
South	61.1	36.1	2.8
Total	71.8	26.5	1.7
Land ownership is one of the most important things in life.			
North	87.1	12.9	0
South	66.7	30.5	2.8
Total	81.0	18.2	.8
The government should control the use and sale of land.			
North	64.7	35.3	0
South	33.3	63.9	2.8
Total	55.3	43.9	.8
GOVERNMENT			
We can trust the government to solve our problems.			
North	65.9	34.1	0
South	63.9	33.3	2.8
Total	65.3	33.9	.8
What the government does is of little concern to me.			
North	38.8	60.0	1.2
South	33.3	61.1	5.6
Total	37.2	60.3	2.5
The government of Guam has too much power.			
North	65.9	32.9	1.2
South	47.2	50.0	2.8
Total	60.3	38.0	1.7
The government should place more limits and controls on business operations on the island.			
North	58.8	34.1	7.1
South	52.8	38.9	8.3
Total	57.0	35.5	7.5
The government is doing a good job in improving Guam's environment.			
North	67.1	30.6	2.3
South	69.5	19.4	11.1
Total	67.8	27.2	5.0
The rise of crime is the fault of the government.			
North	43.5	56.6	0
South	66.7	30.5	2.8
Total	50.5	48.7	.8

	Total Agree	Total Disagree	No Response
MILITARY			
The military is good for Guam.			
North	71.8	22.3	5.9
South	75.0	22.2	2.8
Total	72.7	22.3	5.0
What the military does on Guam does not affect me personally.			
North	45.9	50.6	3.5
South	44.4	50.0	5.6
Total	45.4	50.5	4.1
The military on Guam has too much power.			
North	53.0	43.5	3.5
South	58.3	36.1	5.6
Total	54.6	41.3	4.1
The military has the best land on Guam.			
North	84.7	14.1	1.2
South	66.7	27.8	5.5
Total	79.4	18.1	2.5
The presence of the U.S. military on Guam has helped Guam's economic growth.			
North	76.5	18.8	4.7
South	69.4	25.0	5.6
Total	74.4	20.6	5.0
Airmen and sailors cause many of the crimes on Guam.			
North	36.5	61.2	2.3
South	38.9	55.6	5.5
Total	37.2	59.5	3.3
TOURISM			
Tourism is good for Guam.			
North	57.6	35.3	7.1
South	61.1	30.6	8.3
Total	58.7	33.9	7.4
What goes on in the tourist business has very little effect on me.			
North	34.1	60.0	5.9
South	33.3	58.3	8.4
Total	33.9	59.5	6.6
The government should put limits on the growth of tourism on Guam.			
North	64.7	31.8	3.5
South	47.2	50.0	2.8
Total	59.5	37.2	3.3

	Total Agree	Total Disagree	No Response
Tourism is destroying Guam's environment.			
North	20.0	72.9	7.1
South	38.9	52.8	8.3
Total	25.6	67.0	7.4
Tourism brings money to Guam.			
North	78.8	20.0	1.2
South	77.8	16.7	5.5
Total	78.5	19.0	2.5
Tourism has brought crime to Guam.			
North	42.4	55.3	2.3
South	27.8	66.7	5.5
Total	38.0	58.7	3.3
MODERNIZATION AND CHANGE			
Guam should have more 8 and 10 story office buildings.			
North	32.9	60.0	7.1
South	52.8	38.9	8.3
Total	38.9	53.7	7.4
Modern changes have made Guam a better place.			
North	63.5	29.4	7.1
South	77.8	19.4	2.8
Total	67.7	26.5	5.8
New machines and modern ways of doing things are changing my life.			
North	77.6	22.4	0
South	66.7	27.8	5.5
Total	74.4	24.0	1.6
Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in.			
North	70.6	27.1	2.3
South	47.2	50.0	2.8
Total	63.7	33.8	2.5
Guam has enough good jobs.			
North	56.5	36.5	7.0
South	63.9	27.8	8.3
Total	58.7	33.9	7.4
Immigration to Guam should be controlled.			
North	78.8	15.3	5.9
South	55.5	36.1	8.3
Total	71.9	21.5	6.6
Guam is losing many good customs.			
North	72.9	20.0	7.1
South	72.2	19.5	8.3
Total	72.8	19.8	7.4

INTERPRETATION OF FINDINGS

Family

Both northern and southern Guam-born respondents were in close agreement (less than 6% difference) with all but two of the statements concerning the family on Guam. There was a marked difference in reaction to the statement, "Older children should have authority over younger children," in that northerners agreed by 65.9% and southerners agreed by only 44.5%. The number of southerners who disagreed was higher than the number who agreed with the statement: 17 disagreed, 16 agreed, and 3 did not respond. A higher percentage of southerners (75%) agreed that, "Children should take care of their parents when they get old"; northerners also agreed, although by a smaller percentage (64.7%). The southern response to, "Younger people should always obey their elders," (83.3% agreed) was the highest agreement figure among all the southern responses; agreement to this statement was also high among northern respondents (82.4%).

Education

Only one of the statements on education met with close agreement by northerners and southerners. Nearly two-thirds of both groups disagreed that, "Too much education can be a bad thing." The statement, "On the average, the schools on Guam are just as good and as effective as stateside schools," was agreed to by 57.6% of the northern respondents and by 47.2% respondents in the South. More than 11% of both groups did not respond to this item.

The difference between the two groups was 13.3% in agreeing with the statement, "There is too much discipline in Guam's schools." The northern group was evenly divided in their reaction whereas the southern group was more in disagreement (58.3%) than agreement (36.1%).

The percentage of northerners who agreed with the statement, "There would be less crime if the schools were better," was 64.7% while only 41.7% of southern Guamanians agreed. This was the highest percentage difference in the education category and southerners disagreed more often than they agreed (52.8%).

Agreement with "Chamorro as well as English should be used in schools on Guam," was 71.8% in the North and 55.6% in the South, a difference of 16.2%.

Religion

Approximately three-fourths of both northern and southern respondents agreed that, "The people of Guam are becoming less religious than they used to be." Both groups more often disagreed than agreed that, "People should do what their religious leaders tell them to do," (49.4% for the North and 58.3% for the South). "Religion is a very important part of my life," was agreed to by three-fourths of both northern and southern Guamanians. The sharpest difference in the religion category was in the reaction to, "People on Guam should contribute more money to their church," with the North agreeing by 67% and the South disagreeing more often than they agreed (50% disagree and 47.2% agree).

Land

There was a disparity greater than 15% in the North-South responses to all three of the statements on land, with the North exceeding the South in each case. The difference in agreement was 15.4% on the statement, "People should not sell their land"; a difference of 20.4% on, "Land ownership is the most important things in life"; and 31.4% on, "The government should control the use and sale of land." The disparity between North and South on the last of these statements was the greatest among all the 42 questions; the northern agreement (64.7%) and the southern disagreement (63.9%) were less than one percent apart. The northern total agree response to the second statement was the highest among all the 42 statements: 87.1%.

Government

Four of the statements in this category showed a fair consensus of opinion between North and South; two did not. Northerners agreed that, "The government should place more limits and controls on business operations on the island," by 58.8%; southern agreement was only 6% lower. On the other hand, the respondents from northern villages indicated they agreed with the statement that, "The Government of Guam has too much power," by 65.9%. Southerners disagreed by 50%; 47.2% agreed and 2.8% did not respond. Although both groups agreed by about two-thirds that, "The government is doing a good job in improving the environment," there was a high rate of no response in the south--11.1%.

In response to the statement, "The rise of crime is the fault of the government," northerners disagreed by a proportion of 56.5%. The South agreed with the statement by 66.7%.

Military

In response to the statement, "The presence of the U.S. military on Guam has helped Guam's economic growth," northerners agreed by 76.5% and southerners by 69.4%. The two groups were in close agreement that, "The military is good for Guam." Half of both northern and southern respondents were in disagreement with the item, "What the military does on Guam does not affect me personally," and more than half of both groups disagreed with the statement that "Airmen and sailors cause many of the crimes on Guam" (North: 61.2%, South: 55.6%).

The greatest divergence in opinion regarding the military, 18%, was in response to the statement, "The military has the best land on Guam." Northern respondents agreed by a proportion of 84.7% and the figure for southern respondents was 66.7%. A little more than half of both groups agreed that, "The military on Guam has too much power"--North: 53%, South: 58.3%.

Tourism

The agree responses to 4 of the 6 statements on tourism varied by more than 14%. Two were within 3.5 percentage points or less. The northerners agreed that, "The government should put limits on the growth of tourism on Guam," by a proportion of 64.7% and the South disagreed by 50%; 47.2% agreed and 2.8% did not respond. About half of the southern respondents (52.8%) disagreed that, "Tourism is destroying Guam's environment," whereas the North disagreed in high proportions (72.9%). Both northern and southern respondents were in strong agreement that, "Tourism brings money to Guam" (North: 78.8%; South: 77.8%), and more than half of both groups agreed that, "Tourism is good for Guam" (North: 57.6%; South: 61.1%). Both groups disagreed with two other statements: "What goes on in the tourist business has very little effect on me," and "Tourism has brought crime to Guam"; however, southern disagreement with the latter item was 11.4% higher than northern disagreement (66.7% vs. 55.3%).

Modernization and Change

It was in this category that the greatest North-South differences appeared. In only one instance was there close agreement between the two groups: nearly three-fourths of both groups agreed that, "Guam is losing many good customs," (North: 72.9%, South: 72.2%). Sixty percent of northern respondents disagreed that, "Guam should have more 8 and 10 story office buildings," whereas slightly more than half (52.8%) of the southerners agreed with the statement.

Respondents from North and South alike agreed that, "Modern changes have made Guam a better place," although the percentage of southerners who agreed was 14.3% greater, (77.8% vs. 63.5%).

Guamanian respondents who live in the southern part of Guam reported agreement with the statement that, "Guam has enough good jobs," (63.9%); northern respondents agreed with the statement in slightly smaller proportions (56.5%).

"New machines and modern ways of doing things are changing my life," was a statement agreed to in high proportions by both groups of Guam-born residents, (North: 77.6%, South: 66.7%).

One of the two most striking differences occurred in response to the statement that, "Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in." Northern respondents agreed by a high percentage (70.6%), whereas less than half of the southern respondents agreed (47.2%); exactly half of the southerners disagreed.

The other striking difference was in response to the statement, "Immigration to Guam should be controlled." Nearly 79% of those from the North agreed with the statement, but only 55.5% of those from the South agreed.

SUMMARY AND IMPLICATIONS

Both northern and southern Guamanians feel that family ties are strong, that respect must be shown to older people, and that financial responsibilities to the family extend to working children. They also share a feeling that family cohesiveness is diminishing in today's society. Northern Guamanians seem to feel that older children should have authority over younger children; the southern Guamanian appears to be ambivalent on the subject.

Guamanians from both regions have positive feelings toward education, although neither group feels very strongly that Guam's schools are on a par with schools in the U.S. The northern residents tend to feel there would be less crime if the schools were better; the South tends to place responsibility on the government for a rise in the crime rate. Northerners, much more strongly than southerners, appear to want both Chamorro and English to be used in the schools, which may reflect a feeling of loss of their language among residents of the North.

Both northerners and southerners regard religion as important in their lives; however, at the same time they perceive religion to be losing ground among the people of Guam. Guamanians apparently do not feel that people should always do what their religious leaders tell them to do. Northern Guamanians tend to feel that the church should receive financial support; southerners appear undecided on the issue.

Guamanians feel that land ownership is one of the most important things in life and that people should not sell their land; however, northern Guamanians have comparatively stronger feelings on the importance of land and its retention, which may be because land use in the North is more intensive and because there are large tracts of land in the North that are no longer owned by Guamanians. Northerners and southerners are diametrically opposed on the issue of whether government should exercise control over the use and sale of land.

Guamanians in general have good feelings toward the military, although northerners are more likely to perceive the military as having the best land on the island. This may be attributed to a greater, more visible military impact in northern Guam.

There is ambivalence among Guam-born island residents toward tourism. Northerners and southerners alike tend to regard tourism as beneficial for Guam, although not in overwhelming proportions; they also feel affected by tourism about equally and are unequivocal in indicating that tourism is a moneymaker for the island. On the other hand, both tend to connect tourism with more crime, the North tending toward this perception more than the South. The southerners are less sure than northerners are that the environment is safe from tourism while it is the northerners who think the growth of tourism should be subject to government-imposed limitation.

Both northern and southern Guamanians feel affected by modernization and agree that modernization and change have resulted in improvements on Guam despite a feeling that Guam is losing some good customs. Northerners feel strongly that immigration to Guam should be controlled and they are wary of modernization lest it eventuate in the destruction of Guam's beauty. There are indications that southern Guamanians may perceive modernization and change in a more favorable light than northern Guamanians do.

Contrary to expectations, northern Guamanians are more traditional in some respects than their southern counterparts. They feel threatened on all sides and are worried about losing control. On the other hand, southerners are not concerned that their children are losing their language and they are not as affected as northerners are by the military, tourism, modernization, and loss of land. Guamanians who live in the southern half of the island appear to feel more secure and less uncertain than do the northerners. While Guamanians tend to share similar values concerning the family, education, religion, land ownership, the military, tourism, and modernization, there are differences of opinion and attitude between northern and southern Guamanians concerning these aspects of the present culture on Guam.

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APPENDIX A

METHODOLOGY

OBJECTIVES

Socio-cultural data were collected through interview questionnaires to provide a base line of opinions, attitudes, and household information on the present Guam community so that trends and changes among these categories can be projected, determined, and measured in the future. Two questionnaires, a Household Questionnaire and an Opinion Questionnaire, were used in the study. The following memorandum of July 17 1973, states the survey objectives:

July 17, 1973

Memorandum

To: Carl Vail

From: Scott Wilson

Subject: Socio-Cultural Survey for Guam Project: Preliminary Objectives

A. The following general objectives will be included in the Socio-Cultural Factors to be surveyed as part of the Guam project. Depending upon the available budget, 300 to 600 interviews are projected. A sample will be taken of households on Guam. I understand that in the fall the Village Commissioners' census files will be up to date. The household sample will also break down into a sample of wage earners in order that data gathered will be compatible with the model.

B. Breakdown of information: the informational objectives are divided into three general categories. This breakdown is for convenience in collecting and analyzing data and does not presuppose that the information in each category is unrelated to information in the other categories. The first category is Economic Factors, the second is Social Factors, and the third is Cultural Factors.

C. Objectives Under Economic Factors

The general objective is to assess the net worth of households and wage earners as well as patterns of income and consumption. Insofar as possible, within the limitations of the study, data on past changes in economic situation will be sought.

1. Specific Objectives Under Economic Factors

Specific objectives are subject to modification in order to meet objectives of the economic group.

- a. amounts and sources of income of wage earners in households,
- b. length of time income has been earned from each sources,
- c. previous jobs of present and past wage earners in household,
- d. net worth of households and wage earners, including a breakdown of types of assets into categories decided by economic groups,
- e. patterns of household expenditures by budget categories and by family members. Who spends how much on what, and who controls and manages household expenditures? Are the incomes of individual family members, such as husbands, wives, and children of various ages merged or handled individually?

D. Objectives Under Social Factors

The general objective is to assess the present social structure of the household and the way in which the household relates to other social units. The extent of kinship ties and other social ties is to be examined. The participation of household members in the power structure and in community and religious activities will be measured.

1. Specific Objectives Under Social Factors

- household size and composition by age, sex, and relationship,
- pattern of authority within the family. Who makes decisions, how are they made, and how much freedom does each household member have? At what age are children given decision-making authority in economic matters and in interpersonal relationships? What are the points of conflict within the family structure?
- what kind of relations does a household have with other households, such as the paternal and maternal grandparental households, with Godparents, siblings, and friends? How much inter-visiting is there and how much cooperation in the holding of fiestas and other family occasions?
- what kind of secondary social relationships and organizations do household members participate in? Are they members or participants and to what extent (time) do they participate in economic organizations and activities, youth organizations and activities, public and service organizations and activities, village activities, public meetings, labor organizations, etc.?
- do the members of the household participate in decisions that affect their community and island?
- how has the composition of the household changed from parental to present generation and current dynamic changes?
- where do people live when they first get married and in the later years of marriage as well as in old age?

E. Objectives Under Cultural Factors

Under cultural factors, the general objective is to assess the changing patterns of perceptions, beliefs, values, and techniques which enable people to adapt to the environment. Only a few indications of underlying cultural patterns and changes in these patterns can be measured within the scope of this study.

1. Specific Objectives Under Cultural Factors

- how does the informant perceive the present situation on Guam? What is happening, in the view of the informant?
- how does the family deal with the problem of enculturating their children? What are their objectives in raising their children? What is their concept of a "good" child?
- what traditions do people perceive as changing? Do they feel that they are better off or worse off than they were? What changes are good? What changes are bad?
- do people feel they have control over changes that are taking place in their lives?
- what languages are spoken in the home, in the community, and at work? What languages are used by which members of the household? What is the approximate breakdown of time spent speaking each language?

- how do members of the household perceive the crime situation? Does the family have problems with juvenile delinquency? Does the older generation feel that the younger generation is a problem?
- how has the household technology changed? What do households have that are new? How are the new appliances and items of furniture perceived? Is life in the new way easier or harder? Better or worse?
- how do people feel about other members of the community? (e.g. Guamanian, Statesider, Saipanese, Filipino, Palauan, Japanese, Chinese).
- what is the attitude of people toward economic development? Unqualified approval, qualified approval, neutral, qualified disapproval, unqualified disapproval?
- what is the attitude of people toward military developments?
- what is the attitude of people toward tourism?

2. Characteristics of Informants and Household Members

Age
Sex
Birthplace
Parents' birthplace
Ethnic identity
Employment
Income from employment
Income from other sources
Type of house
size
material
location
approximate value
type of furnishings
size of lot
house or apartment
age
Village
Education completed
Occupation of father
Occupation of mother
Children
age
sex
Size of family of origin
of brothers
of sisters
Marital history

DESIGN OF THE STUDY

THE QUESTIONNAIRES

Every effort was made to minimize bias in designing the questionnaires.

The Household Questionnaire was designed to obtain data concerning household composition in terms of number of people and relation of household members to the household head. Data was sought on patterns of income, including occupational structure of the household and income from wages, business, and other sources, including subsistence. Portions of the questionnaire were designed to obtain data on household expenditures,

both on- and off-island, which included travel, education expenses, and amounts spent for fiestas and support of members of other households. Other sections of the questionnaire were designed to obtain data on the approximate value of assets held by households, including land, housing, home furnishings, automobiles, and investments.

The Opinion Questionnaire was designed to measure how the respondents perceive present conditions on Guam. Items were constructed to find out which traditions people perceive to be changing and whether or not people feel they have control over the changes that are taking place. Other elements of the questionnaire were designed to determine existing attitudes toward other members of the community, toward development, toward the military, and toward tourism. A portion of the questionnaire was framed to discover patterns of language use. Other sections of the questionnaire dealt with perceptions of crime and delinquency, changes in household technology, political activity, religious and other affiliations, and behaviors concerning entertainment and keeping informed.

Due to limitations in time, a full pre-test of the questionnaires was not made. The original versions of both questionnaires were field tested by members of the Behavioral Science research group. A radical revision involving a shortening of the questionnaires resulted from this pre-test. Because of the complexities of the economic data sought, some of the data gathered proved to be incomplete.

SAMPLING

In order to insure that the respondents in the survey were representative of the population as a whole, a random sample of 700 names was drawn, during January and February 1974, from the lists of residents contained in files at all the 19 Village Commissioners' offices. The number of names that were selected in each village was proportionate to each village's percentage of the total 1970 Guam population, as reported in the 1970 U.S. census of population. The residents of Guam's military installations were not included in either the survey or the census figure.

Table 28 shows the 1970 population of each village on Guam, its percent of the 1970 total Guam population, the number of names selected in each village, and the percent of the total sample represented by each village sample.

To determine which names in the Commissioners' files became part of the sample, the population figure of each village was divided by the number in the projected sample of each village, the quotient becoming the interval between each name selected. For example, the Agat population of 4,270 was divided by 46 (the number in the projected sample for Agat) and the quotient was 93. Therefore, every 93rd name was selected from the file, beginning with a number selected blindly from a Table of Random Numbers. If a 93rd name was that of an individual under age 15, each successive listing was considered until someone over age 14 was reached.

The 700 names drawn in the above-described manner comprised the sample to whom Household Questionnaires were to be administered in the survey. From this sample of 700, a sub-sample of 398 names was randomly selected in the following manner to receive the Opinion Questionnaire.

Beginning with a number selected blindly from a Table of Random Numbers, the sample names of each village were grouped in sections of seven. The first, third, fifth, and seventh listings in each group were designated as households in which an Opinion Questionnaire was also to be administered. For example, for the village of Agat a number from 1 to 46 was selected blindly from a Table of Random Numbers. The number selected became the starting point in the list for grouping the names in sections of seven. Thereafter, every first, third, fifth, and seventh name was designated as a household in which an Opinion Questionnaire was to be administered.

TABLE 28

Village Populations and Household Sample Size
By Number and Percent*

Village	Population	Percent of Total 1970 Population	Household Questionnaire Sample Size	Percent of Total Sample
Agana	2,119	3.3%	23	3.3%
Agana Heights	3,737	4.3	30	4.3
Agat	4,270	6.5	46	6.5
Asan	2,094	3.3	23	3.3
Barrigada	5,251	8.1	57	8.1
Chalan Pago/Ordot	2,931	4.7	33	4.7
Dededo	9,083	14.0	98	14.0
Inarajan	1,897	2.8	20	2.8
Mangilao	3,228	5.0	35	5.0
Merizo	1,529	2.3	16	2.3
Mongmong/Toto/Maite	4,031	6.3	44	6.3
Piti	1,284	2.0	14	2.0
Santa Rita	2,604	4.0	28	4.0
Sinajana	3,506	5.4	38	5.4
Talofofo	1,935	3.0	21	3.0
Tamuning	9,983	15.4	108	15.4
Umatac	813	1.3	9	1.3
Yigo	2,786	4.3	30	4.3
Yona	2,599	4.0	28	4.0
	64,680	100	700	100

*Based on 1970 U.S. Census figures.

Each interviewer used a Table of Random Numbers to determine which household member over 14 years of age was to be the respondent for the Opinion Questionnaire. If there were four household members above age 14, the interviewer selected blindly from the Table until a 1, 2, 3, or 4 was obtained. Because the interviewer had already listed each household member in numerical order in the Household Questionnaire, the random number corresponded to the household member who would receive the Opinion Questionnaire.

The initial household sample proved to be larger than could be economically reached by the available interviewers. In June 1974, it was necessary to eliminate a portion of the names in the sample. This was done in such a way that the original sampling proportions of the villages were maintained. Although some villages were nearer completion than others, the names to be dropped from the sample were selected by random methods. At the time the sample size was reduced, 307 interviews had been processed.

In October 1974, 482 questionnaires had been completed and interviewing was concluded. The number of Household Questionnaires completed was 302. Opinion Questionnaires totaled 180. Table 29 shows the number of Household and Opinion Questionnaires completed in each village.

TABLE 29

Sample Composition: Number of Household
and Opinion Questionnaires/Village

Village Name	# Household Questionnaires	# Opinion Questionnaires
Agana	11	5
Agana Heights	16	11
Agat	46	24
Asan	14	8
Barrigada	16	6
Chalan Pago/Ordot	8	5
Dededo	47	39
Inarajan	7	6
Mangilao	17	11
Merizo	6	4
Mongmong/Toto/Maite	19	10
Piti	5	3
Santa Rita	10	6
Sinajana	11	7
Talofofo	3	1
Tamuning	34	15
Umatac	3	2
Yigo	24	14
Yona	5	3
	<u>302</u>	<u>180</u>

Table 30 indicates the relationships between size of village population and size of completed household sample in each village.

TABLE 30

Comparison of Village Population
Proportions and Sample Size*

Village	Percent of Total Population	# Household Questionnaires Completed	Percent of Total Sample
Agana	3.3%	11	4%
Agana Heights	4.2	16	5
Agat	6.6	46	15
Asan	3.2	14	5
Barrigada	8.1	16	5
Chalan Pago/Ordot	4.5	8	3
Dededo	14.1	47	15
Inarajan	3.0	7	2
Mangilao	5.0	17	6
Merizo	2.4	6	2
Mongmong/Toto/Maite	6.2	19	6
Piti	2.0	5	2
Santa Rita	4.0	10	3
Sinajana	5.4	11	4
Talofofo	3.0	3	1
Tamuning	15.4	34	11
Umatac	1.3	3	1
Yigo	4.3	24	8
Yona	4.0	5	2
	<u>100.0%</u>	<u>302</u>	<u>100%</u>

*Based on 1970 U.S. Census, total village population: 64,680.

From an analysis of the completed interviews, it appears that the Commissioners' files may be slightly less representative of the non-Guamanian segments of the population. The reason is that the Commissioners' files tend to be biased toward long-term village residents. Although it was realized that this was a possibility when the sample was designed, this deficiency in the sample would not create difficulties in achieving the major objectives of the study.

INTERVIEWING

The interviewers who administered the questionnaires were carefully screened and selected. Each interviewer participated in one or more training sessions on techniques of survey interviewing and on the administration of the questionnaires used in the study. The training sessions were conducted by members of the Behavioral Science faculty.

In view of the fuel crisis of early 1974, which coincided with the time interviewers were to be hired, University of Guam students who lived in the various villages were hired so that requirements for fuel would be at a minimum. Students enrolled in Behavioral Science courses were hired as interviewers in order to minimize training requirements. Each interviewer was provided the following instructions during training:

SAMPLING INSTRUCTIONS
TO INTERVIEWERS

You will be given a list of names of households, and an address or location for each household. On each list, some of the names are above a line and others are below the line. The names above the line are in the primary sampling list.

Names below the line are to be substituted for names in the primary list only under any one of the following conditions:

A. if you make three visits to a household and find no one home every time. (Make sure you don't always go back at the same time. Ask a neighbor when the family will be home.) We make three visits because we do not want to interview only the people who are always at home.

B. if you are given a downright refusal by the household to cooperate. (In cases of refusal, explain the importance of having everybody in the sample in order to get good results. Offer to come back at a more convenient time. Do not be impolite or insist on an interview, but let the people in the household know you feel their cooperation is important.)

C. if the family has moved away from the village. If the family is still in the village, you may go to the new house and get an interview.

D. if the family cannot be located, if the house is torn down or abandoned, or any other case where it is impossible to locate the family after a reasonable effort.

After you have reached the household, administer the HOUSEHOLD Questionnaire to a responsible adult in the household. Some questions may require consultation with other family members, which is permissible.

In each household, after administering the HOUSEHOLD Questionnaire, you will also administer either the OPINION Questionnaire or the SHORE and WATER Questionnaire, or both of them. If the family name on your list has the letter O after it, administer both the HOUSEHOLD Questionnaire and the OPINION Questionnaire. If the family name has the letters SW after it, administer the HOUSEHOLD Questionnaire and the SHORE and WATER Questionnaire.

To complete all the interviewing in one household, you may have to go back more than once. In making arrangements to return, find out the convenient times to return. In some households they may prefer an exact appointment. Use your judgement.

The OPINION and SHORE and WATER Questionnaires are designed to be administered to a sub-sample of people in households, and may be administered to any person in the household who is 15 years old or over.

To determine who in the household should be administered the OPINION or SHORE and WATER Questionnaire it will be necessary for you, the interviewer, to draw a sample from the household members. This is done so that we will interview a cross section of the population.

On the HOUSEHOLD Questionnaire you will list the household members by age and sex and relationship to the head of household. Each household member will be numbered. To select the person to be interviewed, determine the number of people in the household who are 15 years old or older. Then select the family member to interview by using the Table of Random Numbers which will be supplied to each interviewer. To use the Table, start at the number which has been circled on your table. If this number is smaller than or the same as the number of persons in the household who are 15 years old or older, that is the person to interview. If the number is an 0 or larger than the number of eligible people in the household, continue in the same row to the right until you reach a number you can use. When you have used a number, cross it off then start at the next number when you need to get another interview in another household.

Sample from Table of Random Numbers

26	9	2	1	6	4	2	3	8	7	6	2	6	2	6	4	8	1	0	1
27	3	7	4	2	2	8	1	7	8	0	6	0	0	0	3	2	2	9	7
28	0	7	8	0	8	5	1	5	2	6	5	8	7	5	3	0	5	9	6
29	7	4	2	3	3	2	6	0	0	6	5	2	2	3	6	3	9	0	4
30	1	8	2	7	5	9	5	3	6	5	2	9	9	1	1	7	3	4	3
31	4	3	1	8	7	0	6	0	8	6	5	0	1	0	4	0	6	1	5
32	8	5	8	0	6	1	4	1	2	0	4	4	1	4	7	6	3	5	1
33	4	5	8	5	0	4	5	8	3	9	2	8	7	8	9	0	8	4	3

Interviewers were paid on an hourly basis, which is one way of insuring that the interviewers will not cut corners in sampling and interviewing methods. Due to administrative technicalities, it was not possible to pay interviewers an hourly rate of \$3.00, which would have provided a greater incentive to complete a difficult interviewing assignment. It is recommended in future studies that administrative arrangements be made early to insure adequate compensation.

Due to the difficult nature of locating respondents and the length of the questionnaires involved, many of the interviewers dropped out or completed only a minimum number of questionnaires. A small number of interviewers, however, did an outstanding job despite the obstacles and completed a large number of questionnaires.

APPENDIX B

HOUSEHOLD QUESTIONNAIRE

Sample # _____

Hafa Adai - I'm _____ from the University of Guam. We're asking a scientifically selected sample of households on Guam to tell us something about living on Guam. Your answers will be kept confidential by us. Only statistics from the study will be published.

First of all, (ASK FIRST QUESTION)

H - 1 -

1. Would you please tell me whether the head of this household is a man or a woman? (CIRCLE ON TABLE BELOW)
2. How old is the head of the household? (RECORD)
3. Where was he (or she) born? (RECORD)
4. Now, I would like to ask the same questions about the other people living in the household. We can just start with the oldest and down to the youngest. (RECORD SEX, AGE, AND BIRTHPLACE FOR OLDEST OTHER MEMBER OF THE HOUSEHOLD)
5. How is this person related to the head of the household? (RECORD RELATIONSHIP, THEN ASK AND RECORD SEX, AGE, BIRTHPLACE AND RELATIONSHIP FOR ALL MEMBERS OF THE HOUSEHOLD)

	SEX	AGE	BIRTHPLACE	RELATIONSHIP TO HEAD OF HOUSEHOLD
1 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
2 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
3 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
4 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
5 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
6 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
7 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
8 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
9 M	☐ 1 ☐ F ☐ 2	_____	_____	_____
10 M	☐ 1 ☐ F ☐ 2	_____	_____	_____

(IF MORE THAN 10 MEMBERS CHECK HERE _____ AND LIST INFORMATION ON BACK OF THIS SHEET)

8. Are there any members of this family who are off of Guam for any reason who would normally be living in this household? (NUMBER EACH FAMILY MEMBER STARTING WITH THE NEXT NUMBER AFTER NUMBERS USED ON FIRST LIST.)

Yes 1 (IF YES GET SEX, AGE, BIRTHPLACE AND RELATIONSHIP)

No 2 (SKIP TO QUESTION 10)

# OF HOUSEHOLD MEMBER	SEX	AGE	BIRTHPLACE	RELATIONSHIP	REASON FOR BEING OFF ISLAND
_____	M <u>1</u> F <u>2</u>	_____	_____	_____	_____
_____	M <u>1</u> F <u>2</u>	_____	_____	_____	_____
_____	M <u>1</u> F <u>2</u>	_____	_____	_____	_____
_____	M <u>1</u> F <u>2</u>	_____	_____	_____	_____
_____	M <u>1</u> F <u>2</u>	_____	_____	_____	_____

9. What is the reason that they are off Guam? (RECORD REASON ABOVE)

10. Talking about being off Guam, have any household members made a trip off Guam within the past year? Who? Where to? How long? For what reason? (ASK FOR EACH TRAVELING MEMBER OF THE HOUSEHOLD AND RECORD BELOW.)

Household Member	Destination	How long	Reason
_____	_____	Days _____ Weeks _____ Months _____	_____
_____	_____	Days _____ Weeks _____ Months _____	_____
_____	_____	Days _____ Weeks _____ Months _____	_____
_____	_____	Days _____ Weeks _____ Months _____	_____
_____	_____	Days _____ Weeks _____ Months _____	_____

(IF MORE THAN FIVE, CHECK HERE _____ AND LIST ON BACK OF THIS SHEET.)

11. About how much did the people of this household spend last year on off island travel? (RECORD BELOW)

\$ _____

12. How many members of this household are working at present? (RECORD NUMBER)

Number _____

13. Which ones? (LIST ON TABLE BELOW.) Where is he (or she) working? What does he (or she) do? What is his (or her) annual total income from working? What percentage of his (or her) income goes toward family expenses? (ASK FOR EACH WORKING MEMBER AND RECORD.)

# Of Household Member	Employer	Occupation	Annual Income from Salary or Wages	% of Income used for family expenses
_____	_____	_____	\$ _____	_____ %
_____	_____	_____	\$ _____	_____ %
_____	_____	_____	\$ _____	_____ %
_____	_____	_____	\$ _____	_____ %
_____	_____	_____	\$ _____	_____ %

- 13a. Do the unmarried members of the household turn over their paychecks to their parents? Which ones? (LIST #)

Yes 1 _____

No 2 _____

14. During the past two weeks, did illness or injury keep any of the working members of this household from their work?

Yes 1 (ASK QUESTION 15)

No 2 (SKIP TO QUESTION 16)

15. Who? How many days were missed in the last two weeks because of illness or injury? (ASK FOR EACH WORKING MEMBER WHO LOST TIME IN THE PAST TWO WEEKS.)

#	Number of days
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

We are now going to ask some questions about education.

16. Going down the list of household members, could you tell me the highest grade of schooling completed by each?

(REFER BACK TO QUESTION 5, RECORD HIGHEST GRADE COMPLETED FOR EACH HOUSEHOLD MEMBER.)

# OF HOUSEHOLD MEMBER	HIGHEST GRADE COMPLETED	CURRENTLY ATTENDING	
1	_____	YES ☐	NO ☐
2	_____	YES ☐	NO ☐
3	_____	YES ☐	NO ☐
4	_____	YES ☐	NO ☐
5	_____	YES ☐	NO ☐
6	_____	YES ☐	NO ☐
7	_____	YES ☐	NO ☐
8	_____	YES ☐	NO ☐
9	_____	YES ☐	NO ☐
10	_____	YES ☐	NO ☐

(IF MORE THAN 10, CHECK HERE _____ AND LIST ON BACK OF THIS SHEET.)

17. Could you tell me which persons on the list are still attending school or college? (CHECK YES OR NO FOR EACH ON LIST ABOVE.)
18. Now we would like to know approximately how much this household spends in one year on tuition.
\$ _____
19. For those members of the family attending school or college away from home, approximately how much is spent for room and board (housing and food)?
\$ _____

20. Thinking now about the entire household, you have told us the annual income from salaries and wages. Do the members of this household receive income from any other source?

Yes ☐

No ☐

21. Now, could you tell me how much comes from each of the following sources per year? (HAND RESPONDENT CARD #1) (AFTER ASKING QUESTION 21 IT MAY BE NECESSARY TO ADJUST QUESTION 20.)

Business	\$ _____
Rental income	\$ _____
Lease income	\$ _____
Sale of Land	\$ _____
DIVIDENDS	
From Companies off island	\$ _____
From Companies on island	\$ _____
INTEREST	
Off island	\$ _____
On island	\$ _____
Farm produce	\$ _____
Other (Explain)	\$ _____

24. Approximately how much do you average each month in orders by mail order from the mainland? (RECORD BELOW)
\$ _____
25. Approximately how much does this household spend every year on fiestas and other special occasions?
\$ _____
26. Approximately how much do you spend each year on friends and relatives other than the money you said you spend on fiestas and other special occasions?
\$ _____
27. If you were to estimate the value of the food consumed in your household could you tell approximately what percentage comes from the following sources (HAND RESPONDENT CARD #3.) (HELP RESPONDENT BREAK DOWN PERCENTAGES SO THAT THE TOTAL ADDS TO 100%.)

Stores	_____ %
Ranch or Garden	_____ %
Fishing	_____ %
Relatives & Friends	_____ %
TOTAL	100%

28. Would you indicate the places you do your food shopping on the following list?
(HAND RESPONDENT CARD # 4.)

				RANK
ADA'S	YES	☐	NO	☐
PAYLESS	YES	☐	NO	☐
PEDRO'S	YES	☐	NO	☐
MANGLONA'S	YES	☐	NO	☐
COMMISSARY	YES	☐	NO	☐
VILLAGE STORES	YES	☐	NO	☐
CO-OP	YES	☐	NO	☐
SAV-MOR	YES	☐	NO	☐
OTHER	YES	☐	NO	☐

29. Could you rank the stores you mentioned from the store you do the most shopping to the one you do the least? (RECORD RANKS FOR ALL STORES MENTIONED.) We talked about income and expenses. We would now like to get an estimate of things that are owned by people in the household.

30. Do the people in this household own property land or other real estate?

YES ☐ (ASK QUESTION 31)
NO ☐ (SKIP TO QUESTION 34)

Parcel	Sq. Mtrs.	Source
1		
2		
3		
4		
5		

(IF MORE THAN FIVE PARCELS, CHECK HERE AND LIST ON BACK.)

31. How many parcels? (RECORD ON TABLE ABOVE.)
32. How many square meters? (ASK FOR EACH PARCEL.)
33. Did you acquire the land by purchase or inheritance or gift?
(RECORD ON TABLE ABOVE.)

34. Do you own this house (or apartment) or do you rent?

Owned ☐
Rented ☐ (SKIP TO QUESTION 38)

35. Was this house built by a contractor or by family and friends?

contractor ☐
family & friends ☐
other (explain) ☐

38. How many bedrooms does this house (apartment) have? (RECORD)

39. How many bathrooms? (RECORD) (IF HOUSE DOES NOT HAVE AN INDOOR TOILET, RECORD 0 ABOVE.)

40. I have here a list of items which people sometimes have in their homes (HAND RESPONDENT CARD #5.) For each item on the list would you tell whether or not there is any in this house, the number of items, whether or not they are owned by members of the household and the approximate value. (RECORD)

ITEM	NUMBER	OWNED	VALUE
Automobile		Yes ☐ No ☐	\$
Stove		Yes ☐ No ☐	\$
Refrigerator		Yes ☐ No ☐	\$
Deep Freeze		Yes ☐ No ☐	\$
Air conditioner		Yes ☐ No ☐	\$
Black & White TV		Yes ☐ No ☐	\$
Color TV		Yes ☐ No ☐	\$
Washing Machine		Yes ☐ No ☐	\$
Dryer		Yes ☐ No ☐	\$
Dish Washer		Yes ☐ No ☐	\$
Radio		Yes ☐ No ☐	\$
Tape Recorder		Yes ☐ No ☐	\$
Record Player		Yes ☐ No ☐	\$
Stereo		Yes ☐ No ☐	\$
Other Furniture & Appliances		Yes ☐ No ☐	\$

40. Finally, could you tell us, which figure on this card (HAND RESPONDENT CARD #6) represents the total value of your savings accounts, cash value of your life insurance policies and other investments such as mutual funds, stock and bonds. (RECORD BELOW.)

Less than \$50	1
\$50 - \$100	2
\$100 - \$500	3
\$500 - \$1,000	4
\$1,000 - \$5,000	5
\$5,000 - \$10,000	6
\$10,000 - \$20,000	7
\$20,000 - \$50,000	8
\$50,000 - \$100,000	9
Over \$100,000	10

THANK YOU VERY MUCH FOR YOUR COOPERATION.

APPENDIX C

(NOTE: the questions are not numbered consecutively because the questionnaire underwent revision after a field test. After items were dropped, the numbering system was not revised.)

OPINION QUESTIONNAIRE

Sample # _____
Household _____
Member # _____

In addition to questions about the household, we are also interested in people's opinions about life on Guam. Try to give us your best, most truthful answers. There are no right or wrong answers to any of these questions. We are trying to get some idea of how people feel about things.

(ASK FIRST QUESTION)

0 - 1 -

1. Tell us what you feel are the greatest changes that are taking place here on Guam?

(PROBE) Any others?

0 - 2 -

4. I have here some cards. (HAND RESPONDENT CARDS) We would like to know whether you agree or disagree with the statements printed on the cards. Here is a sheet with seven boxes (HAND RESPONDENT SORTING ENVELOPE). If you agree strongly with a statement, put it in the 'strongly agree' pocket, if you disagree strongly, put it in the 'strongly disagree' pocket. Any other feelings will fit somewhere in between. (AFTER RESPONDENT HAS PLACED ALL 30 CARDS IN THE POCKETS, PLACE THE CARDS IN THE MARKED ENVELOPES PROVIDED. AFTER THE INTERVIEW, RECORD THE RESPONSES.)

Strongly Agree

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Agree

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Agree a little

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Disagree a little

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Disagree

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Strongly disagree

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

5. What languages do you speak? (RECORD BELOW)

6. Which one of these languages do you speak most at home? (CHECK ONE)

Language

Language used most at home

_____	☐
_____	☐
_____	☐
_____	☐

7. Are you a registered member of a political party? (CHECK)

Yes ☐ (ASK FOLLOWING QUESTION)

No ☐ (SKIP TO QUESTION 10)

8. Which one?

☐ Democrat

☐ Republican

☐ Other (SPECIFY) _____

9. Would you say you were very active, active, or inactive as a party member? (CHECK)

☐ Very active

☐ Active

☐ Inactive

10. Do all, some or none of the other members of your family belong to the same party? (CHECK)

☐ All

☐ Some

☐ None

12. Within your family have there been any differences or arguments over political affiliation? (CHECK)

Yes ☐ (ASK FOLLOWING QUESTION)

No ☐ (SKIP TO QUESTION 14)

13. How serious were these differences? (CHECK)

☐ Not serious

☐ Serious

☐ Very serious

14. In the past year, how many crimes have been committed against you, your property, or members of your family. (RECORD NUMBER; IF ONE OR MORE, ASK FOLLOWING; IF NONE, SKIP TO QUESTION 17).

_____ number of crimes

15. Of these, how many did you report to the police? (RECORD NUMBER)

_____ reported

16. How many of these crimes were solved by the police? (RECORD NUMBER)

_____ solved

17. Are you a member of a church or other religious organization?
- Yes ☐ 1 (ASK FOLLOWING QUESTION)
- No ☐ 2 (SKIP TO QUESTION 19)
18. Which one? (RECORD) _____
19. How many times a week do you normally attend an organized religious activity? (CHECK)
- ☐ 1 Never
- ☐ 2 Less than once
- ☐ 3 Once
- ☐ 4 More than once a week
20. Other than political parties and religious organizations, do you belong to any other groups or associations? (RECORD)
- Yes ☐ 1 (ASK QUESTION 21)
- No ☐ 2 (SKIP TO QUESTION 24)
21. Which ones? (LIST; IF MORE THAN 6, CHECK HERE _____ AND LIST ON BACK OF SHEET)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

24. Here is a sheet with an alphabetical list of some of the different kinds of people who live on Guam. We'd like to get an idea of how you think people feel about each other. (HAND RESPONDENT ETHNIC SHEET.) Looking at the first box in the upper left hand corner, (POINT TO BOX), you'll see that is is labeled Filipino-Filipino. If you think the Filipinos on Guam have good feelings about other Filipinos on Guam, put a plus sign (+) in the box. If you think the Filipinos dislike or have bad feelings about other Filipinos here, put a minus (-) sign in the box. (CONTINUE TO POINT TO THE BOXES ON THE SHEET AS YOU COMPLETE YOUR EXPLANATION.) Then go across to the next box to the right, which is Filipino-Guamanian, and put a plus or minus in that box according to whether you think Filipinos on Guam have good feelings for or dislike Guamanians here. If you don't know how the Filipinos might feel about the Guamanians, then put a zero. Keep going across each line, filling in a plus, minus or zero, until you have completed all the squares.

	Filipinos	Guamanians	Japanese	Koreans	Palauans	Statesiders
Filipinos						
Guamanians						
Japanese						
Koreans						
Palauans						
Statesiders						

25. Here is a list of some of the common tasks done around the house. (HAND RESPONDENT CARD # 1.) Would you tell me whether or not the people in your household do these things and who usually does each job: men, women, boys or girls?

<u>Done in household</u>					<u>Men</u>	<u>Women</u>	<u>Boys</u>	<u>Girls</u>
Yes	☐ 1	No	☐ 2	Daily cooking	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Feast and Fiesta cooking	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Washing dishes	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Washing clothes	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Sweeping the floor	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Punishing children	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Gardening	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Shopping for food	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Grating coconuts	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Fishing	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Driving the car	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Changing diapers	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Bathing children	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Gathering firewood	_____	_____	_____	_____
Yes	☐ 1	No	☐ 2	Manging the money	_____	_____	_____	_____

26. Does your family have a cookhouse? (CHECK)

Yes ☐ 1 (ASK FOLLOWING QUESTION)

No ☐ 2 (SKIP TO QUESTION 29)

27. Does your family use the cookhouse? (CHECK)

☐ 1 Never

☐ 2 For special occasions only

☐ 3 Frequently

☐ 4 Almost every day

28. Now, thinking back to when you are growing up, which did your parents use most of the time? (CHECK)

☐ 1 Cookhouse

☐ 2 Kitchen

29. Are your responsibilities to other members of your extended family, more or less than they were in the past? (CHECK)

☐ 1 More

☐ 2 Less

☐ 3 Same

30. If two young people you know got married today, how many children do you think they would want to have? (RECORD NUMBER)

32. Do the women in your household sew none, some, most or all of their own clothes? (CHECK)

☐ 1 None

☐ 2 Some

☐ 3 Most

☐ 4 All

33. Approximately how many times a month do you eat a meal in a restaurant, bar or drive-in? (RECORD)

_____ times a month

34. Approximately how many times a month do you go to the movies? (RECORD)

_____ times a month

35. Approximately how many hours a day do you watch TV? (RECORD)

_____ hours a day

36. Do you read the newspaper: (CHECK)

☐ 1 Daily

☐ 2 A couple of times a week

☐ 3 About once a week

☐ 4 Less than once a week

☐ 5 Never

38. OPINION SCALE SHEET

Here are some statements about Guam. (HAND RESPONDENT STATEMENT AND SCALE.) Would you please place a check on each scale according to whether you strongly disagree or strongly agree with each of the statements. If your opinion is not strong either way, you can put a check somewhere between the opposite ends of the scale. For example, if your opinion is close to but not quite in strong agreement with the statement, you would place your check close to but not at the 'Strongly agree' end of the scale.

	Strongly disagree							Strongly agree
1. Tourism is destroying Guam's environment.	☐	☐	☐	☐	☐	☐	☐	
2. What goes on in the tourist business has very little effect on me.	☐	☐	☐	☐	☐	☐	☐	
3. Tourism is good for Guam.	☐	☐	☐	☐	☐	☐	☐	
4. The government should place more limits and controls on business operations on the island.	☐	☐	☐	☐	☐	☐	☐	
5. Guam has enough good jobs.	☐	☐	☐	☐	☐	☐	☐	
6. Older children should have authority over younger children.	☐	☐	☐	☐	☐	☐	☐	
7. On the average, the schools on Guam are just as good and as effective as stateside schools.	☐	☐	☐	☐	☐	☐	☐	
8. Chamorro as well as English should be used in the schools of Guam.	☐	☐	☐	☐	☐	☐	☐	
9. Immigration to Guam should be controlled.	☐	☐	☐	☐	☐	☐	☐	
10. Guam is losing many good customs.	☐	☐	☐	☐	☐	☐	☐	
11. Guam should have more 8 and 10 story office buildings.	☐	☐	☐	☐	☐	☐	☐	
12. Children should take care of their parents when they get old.	☐	☐	☐	☐	☐	☐	☐	

39. Here is a card with a list of things people sometimes worry about. (HAND RESPONDENT CARD # 2.) Which ones cause you concern? (IF MORE THAN 3, ASK:) Of the ones you've mentioned, which 3 do you worry about the most?

	Worry about the most
☐ 1 Crime	☐
☐ 2 Earthquakes	☐
☐ 3 Education	☐
☐ 4 Getting ahead	☐
☐ 5 Guam being attacked	☐
☐ 6 Job performance	☐
☐ 7 Medical problems	☐
☐ 8 Money	☐
☐ 9 My family	☐
☐ 10 Myself	☐
☐ 11 Relations with other people	☐
☐ 12 Strangers on our island	☐
☐ 13 Typhoons	☐

40. Do you often have trouble falling asleep at night? (CHECK)

☐ 1 Yes
☐ 2 No

41. When you are sick do you see a medical doctor, a suruhano or any other persons? (CHECK)

☐ 1 M. D.
☐ 2 Suruhano
☐ 3 Other (Specify) _____

42. Here is a list of some things often considered important in determining whether or not a person gets ahead in life. (HAND RESPONDENT CARD # 3.) Would you tell us which you think are the top 3 in the order of their importance? (RANK)

		<u>RANK</u>
☐ 1	Land ownership	_____
☐ 2	Family connections	_____
☐ 3	Job or profession	_____
☐ 4	Education	_____
☐ 5	Type of house	_____
☐ 6	Morality	_____
☐ 7	Amount of money	_____

43. Here is a sheet with a list of various occupations. (HAND RESPONDENT OCCUPATION SHEET.) Would you please rank these occupations from the highest to the lowest?

		<u>RANK</u>
☐ 1	Businessman	_____
☐ 2	Craftsman	_____
☐ 3	Farmer	_____
☐ 4	Government worker	_____
☐ 5	Military man	_____
☐ 6	Politician	_____
☐ 7	Priest	_____
☐ 8	Teacher	_____
☐ 9	Technician	_____

44. Finally, we have a few questions to ask in order to classify the people we speak to. (CHECK MALE OR FEMALE, THEN PROCEED TO QUESTIONS.)

Sex: ☐ 1 Male
☐ 2 Female

45. Where were you born? _____
46. Where was your father born? _____
47. Where was your mother born? _____

48. How old are you? _____
49. How long have you lived in this house (apartment)? (IF RESPONDENT SAYS "ALL MY LIFE," THE FOLLOWING QUESTIONS ARE UNNECESSARY.)
- _____

50. How long have you lived in this village? _____
51. How many years of your life have you spent on Guam? _____
52. How many years of your life have you spent living other places?
- _____

(NOTE: the questions are not numbered consecutively because the questionnaire underwent revision after a field test. After items were dropped, the numbering system was not revised.)

(NOTE: question # 4 consisted of cards on which the following statements were typed:)

1. There is too much discipline in Guam schools.
2. There would be less crime if the schools were better.
3. Too much education can be a bad thing.
4. Young people should always obey their elders.
5. Children who are employed should turn their paychecks over to the family.
6. It seems that families on Guam are not as strong and close as they once were.
7. The Government of Guam has too much power.
8. The rise of crime is the fault of the government.
9. The government is doing a good job in improving Guam's environment.
10. What the government does is of little concern to me.
11. We can trust the government to solve our problems.
12. The government should control the use and sale of land.
13. People should not sell their land.
14. The military has the best land on Guam.
15. Land ownership is one of the most important things in life.
16. The military on Guam has too much power.
17. Airmen and sailors cause many of the crimes on Guam.
18. The presence of the U.S. military on Guam has helped Guam's economic growth.
19. What the military does on Guam does not affect me personally.
20. The military is good for Guam.
21. People should do what their religious leaders tell them to do.
22. People on Guam should contribute more money to their church.
23. Religion is a very important part of my life.
24. The people of Guam are becoming less religious than they used to be.
25. Guam's beauty may be destroyed if too many modern machines and new ways of doing things are brought in.
26. New machines and modern ways of doing things are changing my life.
27. Modern changes have made Guam a better place.
28. The government should put limits on the growth of tourism on Guam.
29. Tourism has brought crime to Guam.
30. Tourism brings money to Guam.

APPENDIX D

HOUSEHOLD QUESTIONNAIRE

CROSS TABULATION

HOUSEHOLD MEMBER NO.	TAB NO.	S E X			MEAN AGE	BIRTHPLACE														N.R.
		M	F	NK		GUAM	U.S.	P.I.	JAP	TAIW	MICK	DAIN	H.K.	A/NZ	CAN	VIET	EUR	DTH		
1	1	282	19	1	45	199	27	62	1	0	12	0	0	0	0	0	0	0	1	
2	1	21	274	1	39	211	18	47	3	0	13	2	0	0	0	1	0	0	1	
3	1	144	135	2	18	228	17	24	2	0	5	2	0	0	0	0	0	0	3	
4	1	120	136	0	14	212	22	16	2	0	2	1	0	0	0	0	0	1	2	
5	1	108	117	2	13	192	15	12	3	0	2	0	0	0	1	0	0	0	2	
6	1	89	80	4	12	151	7	8	0	0	3	0	0	0	1	0	0	0	3	
7	1	55	65	1	12	111	1	4	2	0	1	0	0	0	1	0	0	0	2	
8	1	42	37	2	12	71	3	2	1	0	0	0	0	0	1	0	0	0	3	
9	1	23	27	1	9	43	3	2	1	0	0	0	0	0	0	0	0	0	2	
10	1	15	17	1	7	27	2	1	1	0	0	0	0	0	0	0	0	0	2	
11	1	11	6	2	7	15	1	1	0	0	0	0	0	0	0	0	0	0	2	
12	1	4	2	2	6	5	0	0	0	0	0	0	0	0	0	0	0	0	3	
13	1	3	2	2	12	5	0	0	0	0	0	0	0	0	0	0	0	0	2	
14	1	2	1	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	3	
15	1	2	0	2	5	2	0	0	0	0	0	0	0	0	0	0	0	0	2	

HOUSEHOLD MEMBER NO.	TAB NO.	RELATIONSHIP TO HOUSEHOLD HEAD																									
		WIFE	HUS	SUN	DAU	MO	MIL	FA	FIL	BRD	BIL	SIS	SIL	NEP	HIE	MCO	FCO	GRM	GRM	GRS	GRD	AUN	JYC	N/R	SIL	DIL	N.R.
2	1	263	1	16	7	1	2	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
3	1	1	1	129	120	2	6	1	2	1	4	0	0	3	1	1	0	0	0	1	1	0	0	3	3	1	0
4	1	1	0	109	152	2	1	0	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0	4	3	1
5	1	1	2	100	109	1	2	1	0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	1	2	2	2
6	1	0	0	80	77	0	1	2	1	0	2	1	1	1	0	0	0	0	0	2	1	0	0	1	0	0	3
7	1	0	0	50	50	0	3	0	2	0	2	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	2
8	1	0	0	35	33	0	0	0	3	0	1	0	0	0	0	0	0	0	0	2	1	1	0	0	1	1	3
9	1	0	0	20	24	0	0	0	0	0	2	0	1	0	0	0	0	0	0	2	1	0	0	0	0	0	1
10	1	0	0	15	14	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
11	1	0	0	10	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
12	1	0	0	4	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1

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3	25	3	6	5	13	17	8	16	7	10	18	16	71	11	20	4	18	0	0	0	0	0	0	2	0	12	169	70	43
4	24	10	6	15	11	11	9	8	18	9	23	27	40	12	16	4	11	0	0	0	0	1	0	0	2	6	184	49	30
5	38	9	8	11	10	15	12	8	17	18	21	12	33	3	7	4	4	0	1	0	0	0	0	0	0	5	165	28	43
6	44	5	7	15	7	11	8	16	20	9	9	5	22	1	4	0	1	0	0	0	0	0	0	0	1	5	127	15	48
7	47	5	3	14	8	16	6	11	3	4	7	7	14	1	1	0	0	0	0	0	0	0	0	0	0	6	91	11	51
8	43	6	2	10	3	7	6	2	4	2	5	2	9	0	2	0	1	0	0	0	0	0	0	0	0	2	54	8	44
9	32	7	3	4	3	6	0	2	5	4	0	3	5	0	0	2	0	0	0	0	0	0	0	0	0	1	39	6	32
10	25	1	1	4	4	0	3	2	2	1	1	0	4	3	0	0	0	0	0	0	0	0	0	0	0	1	22	5	25
NO. H/H MEAN SPENT ON TUITION NO. H/H MEAN SPENT ON ROOM AND BOARD TAB																													
89 1020 28 1044 1																													

81 HOUSEHOLDS HAD OTHER INCOME (BESIDES WAGES/SALARIES). 217 DID NOT. 4 DID NOT RESPOND. TAB NO 1

OTHER INCOME -- NUMBER OF HOUSEHOLDS IN RANGE INDICATED											
TAB	0 - 50	51 - 100	101 - 500	501 - 1K	1K - 5K	5K - 10K	10K - 20K	20K - 50K	50K & OVER	N.R.	
BUSINESS 1	0	2	1	0	5	1	0	4	1	67	
RENTAL 1	0	0	0	2	13	4	3	0	0	59	
LEASE 1	0	0	1	1	3	1	0	0	0	75	
SALELAND 1	0	0	0	0	2	2	2	1	2	72	
DIV OFF 1	0	1	0	0	2	0	0	0	0	78	
DIV ON 1	0	0	0	0	0	0	1	0	0	80	
INTEROFF 1	0	0	0	0	0	0	1	0	0	80	
INTER ON 1	0	3	4	1	1	1	1	0	0	70	
FARM 1	0	0	1	1	0	0	0	0	0	79	
RETIRE 1	0	0	0	0	13	4	1	0	0	63	
WELFARE 1	0	0	0	0	1	0	0	0	0	80	
OTHER 1	0	0	1	0	1	0	0	0	0	79	

MAIL ORDER H/H	MEAN \$/MONTH	FIESTAS ETC.	H/H	MEAN \$/YEAR	FRIENDS & RELATIVES	H/H	MEAN \$/YEAR	TAB
123	63		221	663		256	329	1

STORES			RANCH OR GARDEN			FISHING			RELATIVES & FRIENDS		
NO. H/H	PERCENT		NO. H/H	PERCENT		NO. H/H	PERCENT		NO. H/H	PERCENT	
1	300	86	102	25		84	17		56	26	

RANK													
PLACE SHOPPED	TAB	1	2	3	4	5	6	7	8	9	YES	NO	NR
ADASEIYU	1	42	55	80	34	25	8	1	0	0	11	20	26
PAYLESS	1	99	106	54	16	3	0	0	0	0	6	5	13
PEDRO'S	1	58	41	30	21	13	4	2	1	0	19	43	70
MANGLONA	1	22	35	28	40	27	15	3	1	0	16	66	49
COM'SARY	1	49	10	5	6	5	2	1	0	0	2	130	92
VILLSTOR	1	8	15	31	24	31	31	9	3	0	40	58	52
CU-JP	1	6	7	7	7	7	10	15	3	0	9	130	101
SAV-MOR	1	21	23	22	16	20	16	14	10	0	19	81	60
OTHER	1	4	2	1	3	1	4	6	1	0	15	77	188

185 HOUSEHOLDS OWN LAND IN SAMPLE TAB NO 1

NO. PARCELS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+
NO. H/H	1	114	43	12	4	6	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

LOT SIZE	0 - 100	100 - 500	500 - 1K	1K - 3K	3K - 5K	5K - 10K	10K - 20K	20K - 40K	40K - 60K	60K - 100K	100K - 150K	150K - 200K	200K - 300K	300K - 500K	500K - 750K	750K - 1M	1M - +	N.R.
NO. LOTS	9	15	105	44	51	36	14	12	1	2	2	1	0	0	0	0	2	2424
TAB NO 1																		

THIS SAMPLE OF 302 HOUSEHOLDS OWNS A MEAN OF 12835 SQUARE METERS TAB 1

OWN	RENT	RELATIVES	ELSEWHERE	N.R.	CONTRACTOR FAMILY & FRIENDS	SELF CONTRACTOR & FRIENDS	N.R.	TAB		
270	25	4	3	0	198	70	6	5	23	1

NO. BEDROOMS	0	1	2	3	4	5	6	7	8+	NR
TAB NO. 1	1	9	56	139	79	11	4	1	1	1

NO. BATHROOMS	0	1	2	3	4	5	6	7	8+	NR
TAB NO. 1	10	170	110	6	3	1	0	0	1	1

AUTO	STOVE	FRIG	FREEZE	A.C.	8&W TV	COL TV	WASH	DRYER	DISH W.	RADIO	TAPE	REC	MONO	STEREO	OTHER
HOUSEHOLDS 1	292	278	286	179	145	172	143	272	100	17	230	188	194	206	267
TOT ITEMS 1	562	296	304	189	306	183	153	281	106	17	279	219	202	213	267

TOT VALUE	1177750	65225	80600	45725	95250	41675	62450	66025	23450	3375	29450	39350	31700	59175	435325
1															
NET WORTH	0 - 50	- 100	- 500	- 1K	- 5K	- 10K	- 20K	- 50K	- 100K	- +	N.R.	NO. FAMILIES	MEAN NET WORTH		
	16	5	17	31	52	70	49	31	9	6	16	286	13304		

APPENDIX E

OPINION SURVEY

OPINION STATEMENTS

OPINION	TAB	PERCENT AGREE	STRONG AGREE		AGREE		AGREE LITTLE		DISAGREE LITTLE		DISAGREE		STRONG DISAGREE		PERCENT DISAGREE	NO RESPONSE	
1	1	38.33	7	3.9	20	11.1	42	23.3	44	24.4	39	21.7	23	12.8	58.89	5	2.8
2	1	56.11	17	9.4	42	23.3	42	23.3	36	20.0	32	17.8	4	2.2	40.00	7	3.9
3	1	33.33	4	2.2	16	8.9	40	22.2	35	19.4	42	23.3	36	20.0	62.78	7	3.9
4	1	78.89	46	25.6	49	27.2	47	26.1	22	12.2	9	5.0	4	2.2	19.44	3	1.7
5	1	67.78	15	8.3	37	20.6	70	38.9	27	15.0	17	9.4	8	4.4	28.89	6	3.3
6	1	75.00	18	10.0	67	37.2	50	27.8	26	14.4	12	6.7	1	0.6	21.67	6	3.3
7	1	58.89	16	8.9	32	17.8	58	32.2	41	22.8	23	12.8	3	1.7	37.22	7	3.9
8	1	52.78	16	8.9	25	13.9	54	30.0	42	23.3	35	19.4	4	2.2	45.00	4	2.2
9	1	66.11	18	10.0	46	25.6	55	30.6	33	18.3	10	5.6	6	3.3	27.22	12	6.7
10	1	31.67	7	3.9	10	5.6	40	22.2	41	22.8	44	24.4	30	16.7	63.89	8	4.4
11	1	54.44	9	5.0	33	18.3	56	31.1	42	23.3	24	13.3	10	5.6	42.22	6	3.3
12	1	50.00	14	10.6	34	18.9	37	20.6	45	25.0	28	15.6	12	6.7	47.22	5	2.8
13	1	65.56	33	18.3	46	25.6	39	21.7	37	20.6	17	9.4	2	1.1	31.11	6	3.3
14	1	78.33	31	17.2	56	31.1	54	30.0	26	14.4	5	2.8	1	0.6	17.78	7	3.9
15	1	74.69	43	23.9	57	31.7	42	23.3	22	12.2	9	5.0	4	2.2	19.44	3	1.7
16	1	53.67	12	6.7	33	18.3	52	28.9	37	20.6	29	16.1	6	3.3	40.00	11	6.1
17	1	35.56	4	2.2	15	8.3	45	25.0	35	19.4	57	31.7	16	8.9	60.00	8	4.4
18	1	75.56	29	16.1	56	31.1	51	28.3	27	15.0	6	3.3	0	00.0	18.33	11	6.1
19	1	41.67	8	4.4	32	17.8	35	19.4	49	27.2	39	21.7	7	3.9	52.78	10	5.6
20	1	72.78	22	12.2	56	31.1	53	29.4	33	18.3	4	2.2	2	1.1	21.67	10	5.6
21	1	42.76	9	5.0	23	12.8	45	25.0	53	29.4	31	17.2	11	6.1	52.78	8	4.4
22	1	58.89	12	6.7	32	19.4	59	32.8	41	22.8	22	12.2	5	2.8	37.78	6	3.3
23	1	75.00	40	22.2	54	30.0	41	22.8	27	15.0	5	2.8	6	3.3	21.11	7	3.9
24	1	72.75	23	12.8	51	28.3	57	31.7	30	16.7	10	5.6	4	2.2	24.44	5	2.8
25	1	59.44	27	15.0	38	21.1	42	23.3	42	23.3	19	10.6	5	2.8	36.67	7	3.9
26	1	72.22	23	12.8	47	26.1	60	33.3	28	15.6	13	7.2	2	1.1	23.89	7	3.9

27	1	65.00	12	6.7	47	25.1	53	32.2	29	16.1	17	9.4	2	1.1	26.67	15	8.3
28	1	56.67	14	7.8	39	21.7	49	27.2	32	17.8	30	16.7	8	4.4	38.89	8	4.4
29	1	35.00	5	2.0	17	10.6	34	21.7	40	22.2	51	28.3	17	9.4	60.00	9	5.0
30	1	78.33	32	17.8	64	35.5	45	25.0	19	10.6	10	5.6	1	0.6	16.67	9	5.0

LANGUAGES SPOKEN

ENGL	CHAM	CHIN	JAPA	KORE	VIET	PHIL	TIAM	PALA	OTH MI	GERM	FREN	SPAN	ITAL	HAWA	OTH
174	128	0	10	0	3	44	1	4	1	4	1	13	0	3	0
129	38	0	1	0	0	9	1	2	1	0	0	0	0	0	0

SPOKEN MOST AT HOME

NUMBER WHO SPEAK ENGLISH AND CHAMORRO 13

NUMBER WHO SPEAK ENGLISH AND ANOTHER LANGUAGE 4

NUMBER OF PARTY MEMBERS 88

DEMOCRATS = 44 REPUBLICANS = 29 INDEPENDENTS = 5 HALFCALF = 6 OTHER = 3 NO RESPONSE = 1

PARTY ACTIVITY 10 VERY ACTIVE 29 ACTIVE 49 INACTIVE 0 NO RESPONSE

REST OF FAMILY IN SAME PARTY

ALL = 33 SOME = 61 NONE = 70 NO RESPONSE = 16

FAMILY ARGUMENTS 17 YES 151 NO 13 NO RESPONSE

HOW SERIOUS 17 NOT 3 SERIOUS 0 VERY SERIOUS 160 NO RESPONSE

118 CRIMES COMMITED AGAINST 85 CRIMES REPORTED 12 CRIMES SOLVED BY POLICE (TOTAL)

126 CHURCH MEMBERS

116 CATHOLICS 7 PROTESTANTS 1 PALAUAN 1 BAHAI 0 JEWS 0 MUSLEMS 0 BUDDHISTS 0 OTHER 2 N.R.

FREQUENCY OF CHURCH ATTENDANCE

9 NEVER 14 LESS THAN 1 TIME/WEEK 60 1 TIME/WEEK 42 MORE THAN 1 TIME/WEEK 0 NO RESPONSE

OTHER ORGANIZATIONS

SERVICE	VETERANS	COMMUNITY	YOUTH	SPORTS	PROFESSIONAL	SCHOOL	RELIGIOUS
4	1	7	5	5	16	6	19

	FILIPINO			GUAMANIAN			JAPANESE			KOREAN			PALAUAN			STATESIDE		
FILIPINO	149	16	15	111	54	15	59	32	89	47	26	107	51	36	93	114	34	32
O/O	82	8	8	61	30	8	32	17	49	26	14	59	28	20	51	63	18	17
GUAMANIAN	106	61	13	156	10	14	111	30	39	95	24	61	93	41	46	131	25	24
O/O	58	33	7	86	5	7	61	16	21	52	13	33	51	22	25	72	13	13

JAPANESE	59	28	93	119	23	38	130	7	43	70	31	79	51	18	111	98	17	65
O/O	32	15	51	66	12	21	72	3	23	38	17	43	28	10	61	54	9	36
KOREAN	52	21	106	98	19	63	73	26	81	127	5	48	42	13	125	94	16	70
O/O	29	11	59	54	10	35	40	14	45	70	2	26	23	7	69	52	8	38
PALAUAN	51	30	99	89	40	51	58	17	105	47	10	123	133	6	41	100	14	66
J/O	28	16	55	49	22	28	32	9	58	26	5	68	73	3	22	55	7	36
STATESIDE	107	31	42	119	32	29	100	15	65	88	19	73	100	17	63	146	4	30
O/O	59	17	23	66	17	16	55	8	36	48	10	40	55	9	35	81	2	16

PLUS MINUS ZERO

GREATEST CHANGE ON GUAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	3	31	1	2	4	2	29	2	1	1	1	4	0	0	0	0	0	0	0	0

TASK	MEN	WOMEN	BOYS	GIRLS	MEEWO	MEEBO	MEEGI	MOEBO	MOEGI	BOEGI	M,WEB	M,WEG	M,B&G	M,B&G	ALL	4	N	R	NO	YES
DAILY COOKING	6	101	0	4	20	0	0	0	37	0	1	2	2	0	6	0	0	1		
FST&FSTA COOK	4	15	0	2	49	0	0	1	9	0	1	5	0	0	63	4	27	0		
WASHING DISHES	4	51	1	39	15	0	1	0	44	7	1	0	5	1	11	0	0	0		
WASHING CLOTHES	3	94	0	12	7	0	0	1	47	2	1	2	4	3	1	0	1	2		
SWEEPING FLOOR	4	53	1	54	9	0	1	2	30	7	1	0	8	0	9	0	0	1		
PUNISH CHILDREN	12	24	0	3	104	0	0	1	0	0	0	4	0	0	5	4	23	0		
GARDENING	34	21	1	1	45	7	0	3	4	1	10	1	1	2	21	2	25	1		
FOOD SHOPING	10	74	0	0	55	1	1	0	26	0	4	1	1	0	7	0	0	0		
COCONUT GRATING	41	13	41	3	14	12	0	2	1	16	2	1	1	1	5	4	23	0		
FISHING	47	4	6	0	6	45	0	0	0	0	3	0	0	0	6	7	56	0		
DRIVING CAR	33	10	2	0	89	5	1	0	1	0	7	1	0	2	24	0	2	3		
CHANGE DIAPERS	1	34	0	5	16	0	0	0	36	0	0	0	2	0	2	11	72	1		
BATHE CHILDREN	2	39	0	12	17	0	0	0	33	3	1	0	1	0	1	12	58	1		
GATHER FIREWOOD	36	7	7	0	5	54	0	0	0	0	3	0	2	2	5	9	49	1		
MANAGE MONEY	19	86	0	1	69	1	0	0	0	0	0	0	0	0	3	0	0	1		

NUMBER FAMILIES WITH COOKHOUSE = 72

COOKHOUSE IS USED NEVER = 0 ONLY FOR SPECIAL OCCASIONS = 19 FREQUENTLY = 27 ALMOST EVERY DAY = 25 NO RESP 93

65 PARENTS USED COOKHOUSE 18 USED KITCHEN. NO RESPONSE = 5

DEGREE OF FAMILY RESPONSIBILITY NOW VS. PAST 96 = MORE 45 = LESS 35 = SAME NO RESPONSE = 4

NUMBER OF CHILDREN DESIRED 0 1 2 3 4 5 6 7 8 9+ MEAN

NUMBER OF RESPONSES 4 9 52 32 33 24 1 2 4 19 3.33

HOW MUCH WOMEN SAW NONE = 75 SOME = 78 MOST = 21 ALL = 5 NO RESPONSE = 1

ACTIVITY	0	1	2	3	4	5	6	7	8	9+	
TIMES/MONTH RESTAURANT	54	20	34	23	13	17	4	1	3	11	3.04 MEAN
TIMES/MONTH MOVIES	61	16	29	26	14	6	0	2	2	4	1.77 MEAN
HOURS/DAY WATCH T.V.	15	13	21	16	31	31	9	6	32	6	4.47 MEAN
READ NEWSPAPER DAILY	= 143 COUPLE X/WK = 27 UNCE/WK = 3 LESS THAN UNCE/WK = 2 NEVER = 3 NO RESPONSE = 2										

OPINION	TAB	PERCENT DISAGREE	STRONG DISAGREE		DISAGREE		DISAGREE LITTLE		AGREE LITTLE		AGREE		STRONG AGREE		PERCENT AGREE	NO RESPONSE	
1	1	70.56	34	18.9	54	30.0	39	21.7	19	10.6	10	5.6	10	5.6	21.67	14	7.7
2	1	59.44	22	12.2	37	20.6	48	26.7	23	12.8	22	12.2	16	8.9	33.89	12	6.7
3	1	30.56	9	5.0	16	8.9	30	16.7	37	20.6	34	18.9	41	22.8	62.22	13	7.2
4	1	36.67	14	7.8	15	8.3	37	20.6	40	22.2	25	13.9	36	20.0	56.11	13	7.2
5	1	35.00	18	10.0	16	8.9	29	16.1	49	26.7	31	17.2	23	12.8	56.67	15	8.3
6	1	35.00	10	5.9	12	6.7	35	19.4	43	23.9	33	18.3	28	15.6	57.78	13	7.2
7	1	35.56	17	9.4	11	6.1	36	20.0	42	23.3	31	17.2	23	12.8	53.33	20	11.1
8	1	28.89	10	5.6	12	6.7	30	16.7	37	20.6	39	21.7	39	21.7	63.89	13	7.2
9	1	23.33	11	6.1	9	5.0	22	12.2	44	24.4	33	18.3	48	26.7	69.44	13	7.2
10	1	20.00	6	3.3	10	5.6	20	11.1	46	25.6	38	21.1	47	26.1	72.78	13	7.2
11	1	53.33	32	17.8	29	16.1	35	19.4	45	25.0	11	6.1	15	8.3	39.44	13	7.2
12	1	23.33	14	7.8	11	6.1	17	9.4	46	25.6	24	13.3	56	31.1	70.00	12	6.7

WORRY	RANKED 1	RANKED 2	RANKED 3	CK NO RANK NO	CK/RNK NO	RESP
CRIME	49	19	26	11	70	5
EARTHQUAK	5	11	10	2	147	5
EDUCATION	5	10	9	4	147	6
GET AH'D	0	5	0	4	167	6
G. ATTACK	5	5	4	3	157	6
JOB PERF	0	4	11	3	156	6
MEDICAL	3	16	37	7	111	6
MONEY	20	45	20	8	81	6
FAMILY	57	22	12	5	78	6
MYSELF	6	6	3	1	158	6
REL W/OT	0	1	1	5	167	6

STRANGER	0	3	4	6	161	6
TYPHOONS	16	15	17	10	117	5

TRUBLE FALLING ASLEEP 35 YES 135 NO 10 NO RESPONSE

WHEN SICK SEE- 171 M.D. 3 SIRHANA 0 NURSE 0 ACUPUN 2 RELATIVE 0 FRIEND 3 M.D.&SIR 1 M.D.&SIR&ACU 0 N.R.

IMPORTANT	RANKED 1	RANKED 2	RANKED 3	CK NO RANK NO	CK/RNK NO RESP	
OWN LAND	25	13	21	3	117	1
FAM CONN	37	30	32	1	79	1
JOB	25	64	35	3	52	1
EDUCAT'N	66	36	22	4	51	1
HOUSE	1	4	6	0	168	1
MORALITY	5	9	20	0	145	1
MONEY	16	20	39	2	102	1

OCCUPATION NO.	1	2	3	4	RANKED 5	6	7	8	9	N.R.
BUSINESS	30	25	39	17	14	24	16	5	0	10
CRAFTSMN	3	9	12	31	14	18	41	33	5	14
FARMER	11	9	8	5	13	11	17	33	63	10
GVT WORK	18	15	19	25	32	25	13	15	10	8
MILITARY	7	11	12	28	26	26	27	16	16	11
POLITICS	17	12	38	20	21	16	15	5	25	11
PRIEST	13	8	15	7	14	11	18	43	40	11
TEACHER	63	30	17	18	15	14	8	6	1	8
TECHNICN	18	55	13	17	19	20	9	8	9	12

NUMBER MALES = 114 NUMBER FEMALES = 64 NO RESPONSE = 2

BIRTHPLACE	GUAM	U.S.	P.I.	JAP	TAIW	MIC	H.K.	A/NZ	MEX	U.K.	OTH	N.R.
OF INFORMANT	121	16	31	2	0	8	0	0	0	0	0	2
OF FATHER	110	17	32	2	0	10	0	0	0	0	1	8
OF MOTHER	115	13	32	2	0	9	0	0	1	1	2	4

MEAN AGE = 39.7 MONTHS AT ADDRESS = 204.3 MONTHS IN VILLAGE = 163.8 YEARS ON GUAM = 19.7 YEARS ELSEWHERE = 9.8

GREATEST CHANGE ON GUAM -- CODE NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
98	87	61	8	3	9	3	14	54	11	30	2	1	25	18	6	5	1	36	6	1	19	10	48	3	1	44	17	11	5	10	8	1	3	26	3