

Draft Environmental
Statement - By: Dept. of the

Air Force ACCESS EASEMENT
ACROSS US AIR FORCE LANDS TO

SEIBU LEISURE (HAM), INC. FOR
PROPOSED DEVELOPMENT OF LOT
10080

DEPARTMENT OF THE AIR FORCE



Draft



BUREAU OF PLANNING
GOVERNMENT OF GUAM
P.O. BOX 2950
AGANA, GUAM 96910

Environmental Statement

ACCESS EASEMENT ACROSS US AIR FORCE LANDS
TO SEIBU LEISURE (GUAM), INC.
FOR PROPOSED DEVELOPMENT OF LOT 10080

DRAFT ENVIRONMENTAL STATEMENT
FOR
ACCESS EASEMENT ACROSS US AIR FORCE LANDS
TO SEIBU LEISURE (GUAM), INC.
FOR PROPOSED DEVELOPMENT OF LOT 10080

Summary Sheet

This statement was prepared by a contractor working for the United States Air Force. The Headquarters United States Air Force Environmental Protection Committee has carefully reviewed and approved the report as a draft. Seibu Leisure (Guam), Inc. reimbursed the US Air Force for contract costs but was not involved in and exercised no authority over selection of the contractor, contractor supervision, document preparation or approval.

Dr. Billy Welch, SAF/ILE, Washington, D.C. 20330, Telephone Number 202-697-9297 should be contacted for additional information about the proposed action.

1. Type of Action: Administrative
2. Description of Action: The purpose of this Draft Environmental Statement is to examine the impact of the granting of an access easement to Seibu Leisure (Guam), Inc. across U.S. Government lands in association with the proposed development of Lot 10080, which is, at present, land-locked by U.S. Government lands.

The project site is located at the northwestern extreme of the island of Guam, adjacent to Andersen Air Force Base (Northwest Field), and north of the U.S. Naval Communication Station at Finegayan.

The proposed development of Lot 10080, called the "Uruno Beach Development," is a combination resort/recreational/

residential development, consisting of hotels; facilities for indoor and outdoor recreation; cultural activities; commercial, community service, and educational endeavors, and residential units. The ultimate development of Lot 10080 includes the construction of 6 hotels with some 2,500 rooms; an estimated 1,250 housing units; an infrastructure of roads, mechanical transport system, promenades, waterway, utilities, police, fire and medical services, museums and botanical gardens; shops, markets, restaurants; and schools and churches.

3. Summary of Environmental Impact: The development of a virgin jungle area will certainly have an impact on the aesthetics and the terrestrial biology of the site, and on the adjacent marine environment. Along with increased usage of the site are the impacts of more vehicles, the need for more energy, and utility sources, including waste disposal; and finally associated with increased usage of the site are more noise, possible air pollution, and vandalism of archaeological artifacts. All of these impacts, however, may be reduced by mitigation measures as discussed in the ^{draft} ~~candidate~~ environmental statement.

On the other hand, the development of this site will offer to more people, the opportunity to enjoy the unique scenic features of this area. It will also provide the opportunity for additional employment for the people of Guam, and increase the tax base for the Government of Guam.

Associated with the development of this magnitude will be some unavoidable adverse effects related to construction operations, including noise, traffic, destruction of trees and foliage, disturbing and possibly destroying some wildlife

Many of these effects can be minimized by construction precautions. The attraction of a resort/recreational development of this magnitude will undoubtedly place a heavy demand on the marine environment with adverse effects of disturbing and/or possibly destroying the coral growth and marine biology of the nearshore waters. Again, mitigating measures can reduce the adverse effects of recreational usage of the nearshore waters.

Finally, the tranquil setting of the adjacent properties will be disturbed by the activities of a development as proposed.

4. Alternatives Considered:

- A. No Project
- B. Smaller Complex
- C. Alternative Access Routes
- D. Alternative Liquid and Solid Waste Disposal Schemes

5. Agencies from Which Comments Have Been Requested:

- A. Environmental Protection Agency
 - (1) Region IX
- B. Department of Commerce
 - (1) National Oceanic and Atmospheric Administration
- C. Federal Energy Administration
- D. Advisory Council on Historic Preservation
- E. Department of Interior
 - (1) Bureau of Outdoor Recreation
- F. Department of Defense
 - (1) Army Corps of Engineers
 - (2) US Navy
- G. Department of Housing and Urban Development

- H. Department of Health, Education and Welfare
 - I. The Office of the Governor, Guam (A-95 Clearinghouse Office)
 - J. Guam State Historic Preservation Office
 - K. Bureau of Planning, Guam
 - L. Territorial Planning Commission, Guam
 - M. Guam Environmental Protection Agency
 - N. Department of Parks and Recreation, Guam
 - O. University of Guam Marine Lab
 - P. Land Management Office, Guam
6. The Draft Environmental Statement was made available to the Council on Environmental Quality and the public in _____.

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TECHNICAL REPORT NO. 19, UNIVERSITY OF GUAM MARINE LABORATORY

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GUAM REGISTER OF HISTORIC PLACES, INVENTORY DATA FORMS 66-08-0009/10/11

D

DEPARTMENT OF THE AIR FORCE LETTER, 24 JULY 1975, ELECTRONIC EMISSIONS

E

LIST OF PERSONS CONTACTED

F

URUNO CODE - FROM SLG MASTER PLAN

DRAFT ENVIRONMENTAL STATEMENT
PROPOSED DEVELOPMENT OF LOT 100 80
BY
SEIBU LEISURE (GUAM), INC.

I. INTRODUCTION

A. General

The purpose of this Draft Environmental Statement is to examine the impact, on man and his environment, of granting an access easement to Seibu Leisure (Guam), Inc. across U.S. Government lands, thereby opening the private lands west and northwest of the U.S. Military Reservations on northern Guam to possible development.

The scope of this Draft Environmental Statement includes an examination of the granting of the access easement, as well as the proposed development of Lot 10080 as envisioned by Seibu Leisure (Guam), Inc. in the "Master Plan, Uruno Beach, Guam, For SLG, Inc. and Seibu Urban Development Corporation," prepared by Cabinet Ren Suzuki.

The granting of the access easement across U.S. Government lands by the U.S. Air Force, which would open the private lands on northwest Guam to development, places the USAF as the "lead" agency with respect to Environmental Impact Statement requirements in the possible private development of the shoreline lands. This is the reason for the U.S. Air Force's involvement in the development of

this Draft Environmental Statement for both of the easement per se and the proposed private development of Lot 10080.

The AF is only involved with granting of access easement, and this can only be done after it has had the opportunity to review what Seibu Leisure proposes to do and the comments from Federal, State and local agencies and the public on this proposal. If Seibu Leisure is granted the easement, any restrictions on the development would be imposed by the Federal and local agencies, through their regulatory processes, not by the Air Force. However, the Air Force may place conditions on the use of the access easement itself.

The following Draft Environmental Statement is based upon the earlier-mentioned master plan report. Seibu Leisure (Guam), Inc. has no detailed development plans or site plans at this time, nor have they performed a marketing study for this proposed development.

B. Background

1. Geographical Setting

Guam is located in the Western Pacific approximately 3,700 miles from Hawaii, 6,000 miles from San Francisco, and 1,500 miles south-southeast

of Japan (see Figure 1). It is the largest and most populated island between Hawaii and the Philippines, as well as being the largest and southernmost of the Mariana Islands. The island is 30 miles long, 4 to 9 miles wide, and is approximately 210 square miles in area. The northern half of the island is a broad limestone plateau bounded by steep cliffs that either fall directly to the sea, or to narrow beaches fringed by reefs. The plateau slopes from an elevation of more than 600 feet at the north end of the island to less than 200 feet near the middle of the island. The limestone is so permeable that no permanent streams exist on the plateau, although several small intermittent streams exist near the lowlands of Agana. The northern part of the

island is the groundwater source for Guam, containing a modified basal fresh water lens that floats on salt water according to the Ghyben-Herzberg principle.

The southern half of Guam is a dissected volcanic upland. It is mountainous, with several peaks rising above 1,000 feet in elevation. The west coast is bordered by a narrow coastal lowland in most places, and the east coast by limestone cliffs 100 to 300 feet high. Reefs surround the south half of the island, and they are cut by numerous bays at the mouths of the large, permanent streams that drain the volcanic upland. The relatively impermeable weathered volcanic rocks make the southern half of the island primarily a surface-water province.

2. Climate

Guam is almost uniformly warm and humid throughout the year. Nevertheless, there are two distinct seasons, the wet season and the dry season. Afternoon temperatures are typically in the mid-eighties and nighttime temperatures in the high seventies. The relative humidity commonly ranges from an average of 65 to 80 percent in the afternoon, to 85 to 100 percent at night.

From January through May, the constant tradewinds result in a well-defined dry season, broken only by occasional showers. July through November is the wet season, during which the tradewinds are frequently interrupted by tropical storms with heavy rains. Although typhoons can occur in any month, they are more likely to occur during the wet season.

About two-thirds of the annual precipitation falls in the five-month wet season. There is no certainty to the wet season; droughts are common and severe droughts are not unusual. The mean annual rainfall over the island ranges from 85 inches on the west coast near Apra Harbor to more than 110 inches in the higher mountain areas of southern Guam.

The easterly tradewinds dominate during the dry season, with wind speeds generally in excess of 15 mph; calms are rare. Winds have a strong northerly component from November through March, and a strong southerly component from April through June. From July through October, winds are highly variable and may come from any direction, but seldom do they exceed 15 mph.

3. Ocean Currents

Generally, the prevalent northeast tradewinds of the area play a major role in generating the North Equatorial Drift Current that sweeps by the island from east to west. This great current is responsible for much of the energy that flows along the coasts. It splits at the northeast corner of the island and streams along the east and west coasts of the island as shown in Figure 3. As the stream moves along the western coast, the near shore portions of the stream are distorted and forced into complicated eddy systems by prominent headlands and local submarine topography. These currents may also alter

their flows because of seasonal changes in strength and direction of the North Equatorial Current. They are further complicated in some areas by tidal currents superimposed on them, often resulting in temporary reversal of direction with changes in the tide.

Inshore (inside the reef margin) water movement is generated primarily by tide changes and wave action. These two forces combine to transport water over the reef margin onto the fringing reef flat zone. This water often forms long-shore currents on reef flats, for some distance, and then returns to sea as rip currents via natural low spots or surge channels through the reef margin.

4. Government and People

Guam was first discovered by the West in 1521 and subsequently claimed by Spain in 1565. Following the Spanish-American War in 1898, the island became a U.S. territory after 334 years of Spanish rule. The administration of the island was under the U.S. Navy until the Organic Act in 1950 placed the island under a civilian administration with a Governor appointed by the President of the United States and with U.S. Senate approval. The island was under the jurisdiction of the U.S. Department of Interior. The first elected governor was inaugurated in January 1971.

Guam has a unicameral legislature, consisting of 21 senators, elected at large for a two-year term. It is represented

in the U.S. Congress by an elected, non-voting delegate to the U.S. House of Representatives. Although Guamanians are U.S. citizens, they do not vote in the U.S. national elections.

Guam's culture is distinctly different from that of the U.S. mainland, reflecting a blending of the influences of Spanish, European, Filipino, and even the Oriental cultures. The indigenous Guamanians are distinctly different from Orientals, Filipinos, Caucasians, and Malaysians. They are generally referred to as "Chamorros", and comprise approximately 56 percent of the island population.

An isolated military outpost only a few years ago, Guam now boasts the highest income and standard of living in this region of the world. It is now a tourist destination, with more than 2,200 modern hotel rooms. During the Southeast Asian Conflict, Guam played a major strategic role with a military-related population larger than 30,000 on the island. Today, it continues to play a major role in the defense of the Western Pacific area.

The population of Guam has increased rapidly in the past 10 years. Between 1960 and 1970, the population of Guam increased from approximately 67,000 to 85,000. The present population of Guam is near 103,000, including the military population of Guam.

11.

PROJECT DESCRIPTION

A. Proposed Action

The proposed Uruno Beach Development of Lot 10080 as envisioned by Seibu Leisure (Guam), Inc., for which a request for an access easement across U.S. Government lands has been made to the U.S. Air Force, is described in the "Master Plan, Uruno Beach, Guam for SLG, Inc. and Seibu Urban Development Corporation" prepared by Cabinet Ren Suzuki. The Uruno Beach Development is a combination resort/recreational/residential development, consisting of hotels; facilities for indoor and outdoor recreation; cultural activities; commercial, community service, and educational endeavors; and residential units.

The project site is located at the northwestern extreme of Guam, near the U.S. Air Force's Northwest Field and the U.S. Naval Communication Station at Finegayan. See Figure 4. The project site is approximately 16 kilometers from the Guam International Airport, approximately 22 kilometers from Agaña, and approximately 15 kilometers from Tumon Beach. Lot 10080 has approximately 145 hectares, with approximately 3,300 meters of shoreline.

The project site is presently undeveloped and zoned for agricultural use. The site is comprised of a strip of coastal land approximately 460-610 meters wide and over 3 kilometers long (see Picture Nos. 3 through 6). The elevation varies from sea level to 150 meters, rising from sea level at the beach and becoming steeper as one moves inland toward the precipitous cliff that forms the inland border near Route 3. There is an area of moderately sloped

land, parallel to the beach, which is from 300 to 460 meters wide, as measured from the vegetation line to the base of the cliff. There is no means for vehicular access to the beach front area of the site at the present time.

Seibu Leisure (Guam), Inc. (hereinafter called SLG, Inc.) identifies three phases of construction in the Master Plan beyond which it is not clearly defined as to how or when the ultimate development will be accomplished. The ultimate development of Lot 10080 includes the construction of 6 hotels with some 2,500 rooms; an estimated 1,250 housing units consisting of condominiums, terraced housing and individual houses; a transportation system consisting of roads, mechanical transport system, promenades, and waterway; indoor and outdoor recreational facilities; cultural facilities, such as a museum and a botanical garden; community service facilities, including police and fire stations, and medical clinic; commercial facilities, including shops, markets, restaurants; churches and schools; and two sewage treatment plants. Figure 5 shows the layout of the ultimate development.

The identifiable three phases of construction would span a period of time from 3 to more than 10 years. Phase I would include the construction of a 350-room hotel on the plateau with supporting commercial facilities, a swimming hole, a cable car system, access road and parking, with associated site beautification. Utilities for the ultimate development would be provided from Potts Junction and routed along Route 3. Figure 6 shows the proposed location of the Phase I work.

Phase II would include an access road from the plateau to the bottom of the cliff and a north-south road at the bottom of the cliff. Utilities would include a water storage tank and pressure reducing tank; water distribution system; electrical distribution system; and sewerage collection system and sewage treatment plant and effluent disposal system. Two hotels are proposed under Phase II: a 400-room hotel with associated entertainment facilities, and a 250-room hotel with restaurant and club. Site beautification will continue. Figure 7 shows the proposed improvements under Phase II.

Phase III would include the extension of the north-south road at the bottom of the cliff to the northern property limits and construction of approach roads to the beach front. A second sewage treatment plant would be added in the northern area of the development. Various facilities such as market, shopping center, an outdoor recreation center, etc., will be included in this phase. The construction of residential facilities would commence. Marina and associated marine facilities would be constructed as they are approved. Figure 8 shows the Phase III additions.

The Seibu Master Plan also identifies a "Final Phase" which calls for the continuation of the development and beautification in each of the "zones" within the project site where development was initiated earlier. Development of certain areas for residential use would be contingent upon approval of additional access routes from Route 3 to the proposed sites.

The estimated cost of development through Phases I and II is in excess of \$51,000,000. The cost of constructing the Phase III improvements and beyond are not available at this time.

B. Existing Environmental Setting

1. Aesthetics

The existing visual characteristics of the proposed site are governed by topography, vegetation patterns and land use. Lot 10080, the project site, comprises a long narrow strip of coastline approximately 3 kilometers long and roughly 500 meters wide. The inland boundary is a steep escarpment rising to an elevation of some 130 to 200 meters. Seaward of the escarpment is a gently to steeply sloping ledge, averaging perhaps 200 to 250 meters wide. In some places, this area is broken into several distinct terraces as one moves seaward.

For most of its longshore extent, the site is bordered by a white coral sand beach, perhaps fifteen to twenty-five meters from the vegetation line to MLLW. The beach is broken at several points by rocky limestone outcroppings extending nearly to the sea.

Virtually the entire site is covered with dense vegetation, including the steep cliff areas, as well as the more gently sloping terrain, and extending seaward to the vegetation line. (See Picture Nos. 1 and 2.)

The vegetative community will be described elsewhere in more detail, and consists of a typical limestone forest, although the vegetative pattern strongly suggests major human planting activity, particularly in the case of a large coconut grove near the shore and roughly from one half to two thirds of the way toward the southern end of the site.

Due to the topography, trees, and restricted access, viewshed from or to the project site is currently limited. Spectacular long-distance views and exposure are, however, attainable from the top of the ridge-line which is presently accessible on foot. Principally because of terrain and tall trees, long-distance views are rarely attainable on the more gently sloping portions of the site, with the exception of occasional views of the tall framing cliffs as one looks landward.

From the beach, equally spectacular views of the northern coastline are possible, both to the north and south. The view of sunset is over the water, directly out to sea to the west.

Offshore, the entire coastline is bordered by a rich, varied and essentially unspoiled reef community. The colorful reef fishes, numerous and highly varied shells and other invertebrates, including numerous anemones, sponges, and many kinds of living coral, offer a profusion of color and motion. The clarity of coastal waters in the area, combined with these visual resources, provide excellent opportunities for skin diving and underwater photography.

The entire project area presents a virtually unspoiled appearance with very few gross indications of human activity. The trail access down the cliff face is almost completely obscured from view by dense vegetation. There is no road or vehicular access to the beach or shore areas. The areas to

the north of Lot 10080 are used at the present time for recreational and military purposes. An unimproved road from the Naval Communications facility along the shoreline to the northern boundary of Lot 10080 is obscured from view by the dense vegetation. Similarly obscured are several dwellings and livestock enclosures which are present. The only evidence of human activity in the beach area is the wreckage of a World War II vintage aircraft, a relic of the intense fighting in Guam at that time.

The other major evidences of human activity are the extensive archaeological remains of Chamorro culture (see Section II.B.4.) dating, in most cases, from pre-Magellanic times and scattered primarily throughout the lower portions of the site. Extraneous noise and noticeable air pollution problems are virtually absent on-site, although occasional aircraft activity may have short-term negative effects on noise and air quality.

As a whole, the site is characterized by abundant aesthetic resources. There are spectacular views of steep cliffs, white sand beaches, a magnificently varied coastline, and an unexcelled shallow-water reef flat. Additionally, a number of interesting and visually contrasting features are present. These include color and textural variations between different parts of the vegetative community and exposed rocky escarpments, constantly changing patterns of light and shadow from

the complex and varied terrain, highly varied patterns of clouds and intensely blue and unpolluted skies. Degradation of existing aesthetic resources by human activity is virtually non-existent, with the exception of the occasional air traffic mentioned above.

From the crest of the cliff, the project site is like a stage, with the ocean, sky and clouds forming an ever-changing backdrop. The clouds moving across the sky, the water of the sea interacting with the reef, and the brilliant sunsets contribute to the unique tranquility of the site.

2. Terrestrial Biology (Flora and Fauna)

a. Flora

The proposed project is located in areas of moderate to heavy plant growth. Picture numbers 1 and 2 show the growth and types of plants within the project area. The type of vegetation or plant community in the project area is generally called the Limestone Forest community, which covers 90% of the vegetation found on the northern half of Guam.

Because the proposed site is relatively inaccessible, there is very little published information on the plant community of the northwest shoreline area. Therefore, a botanical study of the proposed site was conducted in March 1975 by Mr. Phillip H. Moore, a noted authority of plant life on Guam. His report, with its list of major

plant species found in the project area, is appended to this statement (see Appendix A).

Of the many species which were encountered on the site, no endangered species of plant life were found. However, six species on the site could be considered as rare or quite rare. They are:

Discocalyx megacarpa (otot).

Eugenia thompsonii (Atoto).

Ixora triantha.

Planchonella obovata (Lalahag).

Terminalia littoralis (talisai-ganu).

b. Fauna

In discussions with the Division of Fish and Wildlife of the Guam Department of Agriculture, it was confirmed that there are no known rare or endangered species of wildlife in the area of the proposed work. However, the Department of Agriculture did indicate that the Guam Rail appears to be decreasing in numbers. Some of the birds that may be encountered in the northern Guam area are:

Coturnix chinensis lineata. Chinese Painted Quail.

Rallus owstoni. Guam Rail.

Pluvialis dominica fulva. Pacific Golden Plover.

Gygis alba candida. White Tern.

Ptilinopus roseicapillus. Marianas Fruit Dove.

Streptopelia bitorquata dusumieri. Philippine Turtle Dove.

Gallicolumba x. xanthonura. White-Throated Ground Dove.

Collocalia inexpectata bartschi. Edible Nest Swiftlet.

Halcyon c. cinnamomina. Micronesian Kingfisher.

Dicrurus macrocercus harterti. Black Drongo.

Corvus kubaryi. Marianas Crow.

Rhipidura rufifrons uraniae. Rufous-Fronted Fantail.

Myiagra oceanica freycineti. Micronesian Broadbill.

Aplonis opacus guami. Micronesian Starling.

Myzomela cardinalis saffordi. Cardinal Honey-Eater.

Some of the wild terrestrial animals that may be encountered during construction are:

Cervus nigricans. Guam Deer.

Wild pig.

Varanus indicus. Monitor Lizard, Iguana.

Pteropus mariannus. Fruit Bat.

Rattus norvegicus. Norway Rat.

Rattus rattus. Black Rat.

Rattus exulans. Polynesian Rat.

Mus musculus. House Mouse.

Suncus murinus. Musk Shrew.

Birgus latro. Coconut crab.

3. Marine Environment

a. Physical characteristics

The beach from Achae Point to just south of Falcona Beach is roughly 10-15 meters wide, extending from the

dense vegetation zone down a 30 degree slope to the ocean. The beach is composed mostly of unconsolidated bioclastic deposits of mollusc shells, foraminifera tests, and coral sand, similar to that described by Jones and Randall (1973) for an unconsolidated beach. The shoreline is interrupted by two small rocky headlands between Uruno Point and Falcona Beach. Remnant patches of raised limestone are also scattered along the shore.

The inner reef flat is roughly 10-15 meters wide, and consists of bioclastic beach deposits, mostly Acropora rubble, mollusc shells, foraminifera, and coral sand. The moat system is shallow, between 1-1.5 meters deep, and poorly developed. There are numerous small freshwater rivulets, especially noticeable at low tide, running from the shore and rocky headlands into the moat and there is an apparent layer of freshwater on the surface in many places.

The outer reef flat varies from 50 meters to 160 meters wide and has numerous scattered patches of exposed limestone. In deeper areas, the substrate is covered by the staghorn coral, Acropora hebes. This coral forms dense, flat-topped thickets which grow upward to the low tide line and comprise the principal structure on the outer reef flat. Additionally, massive Porites micro-atolls can be found in the deeper pools and are scattered

along the reef flat. There are large deposits of broken Acropora branches and other coral debris creating small patches of sand-rubble substrata.

Randall and Holloman (1974) provides a general description of the reef flat and offshore zones (a hydrographic survey map is attached as Figure 9):

"A narrow cuesta-type of algal ridge forms an elevated hummocky region at the reef margin. This ridge is solid and massive and is cut by short shallow surge channels. There is no room-and-pillar development at the reef margin and reef front zone comparable to that found on the southeast side of Ritidian Channel. The reef front is cut by a groove-and-spur system along most of the section, although at some locations considerable development of coral-algal knobs and bosses is taking place on the upper surfaces of spurs. The reef front appears to be somewhat in equilibrium as far as outward growth and erosion are concerned. The 55-foot submarine terrace is present along most of the section, but it is narrow and irregular. At some places there seem to be relic features such as grooves and channels at the seaward margin of the terrace which resemble a sunken reef-margin system.

"The outer part of the reef front, submarine terrace, and seaward slope zone was heavily infested by Acanthaster planci in 1969 along this entire sector. Most of the reef building corals were killed in all three fringing reef zones as a result of predation by these starfish. Wave and surf action prevented intensive starfish damage in the reef margin and inner part of the reef front zones. Rich coral growth is more or less restricted to this narrow wave-assaulted region at the present time. Recent surveys show that recolonization of the dead coralla surface by calcareous red algae in the reef front zone has maintained the structural integrity of the colonies. New coral growth from planula settlement and small patches which survived the initial starfish predation was also evident in the affected zones during this survey."

b. Water movement

Dye studies carried out during high tide in April 1975 showed a northeasterly movement, parallel to shore at all transects. The inner reef flat zones showed strongest movement at Transects 1, 2 and 4 (see Appendix B). Water movement over the inner and outer reef flats at Transect 3 was relatively similar, with movement over the outer reef flat slightly faster. The dye at Transect 4 moved northeasterly and then exited at a rocky headland approximately

200 meters northeast of the drop site. This outcrop diverts the water and is hazardous, especially during high tide, when volume transport is greatest.

The dye studies on April 5, 1975 were conducted during a period of heavy surf (1.5-2 meters), causing high turbulence which, in turn, increased the rate of water movement. In general, the dye studies indicate strong along-shore movement, especially during high tides and heavy surf, creating hazardous swimming conditions as close as 10 meters from shore.

The low tide dye studies showed considerably less movement than during high tides. There was no movement of water at Transect 1 and the dye was visible for over one hour. With the exception of the dye patch dropped at Transect 2, water moved in a northeasterly direction parallel to shore. At Transect 2, the water moved in a southerly direction towards shore. The slow movement is primarily caused by the minimal drainage during low tides when extensive sections of the reef are exposed.

c. Offshore currents

Drogue studies were conducted 1 (1.6 km), 3 (4.8 km) and 5 (8 km) miles north of Ritidian Point by the Navy Oceanographic Office (Huddell et. al., 1974) on February 24, 1971 and August 26, 1971. They state that "During February, surface currents appeared to be relatively

weaker; no movement at all was observed 5 miles (8 km) north of the point. Currents within a mile of Ritidian Point showed a more easterly component during both winter and summer than the currents further from shore. Surface currents north of Ritidian Point flowed against the prevailing winds and opposite to the North Equatorial Current as shown in both the current meter data and drogue tracking."

Offshore current studies indicate a general southwesterly flow except for the morning drogues which moved north from both stations on the two days. Most drogues in our study were affected by the wind. The more protected location of Station 2 (south of Uruno Point) probably accounts for the slower movement of these drogues as opposed to the northern drogues which moved in excess of 1 knot in one instance. None of the drogues ran aground on the reef; however, those from Station 1 traveled closely parallel to the reef margin.

The prevalent southwesterly trend follows the theory (Emery, 1962) that the North Equatorial Current splits northeast of Guam and continues south along the eastern and western sides to converge southwest of Guam. However, the Navy's study at Ritidian seems to contradict this.

In trying to correlate the peculiar northerly drifts with the tidal cycle (since the drogues were moving against

the prevailing wind), it appears that this northerly current exists approximately four hours out-of-phase with the tidal cycle. The Dickinson/Tsuda study included the hours when the tide was at its lowest point. Further current studies should be made to include the hours when the tide is at its peak to see if a northerly current develops.

d. Water movement at 15 meter depth

Dye was released in 15 meters of water at both Stations 5 and 6. The dye patch on Transect 5 moved seaward and diffused down the reef slope, while the dye patch on Transect 6 moved inshore toward the reef margin.

e. Marine biology

Table 1 of Appendix B lists the 56 species of marine benthic algae thus far collected or observed in the six reef zones at the Uruno Point study area. This listing must be considered preliminary, since collections and observations were carried out on only four days. Table 2 presents the relative abundance, frequency, and algal cover of the predominant algae in four - inner reef flat, outer reef flat, reef margin, and reef terrace - of the six reef zones.

The dominant algae on the inner reef flat are Cladophoropsis membranacea, Jania capillacea, Gelidiella acerosa, and Jania capillacae; the dominant algae on the

outer reef flat are Microdictyon okamurai, Boodlea composita, and Polysiphonia sp. Turbinaria ornata is the obvious algae on the reef margin which is comprised predominantly of Porolithon onkodes. In those areas of the reef which possess a distinctly raised reef margin, a golden-colored species of Gelidium is dominant.

The reef front is dominated by the larger algae, e.g., Halymenia durvillaei, Galaxaura oblongata, and Galaxaura marginata, Tolypiocladia glomerulata is the dominant alga on the reef terrace along both Transects 5 and 6. Halimeda discoidea is distributed sparsely on the reef slope which is covered with coralline algae.

When the benthic algae are considered as a whole, the surf community is by far the most dominant and seems to be in ample abundance to serve as food for the herbivorous fish population on the reef terrace.

f. Corals

Table 3 of Appendix B lists the species of corals collected or observed in three reef zones at the Uruno Point study area. The list is not complete, since only three of the six reef zones were sampled. Table 4 shows the relative abundance, frequency, and percent coverage for the inner and outer reef flat corals and Table 5 presents the relative density, frequency, and total density for the reef terrace corals.

Small branches of Acropora hebes and a few small Porites colonies comprise most of the living coral in the inner reef flat. This zone is mostly rubble and sand. The dominant coral on the outer reef flat is Acropora hebes where colonies form extensive thickets. The other more common species are Goniastrea retiformis, Pocillopora damicornis, and Psammocora contigua. The flat elevated limestone areas were devoid of coral and are mostly a sand-algal cover.

The reef terrace is sparsely populated with live coral. The predominant coral is an encrusting Montipora conicula. Another encrusting form, Montipora tuberculosa is also common. These two corals form broad encrusting patches on the substrata and are vividly colored blue and red in their natural state. Other common corals are Favia pallida, Platygyra rustica, Porites lichen and Pocillopora sp.

The reef terrace experienced heavy Acanthaster planci predation (Chesher 1969, Tsuda 1971) and numerous dead coral colonies are evident.

g. Fishes

The reef flat area of Uruno Point contains a varied assemblage of typical tropical reef fish species (Appendix B, Table 6). Tourist oriented development in this area could take advantage of this very accessible "natural

aquarium" by preserving it for the enjoyment of snorkelers and divers. The opportunity to observe such colorful fishes as the butterflyfishes (Chaetodontidae), damselfishes (Pomacentridae), surgeonfishes (Acanthuridae) and triggerfishes (Rhinecanthus rectangularis, the well-known "humuhumu-nukunuku-a-pua'a" of Hawaii) in their natural setting could develop into a considerable tourist attraction.

h. Holothurians

Table 7 of Appendix B includes a list of the holothurians found in the study area. Holothuria (Halodeima) atra is the dominant holothurian of the inner reef flat. It is typically found on, but not restricted to, sandy areas. The second most visually dominant holothurian is Stichopus chloronotus, which seems to be more abundant here than on other reef flats. S. chloronotus is restricted to solid substrates and is generally more abundant in the outer reef flat.

The relatively inconspicuous Holothura (Platyperona) difficilis was found associated with thickets of dead Acropora hebes in the outer reef flat of Transect 3. In these areas, it is the most numerous holothurian, reaching estimated concentrations of over 75 individuals per 10 m². Precise counts were not possible at the time of the survey; however, these holothurians are quite interesting in that their distribution seemed very distinct.

This may indicate narrow habitat requirements for this organism.

Bohadschia bivittata and B. argus are present in moderate numbers in the sandy areas. These species are notable for their irritability and habit of releasing sticky cuvarian organs at the slightest disturbance. This has been known to cause annoyance to swimmers and waders. Actinopyga echinites and the large Holothuria (Microthele) nobilis are also present in moderate numbers.

Finally, one specimen each of Holothuria (Semperothuria) cinerascens and Holothuria (Thymiosycia) hilla were collected. Notably, no synaptids were seen; these are common on reefs elsewhere on Guam.

i. Other macroinvertebrates

A checklist of the other common macroinvertebrates can be found in Table 7, Appendix B.

j. Existing regulations

Pursuant to the Federal Water Pollution Control Act of 1972, the Guam Environmental Protection Agency has proposed a system of water quality regulatory procedures governing the protection of coastal waters. Under the proposed classification system, the area offshore of the project site is classified "AA". This classification is quite stringent, in that it does not permit any degradation or pollutant discharges in regions so designated.

Under existing rules, activities along the shoreline which would be likely to cause such degradation may be prohibited. This would specifically include effluent discharges of sewage or storm water runoff if these would result in a significant impact on coastal waters.

4. Archaeological and Historical

Lot 10080, particularly at lower elevations and on the terraces nearest the beach, is rich in archaeological remains and was apparently heavily populated in prehistoric times. This area has been investigated several times by professional archaeologists (Thompson, 1932; Osborne, 1947; Reed, 1952) during the last forty years, and there appears to be unanimous agreement regarding the value of the site and the importance of the artifacts located there (see Picture Nos. 9 through 12).

Most of the artifacts on the site are the remains of structures built by the ancestors of the Chamorro people, perhaps centuries before the arrival of Magellan in 1521. Included among these remains are a wide range of stone structures and smaller objects including at least twelve sets of latte stones in various stages of repair, several rock shelters, at least five wells, pottery fragments, stone and shell tools, mortars, and the skeletal remains of former inhabitants. Archaeological site survey records describing the findings of the Guam Survey Team of the Bernice P. Bishop Museum and other recent investigations are included as Appendix C.

Several factors combine to make the site of considerable interest and importance archaeologically:

- (1) The artifacts are present in large quantity and high concentration.
- (2) They have not been greatly disturbed by unskilled amateur archaeologists.
- (3) They have been studied by several professionals over a period of several decades, so that there is already a substantial beginning to the task of interpreting the information contained in the site.
- (4) The major artifacts, especially some of the latites and the well sites, are in restorable condition and, therefore, have added importance as one of the few areas where it would be possible to reconstruct most of the elements of prehistoric village life using original materials.

There is also evidence to indicate that the Uruno area was the site of an historic village occupied as recently as the first half of the 19th century. There are records (Coello, 1852, cited by Guam Inventory Team) showing a village called Falcona or Fasonan, in the area which was abandoned by 1852. Reinman (1974), in summarizing his opinion of one of the specific sites within the subject area, wrote as follows: "Finally, the extent of the midden and artifact materials, the presence of rock shelters and caves, and their interpretive

potential, all combine to make this an important site for the reconstruction of village habitation and settlement patterns on the island. Extensive excavations are recommended both for the restoration and the reconstruction of the early to historic village patterns."

We have reviewed available records, investigations and publications and, based on the information contained therein, it is our opinion that the Uruno area is one of the six most important archaeological sites on Guam.

The well-documented archaeological importance of the site has led to its inclusion on both the Guam and National Registers of Historic Places.

5. Liquid and Solid Waste

Because of the remoteness of the site from any nearby built-up areas, and the limited access to the beach area along the project site, the problems of man-made wastes, both liquid and solid, are for all practical purposes, non-existent. There are no habitable structures on the site at the present time. Visitors must either hike down the steep trail, or enter by walking along the shoreline or by boat. There is very little man-made "litter" along the shoreline or in the wooded areas.

Dried leaves and decomposing dead trees, which are natural to any jungle or wooded area, are very much in evidence. Storm runoff does not appear to be a significant problem from the standpoint of degrading the near shore waters because of

the high porosity of the limestone cap. There is evidence of seepage of fresh water along nearly the entire shoreline of the project site.

6. Air

Under normal conditions, air quality at the project site is good. Abnormal conditions may be found during heavy usage of Andersen Air Force Base runways by military aircraft, and particularly during early morning hours when smoke and exhaust fumes are being held close to the ground by temperature differentials. Possible air quality problems due to use of Northwest Field as an airfield are not being discussed here. The field is in use as an emergency landing area only, at this time, and information on its future, received from the U.S. Air Force, does not include reactivation of the field on a full time basis.

7. Surface Water and Groundwater

a. Surface water

Roughly one-half of the island of Guam, the northern half, consists of a limestone plateau. The limestone in the northern portion near the project site is of the Mariana and Barrigada Limestone varieties. In general, the surface of the limestone is highly permeable and results in rapid infiltration of rainwater falling on the ground surface. This explains the total absence of surface water courses in northern Guam, except in areas

where man-made development has taken place and, as a result, impermeable layers are covering the natural ground surface. In those areas, man-made channels are conducting the storm runoff to selected areas for infiltration.

b. Groundwater

Due to the absence of natural surface runoff patterns caused by rapid infiltration of rainwater, all freshwater in the northern half of Guam occurs as groundwater. After penetrating the limestone surface, it filters downward into the natural freshwater "reservoir" underlying most of northern Guam. The freshwater floats on the saltwater which saturates the limestone near sea level. The freshwater surface stands at approximately 1.5 meters to 1.8 meters above sea level near the center between the east and west coastline. For every foot above sea level, there exists 12 meters of freshwater below sea level. This is an approximation based on the difference in specific gravity of seawater and freshwater. Other factors are involved, and a zone of transition of varying thickness is known to exist between the top of the seawater and bottom of the freshwater lens. Near the shorelines, the freshwater lens disappears into the zone of transition, resulting in mostly brackish water up to 600 meters from the shorelines. The brackishness of the mixing zone is compounded by tidal action and consequent slow rise and fall of the shoreward portion of the lens.

The rainwater makes its way to the freshwater lens through limestone of varying buildup. Near the shoreline, the limestone structure is often quite open, porous and cavernous and so permits ready and rapid passage to near sea level. Springs (Tarague/Janum) found along the northern and eastern shorelines are the direct result of such wide open passage. Further inland, the limestone is of tighter structure with much of the cavities filled with silt and mud. This slows the rate of downward movement of the water and provides, in effect, hundreds of feet of sand filtration to the influent on its way to the lens.

The lens is the source of all the freshwater used in northern Guam. Water is recovered by drilling into the lens and pumping from it. The water is basically of good quality, with occasional high chloride (Cl_2) contents and the normally high hardness (calcium, magnesium) associated with waters filtering through limestone, resulting from the partial solution of the limestone.

On the project site, runoff (overflow) from the lens is visible on the sand beaches near the high water mark in many areas. The water, when tasted, is potable, although brackish. Reportedly, freshwater wells were dug between the beaches and the cliffs, providing water to the early settlers in the area. The wells are likely of

the skimming type, removing the shallow thickness of fresh-water floating on the saltwater so near the shore. It is not likely that any sustained draft of freshwater of considerable magnitude is obtainable for commercial purposes so near to the shoreline.

The producing wells nearest the project site are located at NCS Finegayan, Potts Junction, and Agafogumas, with the well closest to the shoreline approximately 2,100 meters inland.

8. Noise

Since the Lot 10080 site is currently uninhabited, man-made noise generated on-site is virtually non-existent. There are no man-made permanent stationary sources of noise emission on Lot 10080, and noise generated by occasional beach visitors and others is generally insignificant. Data on background sound levels are lacking but, based on site visits, it is clear that significant background noise levels exist as a result of wind action on vegetation. Under typical wind conditions, the sound generated by wind and vegetation is predominant over most of the site.

Wave action is typically an important contributor to ambient sound levels, although it is frequently masked by wind noises only a few hundred feet from shore.

The only human activities with a significant impact on ambient noise levels are aircraft operations. These are typically

of short duration and infrequent, due to restricted use of Northwest Field.

Ambient noise levels along the proposed access easement portion of Route 3 appear to be somewhat lower than on Lot 10080, though sound measurements are lacking. Noise generated by traffic along Route 3 has not been quantified, but would appear to be of minor consequence, since the military lands through which it passes are largely uninhabited. Existing sound levels do not appear to have any deleterious effects on current or proposed military operations.

9. Utilities Systems

Utilities discussed herein are water, sewerage, power and communications. At the present, no utilities are in existence on the project site. Water, power and telephone lines along the eastern boundary of the project site are owned and operated by the military commands.

10. Vehicular Traffic

The only roadway presently in the vicinity of the Uruno Development site is Route 3, a two-lane, paved highway serving the Air Force facilities at Northwest Field and the Navy facilities at Ritidian Point. Picture Nos. 7 and 8 show the existing highway facility. Most of the military activities at Northwest Field and Ritidian Point are passive type functions such as radar and microwave facilities and, therefore, do not generate a great deal of vehicular traffic. Consequently,

present traffic on Route 3 is very light, usually not exceeding 300 vehicles per day. A 48-hour traffic count at Potts Junction, furnished by the U.S. Air Force, is shown in Figure 10.

Portions of Route 3 north of Potts Junction approach the edge of a Class 7, 50,000 pound bomb blast clearance zone, and portions of Route 9 in the vicinity of the Agafo Gumas Wells encroach into a Class 7, 250,000 pound bomb blast clearance zone.

Because of electronic emissions, the transport of explosive devices on Route 3 north of Potts Junction is a hazard. Coordination with the U.S. Air Force must be made prior to transporting explosive devices on Route 3.

In discussions with the Planning Division of the Government of Guam Department of Public Works, it has been learned that there are no plans at this time, to improve either Routes 3 or 9. Present usage of these routes is light, and traffic forecasts indicate no significant increase in traffic volumes in the next 15 years.

11. Electronic Emissions

Adjacent to, and completely surrounding the proposed development site at Uruno Beach, is a complex of military installations consisting of the Northwest Field of Andersen Air Force Base and the Navy Communications Station (NCS) at Finegayan. At present, aircraft operations on Northwest Field are

practically non-existent, since air flight activity is handled at Andersen AFB with Northwest Field used only for an occasional emergency.

The Air Force satellite tracking facility on Northwest Field, and the adjacent NCS Finegayan, both operate highly sensitive radiowave and microwave communications equipment. Because of the highly sensitive nature of the equipment, and the proximity of the development site to these facilities, the Air Force and Navy have stipulated that no device can be used on the site which causes interference in the following frequency bands: 225-260 MHz, 399.5-401.5 MHz, 1227-1575 MHz, 2.2-2.3 GHz and 8-16 GHz. Interference is defined as follows:

- (1) For MHz frequency bands - man-made noise shall not exceed atmospheric noise measured at the receiving antenna during low noise periods.
- (2) For GHz frequency bands, maximum permissible power flux densities, to be calculated according to International Telecommunications Union Radio Regulations are:
 - a. 2.2-2.3 GHz = -154 dbW/m²
 - b. 8.025-11.7 GHz = -150 dbW/m²
 - c. 12.50-12.75 GHz = -148 dbW/m²
 - d. Antenna sensitivity = -172 dbm for all bands

The frequency bands indicated above are, for the most part, utilized 24 hours per day, 365 days per year. Details

regarding the military functions that require the use of these frequencies and the manner in which they are employed is largely classified information. Therefore, considerable reliance has necessarily been placed on the Air Force's own summary of the potential for interference from sources related to the proposed project (see Appendix D).

12. Socioeconomics

a. Employment

Civilian employment in Guam is dominated by the government sector. In the third quarter FY-1973, 25.5% of the total civilian employment in Guam was in Government of Guam jobs and 19.8% was in Federal Government jobs. This greatly exceeds the average proportion of both Federal and State government employment in other parts of the United States.

Conversely, the proportion of private sector employment in Guam is significantly below that in the rest of the United States for all economic categories except construction. The high percentage of employment in construction reflects increased building activity associated with the phenomenal economic expansion currently taking place in Guam.

Guam's tourist industry is another significant employer, comparing favorably with government and construction by directly employing more than 3000 persons in

March 1974. The tourist industry is probably indirectly responsible for many more jobs, as almost all businesses are favorably affected by tourism developments and tourist spending on the island.

The expanding economy of Guam, fueled largely by alien investments, has created a demand for additional workers in all employment sectors. However, the three largest employment sectors, namely, government, construction, and tourism, are responsible for most of the additional jobs.

The growth in the number of jobs has exceeded the supply of available skilled workers in Guam, thus necessitating the importation of workers from off-island. Most of these imported workers are non-resident aliens brought temporarily into Guam and used primarily in the construction industry. Others are U.S. citizens hired by the Government of Guam on a contractual basis and aliens that have recently migrated to Guam. In the fourth quarter of FY-73, these imported workers accounted for 39% of total civilian employment.

b. Tax Revenues

Government operating revenues give a good example of the expansion of economic activities on Guam. In FY 1964, Government of Guam operating revenues were only \$17.3 million. Since then, revenues have increased every year and reached \$86.0 million in FY-1973. This is a growth of 400 percent for that decade.

Guam is a separate tax jurisdiction from that of the United States. The Organic Act of 1950 provides that Guam income tax laws shall be the same as those of the U.S.; thus, personal and corporate income taxes provide a substantial source of income to the Government of Guam. Also, income taxes collected by the Federal Government from its employees and military personnel in Guam are remitted to the Government of Guam. Another major source of revenue is a 4% tax on gross receipts of all individuals and companies doing business or performing services in Guam. There are also a use tax, real property tax, social security tax, and other local taxes such as liquor, tobacco, gasoline, admissions, amusement, recreational facilities, and hotel occupancy.

c. Population

The population of Guam in the 1970 census was 84,996. This was a 26.8 percent increase over the 1960 population of 67,044. The Government of Guam estimates a population of over 100,000 today. Population is widely dispersed over the island; however, and there were 11 towns in 1970 with more than 1,000 population. The capitol of Agana had 2,119 people in 1970, but there were six towns with larger populations: Tamuning with 8,230; Mongmong with 5,052; Agana Heights with 3,156; Sinajana with 2,621; Agat with 2,612; and Dededo with 2,386.

Substantial increases in population have been noted in some districts, while others registered decreases.

This reflects a shift of local population toward areas with a higher level of economic activity, such as the Agana-Tumon Beach area in central Guam and Andersen Air Force Base on the northern end of the island. Accounting for population increases in some districts is the fact that alien laborers are housed in proximity to jobs.

d. Tourism

Guam's tourist industry, which was virtually non-existent before 1967, has become one of the leading growth industries. Pan American World Airways inaugurated direct flight service between Japan and Guam in 1967, and 3,400 tourists were accommodated that year. Since then, the tourist industry has grown to a point where it accommodated approximately 242,900 tourists in 1973.

About 75 percent of all visitors to Guam are from Japan, and a large portion of the Japanese visitors are honeymoon couples. The relatively low cost of a three- or four-day trip to Guam from Japan, the warm, sunny weather and clean sandy beaches, and the hotels and other facilities on Guam that cater to tourists make Guam particularly attractive to Japanese travelers.

Newly acquired affluence of the Japanese people, together with a relaxation of restrictions on travel and currency by the Japanese Government, have contributed to a dramatic increase in Japanese foreign travel in recent

years. Recent forecasts by Japan Airlines, McDonnell Douglas Corporation, and others in the travel industry, indicate that Japanese foreign travel is expected to continue to grow substantially during the next several years. It is reasonable to assume that Guam will continue to attract a significant number of these travelers for many years to come.

Guam, thus far, has not attracted substantial tourists from other areas. However, her status as a Duty Free Port with a \$200 allowance is making Guam increasingly popular as a natural stop-over point for travelers to the Orient. Tourist travel to Guam from the Trust Territory of the Pacific Islands is increasing but, at present, accounts for only about 5 percent of the visitors to Guam.

The increasing numbers of tourists have created a boom in construction of hotels and tourist-related facilities. The number of hotel rooms in Guam has grown from 267 in 1967 to over 2250 in 1973. Other tourist-related facilities such as restaurants, nightclubs, gift shops, tour and travel agencies have multiplied to serve the needs of the tourists.

Although Guam has recently experienced certain economic difficulties along with much of the rest of the world, it would appear that economic recovery, particularly in Japan, will see the continuation of the strong growth trends observed during the last decade.

III.

PROBABLE ENVIRONMENTAL IMPACTS

1. Aesthetics

A. Short-Term Impacts

During construction, considerable earth-moving and related construction activity will occur, all of which will tend to impair the visual impression of the site. This distortion will be increased by the presence and movement of large, highly-visible bulldozers, cranes and other heavy equipment. However, because of the currently low usage of the area, restricted access to key vantage points and the obscuring effect of vegetation, the aesthetic impact of construction will probably be minor.

B. Long-Term Impacts

Long-term aesthetic impacts will primarily result from the construction of numerous structures including, perhaps, several hotels, a number of private residences, recreation and support services buildings, roads, an aerial tramway, "swimming hole", marina, and perhaps other unidentified structures.

The aesthetic impact of these structures, individually and collectively, will depend to a major extent upon both their architecture and their precise location, vis-a-vis major features of the topography and the terrain, as modified by existing vegetation.

In the absence of specific information concerning precise locations and design of structures, any comments concerning

their ultimate aesthetic impact must, necessarily, be fairly general. However, several factors stand out as of major importance in determining the degree to which the current undisturbed character of the site is altered:

- (1) Building height and location. Taller buildings near the cliff face will have less impact than buildings of the same height nearer the shore.
- (2) Architecture conforming to existing land forms will obviously be less obtrusive than rigidly rectilinear designs.
- (3) Color schemes which blend in with natural vegetation and exposed rock formations will reduce visual impact.
- (4) To the extent that natural vegetation is left intact, and structures are kept lower in height than the tops of the forest canopy, visual impacts will be minimized.

Proposed development plans call for extensive "environmental cleanup" which probably would consist primarily of clearing out portions of the dense undergrowth which currently limits viewsheds of a ground-based observer over much of the project site. This will have the effect of opening up considerably greater expanses of area to view. This could have both positive and negative aesthetic consequences, depending on location, and clearing practices, and the nature of the views thus created, particularly when the proposed man-made structures have been completed.

Additional aesthetic impacts may be expected from increased human usage, including increased noise from vehicular traffic, the possibility of occasional odors from garbage and wastewater treatment activities, the possibility of uncontrolled erosion in areas of cut or fill, and the negative aesthetic effects of litter in public areas, especially along roadways and on the beaches. A certain amount of degradation of reef areas can be expected from skin divers, bathers, and others who may remove fish, corals and shells as souvenirs, or simply as a form of vandalism.

However, the overall aesthetic impact of these "non-structural" factors will largely be a function of the design and management of the facility, and need not be severe.

C. Mitigating Measures

Careful attention should be given to the siting of structures, along with special care to preserve existing viewsheds. Alterations in land form, either through earth moving, or by the construction of tall buildings, should be minimized.

Architecture and color of structures should be designed to harmonize with the existing landscape.

The clearing of canopy vegetation and undergrowth should be carefully evaluated with respect to its effect on the overall visual impression of the site. While creation of some extended vistas may be desirable, excessive clearing may have decided negative aesthetic effects, not to mention negative effects on wildlife and the plant communities themselves.

2. Terrestrial Biology

A. Flora

Construction of roadways, utility lines, treatment plants and buildings will result in destruction of plants and trees. As noted in section H.B.2., no endangered species were found in a botanical reconnaissance of the area recently, but several rare species were encountered. The "Urano Code", part of the Master Plan, mentions that regulations governing the "destruction or moving of vegetation" will be included in the protective code to be adopted.

B. Fauna

Along with clearing operations and construction of facilities mentioned above, habitats and nests of animals and birds will be disturbed or destroyed. The Guam Department of Agriculture has advised that there are no known rare or endangered species of wildlife in the area. As for the flora, the "Urano Code" mentions, under the Basic Plan for Environmental Preservation and Protection, the need to protect animal life existing on the project site.

3. Marine Environment

Development of Lot 10080 will greatly improve access to beach and reef areas, and will appreciably increase the use of these areas by residents and tourists alike. Impacts resulting from this use may include:

- o Major construction impacts due to marina and swimming hole construction.

- o Effects on reef community due to effluent discharge.
- o Minor to significant damage from overfishing; vandalism; shell, and coral collection.

A. Construction

Construction activities, especially for the marina, swimming holes, and possible sewer outfall, could have significant effects on the reef community. Construction will effectively destroy that part of the reef where construction takes place. Construction activities would have a short-term negative impact on adjacent areas due to increased siltation. Silt can adversely affect corals, as well as a number of other invertebrates, and some fishes.

The area affected by potential construction is not large compared to the overall area of the site, although relatively undisturbed reef areas are an important, limited, and non-renewable resource on Guam. Because plans for construction are not well defined at present, there is insufficient information available to define probable construction impacts more explicitly.

B. Effluent Discharge

If treated sewage effluent is discharged into shallow coastal waters, some effect on the biota can be expected. The magnitude of the effect will depend upon the nature and quantity of the effluent, the location and the depth of the outfall, particularly as these factors affect the dilution and dispersion of effluent in the vicinity of the reef.

In the case of "tertiary" treated effluent as proposed by the developer, the major potential effect on reef communities is the stimulation of growth among primary producers, including both phytoplankton and attached macroscopic algae. Treated sewage effluent represents an ideal nutrient source for algae, and growth rates in relatively sterile tropical waters typically exhibit a strong and rapid response to an increased supply of available nutrients in the vicinity of a new outfall.

The magnitude of this effect is a direct function of the concentration of nutrients in the area under study. If dilution is high and currents carry the effluent generally away from shore, the effect can be minimal. If dilution is inadequate, or if the effluent is for any reason carried shoreward, the stimulatory effects of the added nutrients can be quite severe. Existing current data are inadequate to predict the effects, if any, of such an effluent discharge.

Increased algal growth can affect the reef community in several ways. Attached algae can adversely affect the growth of corals by physically interfering with feeding and by reducing light available to the symbiotic algae upon which many corals depend for an important part of their energy requirements.

The increased quantity of plant materials available may stimulate population increases among herbivores. The change would, most likely, be highly stimulatory to only a few species, and substantial local imbalances in population of the reef community could result.

Growth of thick algal or "seaweed" mats in intertidal and beach areas can cause aesthetic problems, both because of the visual effect and because of the odors caused by the decomposition of the material. Any of the effects mentioned above are probably inconsistent with existing regulations governing Class "AA" waters and would be prohibited.

C. Increased Human Use^e of the Area

Increased utilization of the beach and reef areas by residents and tourists could have a significant impact on certain components of the reef community, especially those species with aesthetic, food, or other commercial value. Beach users can be expected to fish, collect shells, and commit minor acts of vandalism. Since many desirable shells and corals are present in small numbers and require a fairly long time to become re-established, overcollection can rapidly deplete existing stocks. Such depletion has biological and scientific, as well as aesthetic, consequences. Imbalances caused by overcollection can require many years to correct, and can have a serious effect on populations of plants and animals that remain. The value of an area for scientific study can be quickly destroyed in this way, as can its desirability from an aesthetic standpoint. The proposed development can be expected to result in some degradation of the reef community, as outlined above, although the magnitude of the effect will depend upon many factors, including posted and enforced

rules regarding collection; volume of tourist and resident traffic; available facilities; background, interests, and preferences of visitors, and so on.

D. Mitigating Measures

- (1) If swimming holes must be dredged, they should be located in the deeper moat areas of the inner reef flat, within 30 to 40 meters from shore. Although the dye studies on the inner reef of the southern side of Uruno Point show greater water movement, these swimming holes should be situated on this more protected side. When the exact locations of the swimming holes are pinpointed, further dye studies should be carried out at each side.
- (2) It is not feasible to construct a marina on the reef flat. The construction of an inland marina, connected by a channel through the reef flat, is the better alternative. This, again, should be located south of Uruno Point as tentatively planned.
- (3) Based on the limited offshore current studies, the most suitable location to release the sewage effluent seems to be directly off Uruno Point. It is recommended that the effluent be released through multiple diffusers on the reef slope, which lies in about 60 feet of water. Engineering studies will, no doubt, cite this depth as too excessive if the sewerage is to be secondarily treated. However, a safety measure must be included in case the

treatment plant malfunctions, thus bypassing raw sewage into the nearshore waters. Further drogue studies must be carried out over the reef slope directly off Uruno Point at different times of the year.

- (4) Rigorous control over exploitation of reef resources, e.g., fishes, lobsters, and shells, must be established to preserve the natural environment, since easy access to this once relatively inaccessible area will be provided if this resort development becomes a reality.
- (5) In order to make intelligent decisions regarding the protection of the reef area, more detailed information is required. The recommendations contained herein are based on a one-month field investigation, in which it was impossible to consider seasonal variations in biological populations, and variable current patterns during a yearly cycle.

It is, therefore, recommended that a one-year monitoring program be conducted to provide basic biological and physical data necessary to verify the tentative conclusions reached by Dickinson and Tsuda (April 1975).

This would permit decisions regarding the development to be made on a much more solid basis than is now the case.

4. Archaeological/Historical

A. General

The development plans put forth by Seibu specifically call for the protection of archaeological remains, both through

preservation of major (i.e. latte and well) structures and through the establishment of an on-site museum to house artifacts. Because development of the project site is not scheduled to begin perhaps for several years, it should be possible for the developers to carry out a planned program of construction without any serious adverse effect on the archaeological record.

There are, at present, no specific plans for structures or other improvements on the site that are tied to a surveyed location on the ground.

Consequently, the proposed development poses little direct hazard to those artifacts which have been identified to date. The main hazard is to those artifacts currently unidentified which may be located throughout the subject property, in places currently unknown. The abundance of known archaeologic remains strongly suggests that there may be abundant archaeologic resources buried throughout the site which might be severely impacted during earth-moving and other construction activities.

During such earth-moving operations, fragile remains (probably including skeletal elements) would be either immediately destroyed, or significantly changed in position. Since the position in which archaeologic remains are found is of such great importance in interpreting the significance of the objects themselves, changes in relative position can be nearly as significant an impact as physical destruction of the objects.

During construction, on-site personnel and the general public will frequent the site more than they do at present. Exposure of the surveyed sites in this public disclosure document will focus the attention of some who may attempt to remove remains from the site before or during any construction activity. Such vandalism by the public or construction personnel would constitute a significant adverse impact. Selective removal of the more attractive remains may be as significant as their disturbance during construction and excavation. Archaeologic remains without specific record of their occurrence and association quickly lose scientific value.

Once construction activity diminishes (i.e., during operation), the general public and residents of the area will have generally free or minimally-controlled access to the area. Again, the public awareness of the sites on the subject property will encourage uncontrolled exploration of, and removal from, the identified sites and others which are probably located in the vicinity. Adverse impacts from this awareness and access can be attributed to the project.

Since the successful implementation of the proposed development plan will, undoubtedly, give rise to secondary growth and development on other non-military lands in the northern part of the island, there may be expected some secondary effects on archaeologic remains at sites far removed from Uruno Beach. These effects may secondarily and in part be attributed to the subject project.

B. Mitigating Measures

Preservation of existing archaeologic resources will require close cooperation between the developer and local governmental agencies. Appropriate officials of the Government of Guam Department of Commerce should be notified far in advance of proposed construction, and should be given time and access for observations, documentation and salvage operations.

In areas where known surface remains may entice uncontrolled removal, such remains should be collected by qualified archaeologists for preservation in an appropriate institution. If the site may be subject to vandalism or uncontrolled excavation, a layer of clear fill (at least a foot deep) may be placed over the surface of the site with a suitable marker layer, adequate location information, and photos of the site by the qualified archaeologist.

Numerous methods can be employed to restrict public access before and after construction. Construction personnel should be instructed not to remove archaeologic remains from the area and should notify an archaeologist whenever remains are encountered.

Provision should be made to have a qualified archaeologist on call during periods of major excavation, with authority to halt earthmoving and/or construction activity if archaeologic remains are encountered.

It is recommended that an additional detailed survey of the area be conducted by the developer and/or agency prior to the planned area development.

The current designation of the area as a registered historic place on the Guam and National Registers should be viewed as a mitigating measure, since it does provide some protection to the site. The impact assessment reporting requirements and the Government of Guam's right of condemnation under Public Law 12-216 each confer a measure of protection, although close cooperation between the developer and government are mandatory if the integrity of archaeologic remains is to be maintained.

Also, the fact that construction is not scheduled to begin for several years is a mitigating fact in and of itself, since it permits the detailed consideration of alternative plans which is essential to formulating the best possible approach. This detailed investigation should be built into the planning process.

The construction of an on-site museum would appear to be a positive step in preserving the archaeologic record, although this is no substitute for detailed on-site work by professional archaeologists. Any such museum collection should be accompanied by the careful and technically well-supervised on-site reconstruction of existing latte, well, stone habitation, and other large structural features. The reconstruction should be on the original sites, if possible, use existing original materials, and be integrated as a part of an interpretive program to inform the interested public about the features of prehistoric, as well as more recent, Chamorro village life.

5. Liquid and Solid Wastes

A. Liquid Wastes

The Master Plan for the project provides for collection of sewage; conveyance by gravity sewers, pumping stations and force mains; "tertiary" treatment; ocean outfall disposal of effluent. Details of the wastewater treatment facility and effluent outfall are not included in the Master Plan, except that the treatment plant design will produce an effluent of 10 ppm B.O.D. and 20 ppm suspended solids. It is assumed that the effluent will be chlorinated. Extent of the "tertiary" treatment is not indicated, and it is, therefore, difficult to assess the impact of the effluent on the receiving marine environment. However, studies of possible impact of modified primary effluent in other locations along the west coast of Guam, and study of actual impact of the raw sewage outfall in Agana, indicate that minor impact on the marine environment could be expected from the effluent of a tertiary treatment plant; that is, provided that ocean current conditions are favorable and outfall length, depth of discharge and design of the diffuser system will provide maximum dilution with sea water of the treated effluent. Current studies undertaken previously off the west coast of Guam show an offshore current in a generally southwesterly direction. Nearshore currents were found to be running in opposite directions at times, likely as part of an eddy effect and/or tidal changes. Generally, the currents

were parallel to the shore, or offshore, except at times of high wave action, when surface water transport over the reef had the effect of an onshore current.

An additional impact is provided by the need to dispose of the sludge from the wastewater treatment process. The Master Plan includes a sludge dewatering process and sludge incineration on-site, which is assumed to be combined with solid waste incineration. In addition to the space and energy needed for the incinerator facility, there will be an impact on the air quality to a degree, depending on the design of the incinerator. The residue from the sludge incineration will have to be disposed of off-site in a sanitary landfill.

B. Solid Wastes

Although not specifically addressed in the Master Plan, it is implied that solid waste will be collected and the volume reduced by incineration on-site, followed by disposal off-site, of the residue. The impacts of such actions would include the space and energy required for the incinerator and the production of residue, gas, and process water. The advantage is a drastic reduction in volume and a residue free of degradable material, ready for nuisance-free disposal in a landfill.

6. Air

Short-term probable impact from the proposed action would be the creation of construction dust during clearing, grading and trenching operations, and the emission of exhaust from construction

equipment. Dust during the construction phase can be controlled by watering down areas under construction.

Long-term probable impact from the proposed action may include the emission of waste gas and entrained particulate matter from the incinerator and creation of dust in the incinerator dumping area. An odor problem may also arise in the storage area. A properly designed, operated and maintained incinerator may minimize these impacts by scrubbing, filtering, or otherwise cleaning the effluent gas prior to emission from the stack.

Another long-term impact is the introduction of motor vehicles to the project site and the emission of exhaust gas from these vehicles.

7. Surface Water and Groundwater

A. Surface Water

The proposed development, as set forth in the "Master Plan, Uruno Beach, Guam, for SLQ, Inc. and Seibu Urban Development Corporation" includes grading, paved roadways and buildings, all of which will change the present surface conditions. As outlined in Section II.B.7.a., channelized runoff is non-existent under natural conditions as rainfall penetrates rapidly into the ground through permeable limestone. The following impact on the surface water is envisioned as a result of the planned development.

(1) Graded Areas, Paved, Without Topsoil

Initially, permeability will be enhanced by removal of silty surface layers. It is expected that this

condition will quickly reverse as silt from nearby construction runoff will be deposited on these surfaces during the infiltration process, thereby approximating, in time, natural conditions. It is possible that increased runoff of silt-laden storm waters may increase the "tightness" of the surface layers and thereby decrease permeability. The "Uruno Code", an environmental protection code discussed as part of the Master Plan, recognizes the need for regulations concerning "earth moving" and "destruction or moving of vegetation". Put into effect, the resulting erosion control measures would likely reduce the transport of silt.

(2) Graded Areas, Paved or With Topsoil

The effect of paving or topsoiling is to seal completely (paving), or partially (topsoil), the surface of the limestone. This would prevent rainwater from infiltrating and create storm water runoff which would then have to be channeled to other permeable areas for disposition. The location and intensity of natural infiltration would thereby be changed. The Master Plan provides for lined ditch(es) along the access road and collection and conveyance of runoff to a "pond" or "collection reservoir" for possible emergency back-up water supply. In this case, the majority of such runoff would be lost as source of groundwater lens recharge. The planned pond

could be used as a silting basin and holding basin for irrigation water, or as an infiltration basin which would return the runoff water to the ground.

- (3) Depending on the magnitude of grading and paving and conveying and collecting systems, runoff waters may reach the nearshore (reef) waters and contribute to the pollution of those waters by silt and other contaminants.

B. Groundwater

The events outlined in Section III.7.A. directly impact on the groundwater, in that the location and intensity of infiltration would be changed. In addition, the introduction of contaminants must be considered likely. None of this may be of critical importance if one considers that the fresh water lens so near the shoreline is unproductive. In a way, concentrated recharge of the lens near the shoreline may be of value (Mink) in that the gradient of the fresh groundwater towards the sea may be lessened, thus reducing loss to the sea and buildup of usable fresh water inland.

A further impact on the groundwater would be the demand for domestic water supply by the development. This supply would have to come from the groundwater, and since it cannot be developed on-site due to nearness to the shoreline, it would have to be supplied by well(s) located off-site and conveyed to the site by pipelines. The average daily demand of 1.67 mgd from the Master Plan can be developed from the lens by drilling

and developing of extra wells, according to discussions held with the Public Utility Agency of Guam and Singer-Layne in March 1975.

8. Noise

A. Construction

Construction noises would include a considerable contribution from earth-moving equipment. Since a considerable amount of blasting could be required, this could represent a significant periodic contribution to background levels. Since the area is currently uninhabited, the impacts of construction noise during the first increment should be insignificant. However, on-going construction in later phases may result in negative impacts on inhabitants of Phase I facilities. In view of typical high ambient wind noise levels observed in the area, as well as the effects of topography on sound transmission, construction noises are not expected to be of major consequence. More refined estimates would require a program of on-site sound measurements to establish background levels, as well as more detailed information on construction techniques and proposed building locations.

B. Operation

Although the proposed resort is not expected to be a major source of noise generation, there will undoubtedly be an increase in sound levels as a result of vehicular traffic, and the typical sounds of outdoor recreational activity. Except in

the sense that such sounds will be introduced to an area which is presently almost completely unaffected by human influences, noise is not expected to be an area of major impact.

9. Utilities Systems

A. Water System

The impact of the development on the water source has been discussed in Section III.7.B. Additional impact is due to the transmission pipelines needed to convey the water to the site. On-site, two aboveground storage tanks have been included in the Master Plan to provide peak and fire flow backup. Also, on-site, a distribution system is required to convey the water to the areas of development and use. Pipelines will be placed underground. Ground surface space above them is available for limited use, other than structures. The aboveground reservoirs will require site grading, use of space and visual impact. A variety of designs are available for aboveground tanks and many provide a pleasing visual appearance.

B. Sewerage System

Impact of the liquid waste has been discussed in Section II.5.a. In addition, the following facilities will generate impact on the area:

- (1) Collection system, made up of underground gravity line, above- and below-ground pumping stations, underground force mains, two aboveground tertiary wastewater treatment plants, two ocean outfalls

across the reef flat into minimum of -60 feet of water (by Guam law), and a diffusion system.

- (2) Septic tank and leaching field for a first phase hotel.

Gravity lines and force mains will be underground, except for manholes which extend to the surface. Ground space above the lines is usable except for structures. The wastewater treatment plant will have a combination of aboveground and partially buried structures. Grading of the terrain will be necessary to accomplish this. It is possible to design the treatment plant structures to provide architectural features to blend in with surrounding areas. The effluent outfall line will be buried across the reef flat and likely will be buried below the bottom to a water depth of -50 feet, approximately. The rest of the line in the area of the diffusers will likely be above the bottom of the sea on pedestals.

C. Power

According to discussions held in March 1975 with the Guam Power Authority, a new transmission line will have to be built along Route 3 from Marine Drive to serve the project. In addition an on-site substation and underground power distribution systems and transformers will be required. The impact will include use of energy, trenching for duct lines, grading for substation, additional aboveground power line along Route 3. Duct lines can be placed under roadways or sidewalks, and

are not visible except for handholes and vaults which extend to the ground surface.

D. Communications

According to discussions held in March 1975 with the Guam Telephone Authority, new telephone duct lines would have to be provided for this size of project along Route 3 from Marine Drive. Ductlines, handholes, and vaults would be required on-site, which could be placed under roads and sidewalks. Therefore, only the tops of handholes and vaults would be visible. The Guam Telephone Authority would also require a central office on-site. Cable TV ducts could be placed together with the telephone cables. The Master Plan envisions elimination of individual TV antennas for buildings.

10. Vehicular Traffic

Development of the Uruno Beach site, as proposed by Seibu Leisure, will, of necessity, create impacts on traffic patterns and densities in northwestern Guam. Since traffic impacts will be somewhat different during the construction (short term) and operational (long term) phases of the project, they will be discussed separately here.

A. Short-Term Impacts

During the construction phase of the project, traffic generated will be of two types; namely: (1) vehicles used by the construction workers to commute daily to the site, and (2) large, heavy trucks used to deliver construction equipment and

materials to the site. A detailed construction schedule has not yet been finalized by Seibu Leisure, and without such a schedule, it is impossible here to estimate with any accuracy the number of workers that will be commuting daily to the site or the frequency of delivery of equipment and supplies. It is easily conceivable, however, that during peak periods of construction activity, there could be as many as several hundred workers commuting daily to the site. Also, during these peak construction periods, there could be frequent delivery of materials and supplies. Therefore, it is possible to speculate that there may be as many as 300 to 500 vehicular trips per day to the Uruno Beach development site during the construction phase of the project.

B. Long-Term Impacts

Seibu Leisure estimates that when Uruno Beach is fully developed and operational, there will be a total population of approximately 10,500 people on the site. This on-site population will be composed of several groups of people, each with its own travel characteristics, as described below:

1. Transient Hotel Guests

Assuming two persons per room yields 5,000 total guests, with an average four-day visit, gives a 1,250 daily turnover (1,250 arrivals and 1,250 departures). Arriving and departing transient guests would be transported by tour buses at a capacity of 50 passengers each, requiring 25 buses entering and 25

leaving for the daily turnover. If one-half the total guests (2,500 people) take island sightseeing and/or shopping tours each day, that would account for 100 bus trips per day (50 entering and 50 leaving).

2. Permanent Residents

Many of these residents will be retired or long-term vacationers, whose daily needs will be served to a large extent by on-site facilities. Thus, travel by this group would be relatively light.

3. Employees

With approximately 3,000 total employees (see Section III.12), shift changes would occur three times daily, with approximately 1,000 people moving in each direction. If individual autos are used by employees for commuting, then 900 to 1,000 autos would be arriving at the site, with an equal number departing the site during shift change periods.

4. Casual Daily Visitors

Island residents who visit the site to utilize its many and varied facilities.

5. Service and Delivery

A variety of service and delivery vehicles would be required to service the daily needs of the Uruno Development.

Given a remote resort community with a population composition as described above, it is possible to speculate the following daily vehicular traffic volumes:

	<u>Transportation Mode</u>	<u>Daily Round-Trips</u>
Transient (Tourist)	Bus	150
Permanent Residents	Auto	200
Employees	Auto	3,000
Local Visitors	Auto	600
Service	Trucks/Vans	<u>50</u>
Total Daily Round-Trips		4,000

It is obvious that peak hour traffic will be determined by the employee shift changes, with the highest traffic volumes probably coinciding with the afternoon shift change, when one-direction traffic could be as high as 1,000 to 1,200 vehicles during peak hour. The Highway Research Board has determined maximum one-direction traffic capacity of a two lane rural road to be 1,400 to 1,700 vehicles per hour. Estimated traffic generated by the Uruno Development, while well within the capacity of a two lane road such as Route 3 is, however, quite high. Several means of reducing this traffic volume will be discussed in Section III.10.C. of this report.

C. Mitigating Measures

(1) Short-Term Phase

The most obvious means of reducing the volume of traffic during the construction period would be by bussing the workers to and from the site daily, thereby eliminating the need for a large volume of individual auto traffic. If bussing is not feasible or acceptable for

any reason, then every effort should be made to induce carpooling among the workers. This, while not eliminating the need for autos, would significantly reduce the required number.

Also, during construction, efforts should be made to coordinate the ordering and delivery of materials and supplies. This would lead to the more effective utilization of delivery vehicles, thus reducing the total number of delivery trips to the site.

(2) Long-Term Phase

Since employees commuting to and from the site generate the heaviest traffic volumes, carpooling would be very effective in reducing total number of vehicles. Staggered working hours would also be beneficial in reducing peak traffic volumes associated with employee shift changes. If Guam's proposed mass transit system provides service to the Uruno site, it could effectively reduce traffic by attracting not only employees, but permanent residents and casual visitors as well. Public transportation service, if approved by the Air Force, could be made even more attractive by charging an auto parking fee at the Uruno site. Tour buses and service vehicles, for their own convenience, will probably elect to operate during light traffic periods and have little effect on peak period traffic.

While the potential exists for high volumes of traffic to and from the Uruno site, it is felt that the application of some or all of the above discussed mitigation measures will serve to keep traffic volume at a minimum and acceptable level.

11. Electronic Emissions

A. Planning and Design

Planning and design of facilities and equipment to be used, installed, or constructed at the Uruno resort development site is, at present, in the very preliminary stages. Thus, there is not yet available any definitive and usable information on which to base a detailed estimate of electromagnetic noise emissions from the developed site.

No doubt, some electromagnetic interference and background noise will be generated by the planned activities at Uruno Beach. However, proper application of, and strict adherence to, mitigation measures discussed in Section III.11.B. of this report can effectively maintain electromagnetic noise and interference within acceptable level. This conclusion is confirmed by the Air Force in a letter dated 24 July 1975 (see page 2 of Appendix D). Specifically, the Air Force does not expect traffic along Route 3 to impact their operations, regardless of traffic volume. The only exception noted involves a potential hazard during construction when the contractor is transporting explosive devices to the construction site; it is recommended that coordination with the Air Force take place prior to transport.

Similarly, it is not expected that existing electromagnetic emissions pose a significant hazard to personnel. Power densities may, under rare circumstances, reach $16\text{MW}/\text{cm}^2$ at a height of 8 feet above the road surface at the point of nearest approach; maximum exposure should not exceed 60 seconds. This situation is not considered particularly hazardous to personnel traffic on the road.

B. Mitigating Measures

Since electromagnetic emissions and background noise from Uruno Beach could have negative impacts on the operation of the Air Force Satellite Tracking Facility at Northwest Field, mitigating measures must be employed to prevent the occurrence of these negative impacts. Mitigating measures that would be effective toward this end are as follows:

- (1) Closely coordinate with the satellite tracking facility to determine and eliminate machinery, equipment and facilities that would be incompatible with the Air Force mission.
- (2) All electromagnetic emission sources that cannot be eliminated must be properly shielded, encased, or housed to absorb or dissipate any detrimental emissions.
- (3) All electrical, telephone, and telegraph equipment should be properly shielded and all transmission lines should be underground.
- (4) Periodic inspections, coordinated with the satellite tracking facility, should be conducted to insure that

All emissions, both individually and cumulatively, are within acceptable Air Force standards, as defined in Appendix D.

Continuing close cooperation with the Air Force and stringent adherence to the above measures will lead to the prevention of any adverse impacts on the military mission arising from the Uruno Beach Development Project.

12. Socioeconomic Impacts

A. Employment

A major economic impact of the construction and operation of the proposed Uruno Development Project will be the creation of employment opportunities both during the construction (short-term) and operation (long-term) phases. This section contains estimates of the magnitude of each of these impacts.

(1) Construction Employment

At present, Seibu Leisure has not completed the details of the construction schedule for the Uruno Beach Project and, therefore, cannot give an accurate estimate of employment levels during the various increments of construction. Seibu Leisure, however, plans a capital investment at Uruno Beach of approximately \$51.5 million. For development projects of this nature on Guam, the labor costs usually run 35 to 40 percent of the total capital investment. Using these percentages and assuming an annual average salary \$12,000 gives an estimate of 1,500

to 1,700 man/years of labor for this project. If, for instance, construction is scheduled for an eight year period, this gives an average of approximately 200 jobs a year for the full eight years. Probably, a steady employment level for the duration of the development phase is unrealistic. More likely, a series of peaks and valleys will occur in employment levels as the various increments of development are initiated.

(2) Permanent Employment

Seibu Leisure's Master Plan calls for the construction of 6 hotels with a total of 2,500 rooms at the Uruno Development site. The existing hotel industry on Guam had, in early 1974, a total of 2,253 hotel rooms and a total of 1,560 employees, for an average of .70 employees per hotel room. Assuming this same ratio for the Uruno Development gives an estimated permanent hotel staff of 1,750 people. In addition to hotel staff, there will probably be several hundred new jobs created in related activities such as: tourist shops, taxi and tour operations, travel agencies, etc.

Along with the hotels and tourist facilities to be constructed at the Uruno site, Seibu Leisure also plans to construct apartments and single family dwelling units for permanent residents. Community service and shopping facilities to serve the permanent residents will account for numerous additional jobs.

Thus, it is easily conceivable that the Uruno Development could contribute as many as 3,000 new permanent jobs.

B. Tax Revenues

The Uruno Development will provide substantial tax revenues to the Government of Guam, in the form of income taxes, real property taxes, sales taxes, and room occupancy taxes. The magnitude of tax revenues generated by the Uruno Development can be illustrated by estimating room occupancy taxes. With 2,500 rooms available and assuming an occupancy rate of 75%, and an average daily room charge of \$25.00, annual room occupancy taxes come to approximately \$1.7 million. This is more room occupancy taxes than were collected in the four years 1970 through 1973. Total room occupancy taxes for that four-year period were \$1.5 million.

C. Population

The population of Guam is growing quite rapidly, and is a very young population. It is estimated that almost one-half of the population is still in school. This means that substantial numbers of the population will be entering the labor force and seeking jobs during the next decade. The Uruno Development will, no doubt, provide many of these jobs.

Nearby areas such as Dededo are experiencing much residential construction activity and very high population growth rates. Thus, new employment opportunities and other economic activities created by the Uruno Development could accelerate the growth and further development of communities in the area.

D. Tourism

In recent years, tourism on Guam has developed and become a significant segment of Guam's total economy. Therefore, the Government of Guam is interested in promoting and maintaining a viable tourist industry that will enhance the attractiveness of Guam as a tourist destination area.

The Uruno Beach Development will have some important impacts on Guam's tourist industry. One of the main impacts will be the greatly increased capacity of the tourist industry. The Uruno Development, as planned, will add 2,500 hotel rooms, thus doubling the present number of hotel rooms. With this large increase in hotel capacity, increasingly larger numbers of tourists can be accommodated.

Another major impact will arise because of the remote location of the Uruno Development site. At present, almost all of Guam's hotels and related tourist facilities are concentrated on Tumon Beach near the capitol city of Agana. The remoteness, tranquility, and uncluttered scenic beauty of the Uruno Development will provide a much needed and welcome alternative to the more crowded and faster-paced Tumon Beach area. The pleasant surroundings at Uruno may also be conducive to a longer stay on Guam by many vacationers.

E. Mitigating Measures

The socioeconomic impacts arising from the proposed development of Uruno Beach will be positive and beneficial to

Guam and her people. The development will provide new jobs, new tax revenues, and new economic opportunities.

The only mitigating measures that can be suggested here are concerned with the timing of the various increments of development. The time schedule for the construction and completion of each increment should be carefully coordinated with the rate of growth of Guam's labor force and tourists. This will provide for the most efficient use of the labor force and, at the same time, insure the introduction of additional hotel rooms and facilities as they are needed to accommodate the increasing volume of tourists.

F. Growth Inducement

It is conceivable that the proposed project may have an impact on the rate of population growth on Guam, or at least some detectable effect on the distribution of population in the northern part of the island.

Aside from the obvious dramatic effect on the population of Lot 10080 as described elsewhere, the proposed project may well stimulate off-site development in the northern district as a response to the economic opportunities it provides. There will be some increase in demand for housing, retail goods and services, recreational facilities and so on, and at least a portion of this demand will fall on off-site, non-military population centers in the northern parts of the island, particularly Dededo.

Although by and large the project is designed to accommodate already expected growth in tourism, it is, nevertheless, certain that the existence of the proposed facilities will contribute, directly and indirectly, to this growth. The resort complex will undoubtedly be heavily advertised abroad, particularly in Japan, and this increased exposure for Guam will certainly result in an increase in overall tourist traffic.

The existence of new jobs at the site, both during construction and later in the operational phase, will represent a significant new economic resource for the island. Such employment opportunities tend to improve the general economic climate to some degree. A stronger regional economy will tend to reduce out-migration, as well as to attract new residents. Thus, the overall effect of the proposed project should be to contribute slightly to the growth of the northern district's population, and perhaps of Guam as a whole. These potential effects, though minor, should be evaluated in relation to the communities' immediate and long-range goals regarding the desirability of growth per se, as well as with regard to the ultimate consequences of significant shifts in the distribution of population on the island.

IV.

ADVERSE IMPACT

1. Aesthetics

While most of the specific aesthetic impacts mentioned above can be avoided or minimized by giving proper attention to design and construction, it will probably be impossible to preserve the current overall visual impression of an essentially virgin, unaltered natural environment. Even though the project may be carried out with scrupulous attention to the preservation of aesthetic values, it is nevertheless virtually certain that the area will be clearly identifiable as an area of human habitation as opposed to unspoiled wilderness. The increased human activity will certainly be visible, and will bring with it an unavoidable alteration in the overall character of the site, no matter how tastefully the project is executed.

2. Terrestrial Biology

Adverse environmental effects such as disturbance and destruction of natural growth of plants and trees, and of wildlife habitats, must be considered an adverse environmental effect due to the proposed action. Mitigating measures may be introduced by way of the protective code, which should lessen the amount of damage.

3. Marine Environment

The major potential impacts on the marine environment, as identified in prior sections were:

- o Some degree of siltation during the construction phase.
- o Destruction of that portion of the reef used for swimming hole construction.

- o An undesirable increase in nutrient concentrations due to treated effluent discharge.

Of these major areas of potential impact, all are susceptible to mitigation at least to some degree. It is likely, however, that the planned development will have at least some adverse and unavoidable effects in each of the areas indicated above, although available practical mitigation measures should be able to reduce these impacts to minor and perhaps insignificant levels.

Proper timing of construction in the dry season, coupled with good construction practices, could greatly reduce the potential for siltation of reef areas from terrestrial runoff. Similarly, conservative grading and re-planting practices could reduce erosion and the potential for siltation from storm water runoff. The size, location, and design of swimming areas has not been firmly established in existing plans; thus, these areas could be designed and located so that adverse effects were largely avoided. Appropriate safeguards and restrictions regarding vandalism and collection of sealife, as discussed under Mitigating Measures, could similarly reduce this adverse impact to an insignificant level. One alternative under consideration is to pump sewage generated at the site into the Northern District Sewerage system; if employed, effluent discharge to the reef areas adjacent to the project site could be virtually eliminated. In summary, adverse and unavoidable effects of the project need not be significant, assuming that appropriate mitigating measures are employed.

4. Archeological/Historical

Some currently unknown archaeological sites will probably be disrupted, although effects on known sites should be minimal. Increased access to the area will result in an increased threat to the site from vandalism and unauthorized amateur archaeologists, even though provision for orderly salvage prior to construction will probably be made.

5. Liquid and Solid Wastes

A. Liquid Wastes

The method of disposal of the liquid wastes generated by this project are not considered to provide adverse environmental impact on the receiving water except as indicated under Section IV.9. - Utilities Systems. Production of gas and sludge residue in the incineration process will have minor impact compared to the solid waste incineration by-products.

B. Solid Wastes

The incineration of solid wastes on-site will have an adverse impact on the environment and the surrounding project itself. Adverse impact will be the need for the incinerator site, including destruction during construction of the existing natural growth, gas, process water and residue production and subsequent disposal.

6. Air

If the proposed action is implemented, the only long-term adverse effects on the air quality of the site would be created by the incinerator and the motor vehicles.

At the incinerator, principal gaseous emissions are carbon dioxide, water vapor, nitrogen and oxygen, all normally present in the atmosphere and therefore not necessarily pollutant. There are, however, other trace gases produced, such as sulfur oxides, nitrogen oxides, carbon monoxide, hydrogen chloride and other hydrocarbon gases, and these must be considered noxious pollutants. The amount of emission of these gases would be the important factor to be considered and would largely be dependent upon the amount and type of waste incinerated. Entrained particulate matter emission is another adverse impact, both from the viewpoint of particulate matter in suspension in the atmosphere, and the resulting reduction in visibility.

Motor vehicle emissions will have an adverse impact on the air quality of the project site. Mitigating circumstances may be considered the usual presence of wind, and the project being developed mostly as a destination resort with fewer vehicles per unit than would be the case in a densely populated residential area.

7. Surface Water and Groundwater

The Master Plan provides only limited information on the disposal of the storm water. It is, therefore, difficult to assess unavoidable adverse environmental effects on both the surface and groundwater due to the proposed action. Generally, the adverse effect is considered to be minimal, if the surface runoff is to be kept from entering the nearshore (reef) waters, and if it is allowed to infiltrate into the ground.

8. Noise

An increase in noise due to vehicular traffic is probably the only potentially important adverse noise problem. However, in view of the fairly high average ambient levels due to natural phenomena (wind and surf), these effects are not expected to be significant.

9. Utilities Systems

The adverse impact of the utilities systems (water, sewerage, power and communications) will be the construction of lines, tanks, plants, substations, during which the natural growth and contours will be destroyed. In the case of underground lines located outside of roadways and sidewalks, vegetation will re-grow, and thus the impact is of a temporary nature. In the case of grading for structures, the contours will be permanently altered and space permanently taken up, thereby reducing the available open space. Trenching across the reef flat and to the -50 foot depth approximately will destroy corals and other reef growth in the immediate vicinity of the trenches. During blasting, there may be destruction of fish and other sealife. It is likely that corals will re-grow in time over the trenches (Jones, Randall). A possible adverse impact is the odor from the wastewater treatment plants during certain stages of the treatment process. This may be prevented by inclusion in the plant design of odor-controlling features. Prevailing wind direction is generally offshore and will thus take odors out to sea.

10. Vehicular Traffic

It is not expected that the traffic demand generated by the proposed project would have a significant adverse impact on the highway network, either at the project site or elsewhere on Guam. Existing roads appear to be adequate to handle anticipated peak traffic loads without significant reduction in efficiency.

11. Radiation Emissions

Based upon statements received from the Air Force, there would not appear to be any unavoidable adverse impacts on the military use of electromagnetic frequencies by the proposed project. Similarly, the radiation hazard to traffic along Route 3 does not appear significant based upon available information.

12. Socioeconomics

Assuming that growth of the tourist industry is consistent with community goals, the project should have no significant unavoidable adverse socioeconomic effects. If successful, the project should generate sufficient return to the public sector to more than offset the costs of additional social services.

V. ALTERNATIVES TO THE PROPOSED ACTION

1. Aesthetics

The current state of planning of the developer leaves a wide range of alternative approaches open. Since there is still considerable time (perhaps five to ten years) before major construction will be under way, there is every reason to suppose that aesthetic questions will be fully aired, with thorough consideration given to minimizing negative aesthetic impacts.

A. No Project

The "no project" alternative would negate essentially all of the indicated potential aesthetic impacts, permitting the site to remain in its current virtually pristine condition for the time being. However, a certain amount of minimal aesthetic degradation, especially of reef and shore areas, can be expected to occur anyway as beach usage continues to increase in adjacent areas under military control.

2. Terrestrial Biology

The "no project" alternative would eliminate environmental impact due to the proposed action. Development to a lesser degree would reduce the impact of the action. A detailed survey of fauna and flora will identify specific areas of concern and will provide a guide to proper planning to minimize the impact on flora and fauna.

3. Marine Environment

A. No Project

The alternative of "no project" would completely eliminate impacts due to construction. The reduced availability of facilities and continued limited access would also greatly decrease the likelihood of overcollection and vandalism. However, even in the absence of the project, visitor usage will probably continue to increase to some extent, with a corresponding increase in fishing, shelling, and minor acts of vandalism.

4. Archaeological/Historical

Since the developer is not, at present, committed to a specific set of detailed construction plans, there are many specific alternative choices available relative to the siting of buildings, access

roads, utilities and so on. This flexibility, coupled with the expressed willingness of the developer to safeguard archaeologic values, means that, in general, it should be possible to develop a construction plan which is maximally responsive to the need for preservation of archaeological resources. On the other hand, the absence of a specific set of plans means that it is not possible to deal with each as they might specifically impact upon archaeologic resources.

A. No Project

The alternative of "no project", if adopted, would mean that none of the immediate pressures on archaeologic remains described above would be brought to bear immediately. On the other hand, there would, in all probability, be little effort by the Government of Guam or others to undertake detailed site investigations without the pressure of imminent development. Consequently, in the "no project" case, small-scale vandalism and exploitation of the site by amateurs should be expected to continue until a major study and/or restoration effort is undertaken. In this sense, the "no project" alternative could eventually result in the recovery of less information from existing remains than a well-conducted, professional site investigation carried out in coordination with current development plans.

5. Liquid and Solid Wastes

A. Liquid Wastes

Alternatives to the treatment of liquid wastes are discussed under Section V.9., Utilities Systems. The alternatives

to the disposal of the treated effluents from various treatment processes are discussed herein. Three alternatives are available, the disposal on the ground surface by spreading, sprinkling, irrigating; the injection underground by injection well; "complete treatment" and re-use.

- (1) Ground Surface Disposal: This is practiced in many areas and results in practical re-use of the wastewater and consequent saving of energy and resources. The degree of treatment required varies, depending on the location of the application and use of surrounding areas. Application in the non-residential areas of the project appears feasible with proper treatment and chlorination.
- (2) Underground Injection: The location of the project near the shore lends itself to the consideration of this method of disposal. The hydraulic conductivity in the limestone would be expected to accommodate large amounts of effluents injected under reasonably low pressures. The gradient of the fresh water lens is seaward in the area (Mink) and the nearshore zone is underlain by salt or brackish water, thereby eliminating the threat to the fresh water supply. Secondary treatment with sand filtration may be sufficient for this purpose.
- (3) "Complete Treatment" is that which would produce an effluent ready to be used for domestic purposes.

Considering the remoteness of the site and the cost to bring the water to it, this scheme may well be economically competitive. The tight quality control necessary, cost of treatment and consumer reluctance may, on the other hand, eliminate this scheme from consideration.

These three alternatives have in common the deletion of the ocean outfall portion, and with it, the disturbance of the reef and nearshore waters.

6. Air

If the proposed action were not to be implemented, as a no-project alternative, there would be no degrading of the air quality as it exists.

Alternatives to the incineration on-site of solid waste materials would include the off-site burial of solid waste in the Government of Guam sanitary landfill, or the off-site incineration in a joint military and Government of Guam incinerator. The latter method was suggested in discussions by the Guam Environmental Protection Agency in March of 1975. Such a joint facility was being discussed at that time without firm implementation dates having been established.

As a possible mitigating measure for motor vehicle emissions, the limiting of the number of vehicles using the project site may be considered with a form of mass transportation serving the project on- and off-site.

7. Surface Water and Groundwater

This paragraph is written with the understanding that the Master Plan provides for storm runoff to be collected and used as an emergency supply. Alternatives to this proposal then would be:

A. Disposal on Land by Infiltration or Injection

Disposal on land as close as possible to the natural location of infiltration and at approximately the natural rate would be the preferred method. Realizing that some concentrated runoff patterns will result in a development of this nature, such concentrated runoff could be disposed of in seepage pits, which would take up considerable area; or by injection wells, which would penetrate into the brackish water or saltwater zone below. Results of disposing stormwater by way of injection wells have been varied on Guam. In general, better results may be expected close to the shoreline rather than further inland. This is due to the fact that the limestone may be expected to be more porous, open and cavernous in the barrier reef limestone structure near the shore. Injection wells at Andersen Air Force Base, to the east of the project, have performed satisfactorily for many years (Mink). In either case, large area infiltration or injection wells will recharge the lens, or be otherwise of benefit to it. Recharge of the lens is of critical importance to the sustained draft of fresh water from the lens.

B. Disposal to the Sea, into the Reef or by Deepwater Outfall

Disposal at sea into the reef is considered a poor alternative due to the probable impact on the ecology of the reef by siltation, and introduction of other pollutants. Deepwater outfall is technically feasible and ecologically more acceptable than the nearshore water discharge for reasons of greater dilution ratios. If considered, the possibility of combining it with the wastewater effluent outfall should be examined.

An alternative to supply the development with domestic water from the lens, would be the use of a desalination process which would convert salt water or brackish water to potable water by way of distillation exchange or reverse osmosis. All processes would require the use of electrical energy and disposal of brines.

8. Noise

Noise, including noise from vehicular traffic, is not expected to present significant problems. However, there will undoubtedly be opportunities, during later planning phases, to situate roadways relative to various structures so that traffic noise impacts are minimized.

Vegetation is very effective at screening out certain types of noise, while generating others. Whatever adverse noise impacts may be generated could be reduced, to some extent, by retaining as much existing vegetation as possible, and by new strategic plantings.

9. Utilities Systems

A. General

There is no alternative for the on-site distribution or collection systems for the utilities. Alternatives are available as far as source and treatment are concerned.

B. Water

Water could be produced from on-site brackish or salt water instead of by removal from the freshwater lens. This is possible by desalination by distillation, reverse osmosis, and ion exchange. Advantage would be on-site production and unlimited supply of the basic source. Disadvantages include high cost, the impact of the plant facility, and need to dispose of the brine as by-product.

C. Sewer System

The alternatives to the disposal of the effluent have been discussed elsewhere in this assessment. The degree of sewage treatment should match the proposed method of effluent disposal. Thus the ocean disposal of raw sewage, or sewage treated only by primary removal of floatables, may be entirely satisfactory provided ideal current conditions exist. On land, disposal must be safe for users of the area as basic consideration and must produce an effluent which can readily be accepted by the receiving ground. Secondary treatment with chlorination should suffice, although it is recognized that chlorination does not free the effluent entirely from pathogenic organisms. For injection into the ground, secondary treatment with sand

filtration has been suggested mainly to provide an effluent which will not plug the receiving aquifer and will reduce biological reaction with the soils and waters of the aquifer.

Complete treatment is required for water intended for domestic re-use.

D. Power System

On-site generation of power is an alternative which would reduce the impact on off-site areas by eliminating the need for transmission mains. On-site noise, air quality, and aesthetic impacts would be increased. The efficiency of the smaller unit in comparison to the island-wide system and transmission to the site would have to be closely examined.

E. Communications

One possible alternative to the off-site duct system along Route 3 was mentioned in discussions with the Guam Telephone Authority in March 1975. This would include the providing of a microwave communications link with appropriate transmission and receiving towers and facilities. A decision on the method to be used would require a detailed study by the Guam Telephone Authority of all parameters involved.

10. Vehicular Traffic

A. No Action

If the alternative of "no action" is selected, then there would be no traffic impacts at all. Traffic in the area would remain much as it is today, very light.

B. Smaller Resort Complex

During construction, daily traffic volumes probably would not be substantially different from those of the larger project. The significant change would be in the duration of the construction period. A smaller complex simply would take less time to construct.

A smaller complex, however, with a smaller population, would generate a proportionally reduced volume of traffic during the operational phase.

C. Alternative Access Routes to the Site

All alternative access routes from the south to the proposed development would entail traversing U.S. Government lands. To the east of Route 3, the only existing access route to the site, and north of Route 9, are bomb storage areas with the associated blast clear zones. To the west of Potts Junction lies the U.S. Naval Communications Station Finegayan. Possible alternative route exists through the NCS area. However, such an alignment would entail construction through areas where no roads exist. Further, there are sensitive communications facilities in the area, for which information is not available. Such a route would also subject the NCS area to public traffic, where virtually none now exist. It appears that the existing alignment of Route 3 north of Potts Junction is the only viable alternative at this time. Figure 11 shows the relationship of the site to possible access routes.

11. Radiation Emissions

There are no known alternative modes of operation which can be suggested for meeting the military's mission. Alternatives, which would basically resolve to changes in frequency, direction, power output, and broadcast location, all depend upon operating and technical considerations which are classified. Based upon existing information, no such viable alternatives can be identified.

With regard to potential radiation hazards, the chief option available concerns relocation of Route 3. By relocating a portion of Route 3, it would be possible to reduce the likelihood of exposure to radiation to traffic along the route. Potential routes are discussed in Section V.10. However, the minimal radiation hazard presented by the current situation would not seem to merit, by itself, a major rerouting of Route 3.

12. Socioeconomics

A. No Action

To exercise the alternative of "no action" would be to lose an opportunity for significant economic growth. The planned development of Uruno Beach, by increasing the capacity and diversity of Guam's tourist industry, would add strength to Guam's growing economy. The social and economic impacts of "no action", in light of the opportunity for a productive resort community, would therefore be substantially detrimental.

B. Smaller Resort Complex

This alternative of developing a resort complex smaller in scope than that proposed by Seibu Leisure would simply

reduce the magnitude of the positive socioeconomic impacts described in the impacts sections of this assessment.

VI.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Environmental Protection Agency regulations require, under this section, the examination and the discussion of the following:

A. Environmentally Significant Consequences of the Proposed Action

Environmentally significant consequences of the proposed action are the opening up of the area to traffic, to resident and transient population; short- and long-term effect on fauna and flora, on the beach and offshore waters, on air quality and noise levels. Most of these consequences are of on-site importance only. The generation of needed power, water, and the propagation of traffic may be considered as affecting off-site areas as well. The degree to which these actions affect on- and off-site environment has been examined in other sections.

B. Cumulative and Long-Term Effects of Proposed Action Which Reduce or Enhance the State of the Environment for Future Generations

The area, in its present state, is inaccessible for all practical purpose. Opening of the site would allow enjoyment by many of the natural attributes of the site, slightly modified by construction measures. For example, long-term or ultimate yield of archaeological information from the site should not be materially diminished. In fact, the proposed development may actually increase the yield of information by at least partially underwriting the cost of a detailed archaeological investigation.

In viewing the long-term versus short-term effects of the project on aesthetics, it is necessary to weigh the aesthetic alterations which the project will cause against the increase in opportunities for the use of the site by ever-increasing numbers of the general public. The problem is illustrated by the obvious extreme case of a pristine site to which no one has access. By permitting and controlling access and development, while at the same time safeguarding aesthetic values, the overall aesthetic benefit enjoyed by the public at a given site may theoretically be increased. A certain amount of aesthetic degradation may, therefore, conceivably be justified in certain cases. This principle may apply in the case of Uruno Beach, provided that careful attention is placed upon safeguarding the overall aesthetic, especially visual, integrity of the site.

Perhaps the most important long-term value of the reef area is as a recreational and open-space zone. As such, the careful development of the site as a recreational area with suitable monitoring, controls, and improved public access, may serve the long-term interests of Guam's people.

However, any significant degradation of the area through inadequately considered construction, contamination of coastal waters by sewage effluent, storm water runoff or other pollutants, would have a definite negative impact on the long-term value of the site for recreational purposes. Without more detailed knowledge of the plans to be implemented, more precise evaluation of the project's

ultimate impact on long-term "productivity" from the recreational standpoint would be speculative.

C. Effects Narrowing the Beneficial Use of the Environment or Long-Term Risks to Health and Safety

The beneficial use of the on-site environment does not appear unduly hampered by the proposed action. Rather, it may be enhanced, as indicated in previous sections. Long-term risks to health and safety are remote or non-existent. Possible danger to health due to discharge of pathogenic organisms to the marine environment and body contact areas is remote with the degree of treatment planned for, and assuming that the outfall design will follow acceptable sanitary engineering standards.

D. Financial Profits or Losses Due to the Proposed Action

Financial profits will likely be incurred by the owners and developers of the project property. Additional long-term benefits will go to hotel operators, shop and restaurant keepers, and the numerous employees, both on-site and off-site, affected by the proposed action. The Government of Guam and the people of the Territory would benefit indirectly by way of taxes collected from commercial and residential establishments. Financial losses are possible in the form of failures of business being conducted on the site; however, these are not considered directly part of the proposed action and not due to the proposed action.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

For a development of this type, certain irreversible and irretrievable commitments of resources are being made. The site, for one, is being committed to a use as resort/residential facility. Considering the cost of the complex, such commitment must be considered irreversible and, thereby, curtailing the diversity and range of use.

As presently conceived, no irreversible impact on archaeological resources need occur, assuming that careful planning is undertaken, suitable mitigating measures are employed, and applicable statutory protections are observed with the cooperation and active participation of the developer. The "Urano Code" of the Master Plan appears a good starting point for the development of such statutory protection.

Construction of the swimming holes and marina would, for all practical purposes, irretrievably commit these areas to intense recreational use, with marked effects on the areas of reef where construction occurs. Opening of the site to easier public access would ensure greater utilization of the area for many years to come, with all of the consequences for the area which greater use entails.

Although it is conceivable that use of the site could be restricted in the future, opening of the site to greater public access likely represents a permanent commitment of this area to medium to high density recreational use.

The impacts of the proposed sewer outfall are, basically, as permanent as the resort complex itself, although there is the possibility of

alternative waste treatment measures such as deep well injection or pumping of the effluent into the proposed Northern District Sewerage System. This system itself discharges treated effluent to the ocean further south from the project site, thus the location of the discharge only, would be moved. The quantity discharged to the ocean would remain the same. If the discharge were eliminated, many, if not all, of the biological effects of the outfall would be eliminated, although this might take several months to many years to achieve, depending on the severity of the impact.

Implementation of the Master Plan would also commit natural resources in the form of water and fuel oil, for the generation of power, to the proposed action. Water, in this case, might be considered a renewable source due to the replenishing of the groundwater supply through rain, although this source is by no means inexhaustible. Fuel oil must be considered a non-renewable source.

Other natural resources to be committed irretrievably include building materials such as wood, asphalt, stone, cement, steel, glass and others.

VIII.

DETAILS OF UNRESOLVED ISSUES

A development of the magnitude proposed by Seibu Leisure (Guam), Inc. has resulted in the following unresolved issues.

1. The effects of the Seibu-Leisure development on land use plans, policies and controls have not yet been determined.
2. The full impact of the Seibu-Leisure proposal on the marine environment and archeological resources is yet to be determined.
3. It is not known what the impact of the proposed development will be on the existing water supply system.

4. The impact of providing power for the Seibu-Leisure proposal in terms of present generating capacity, fuel consumption and air pollution has not been fully investigated.

5. Similarly the impact on ambient air quality and the ultimate residue disposal site of the solid waste and sludge incineration system remains to be determined.

6. Guam is currently importing skilled labor. The impact on the labor market of the additional personnel required for construction and operation of the development has not been fully explored.

7. The environmental impact of using air or sea access routes to the proposed development is unresolved.

8. The impact of the increased traffic to serve Seibu-Leisure on the Circular Disposed Array Antenna (CDAA) needs to be further explored.

9. The mitigating effects of those considerations which offset the adverse environmental impacts are not yet fully resolved.

B I B L I O G R A P H Y

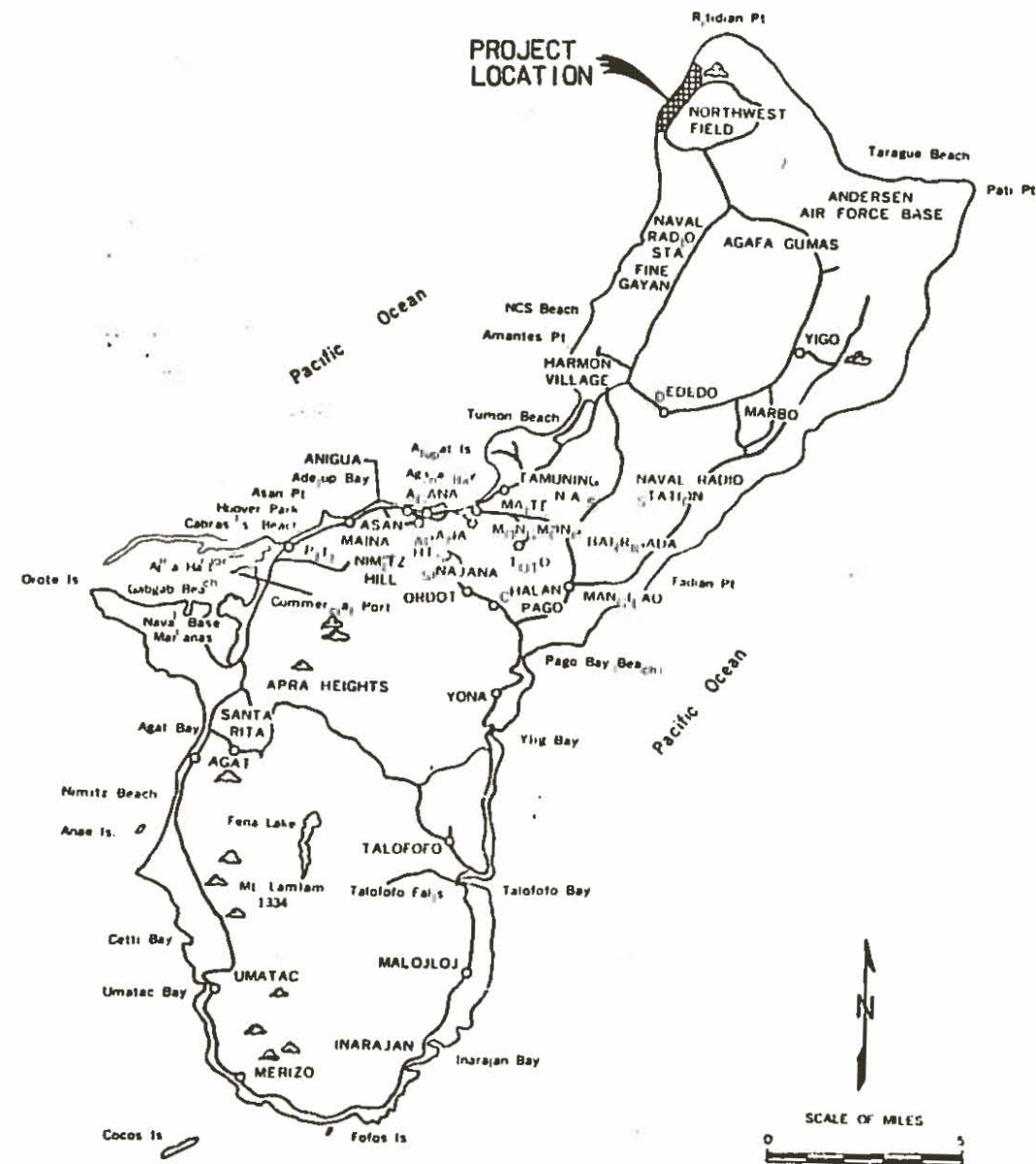
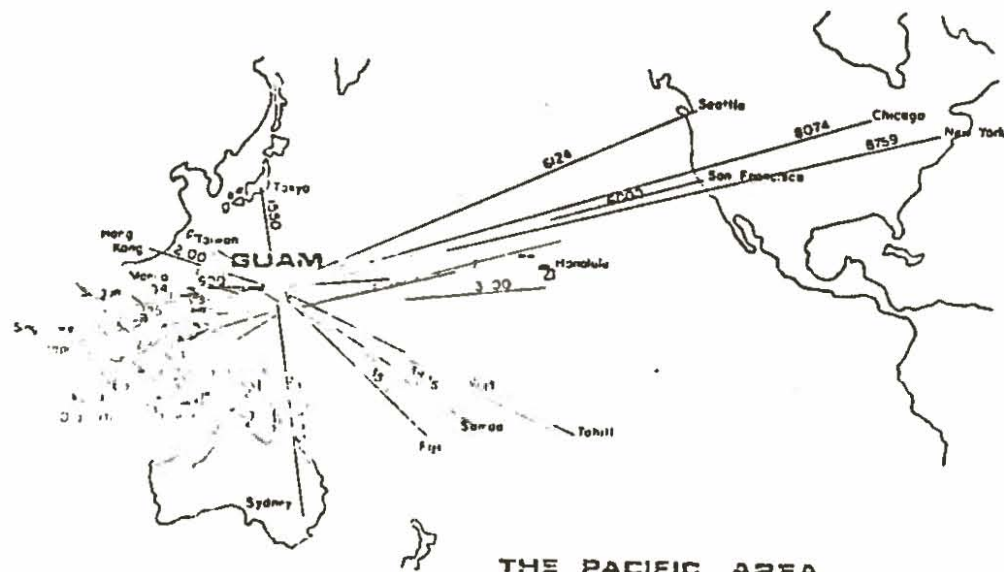
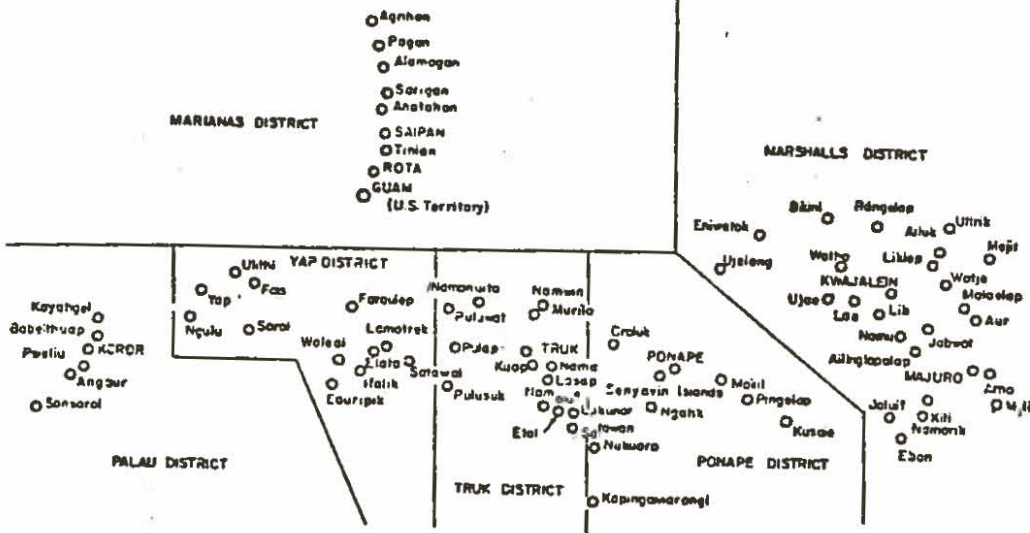
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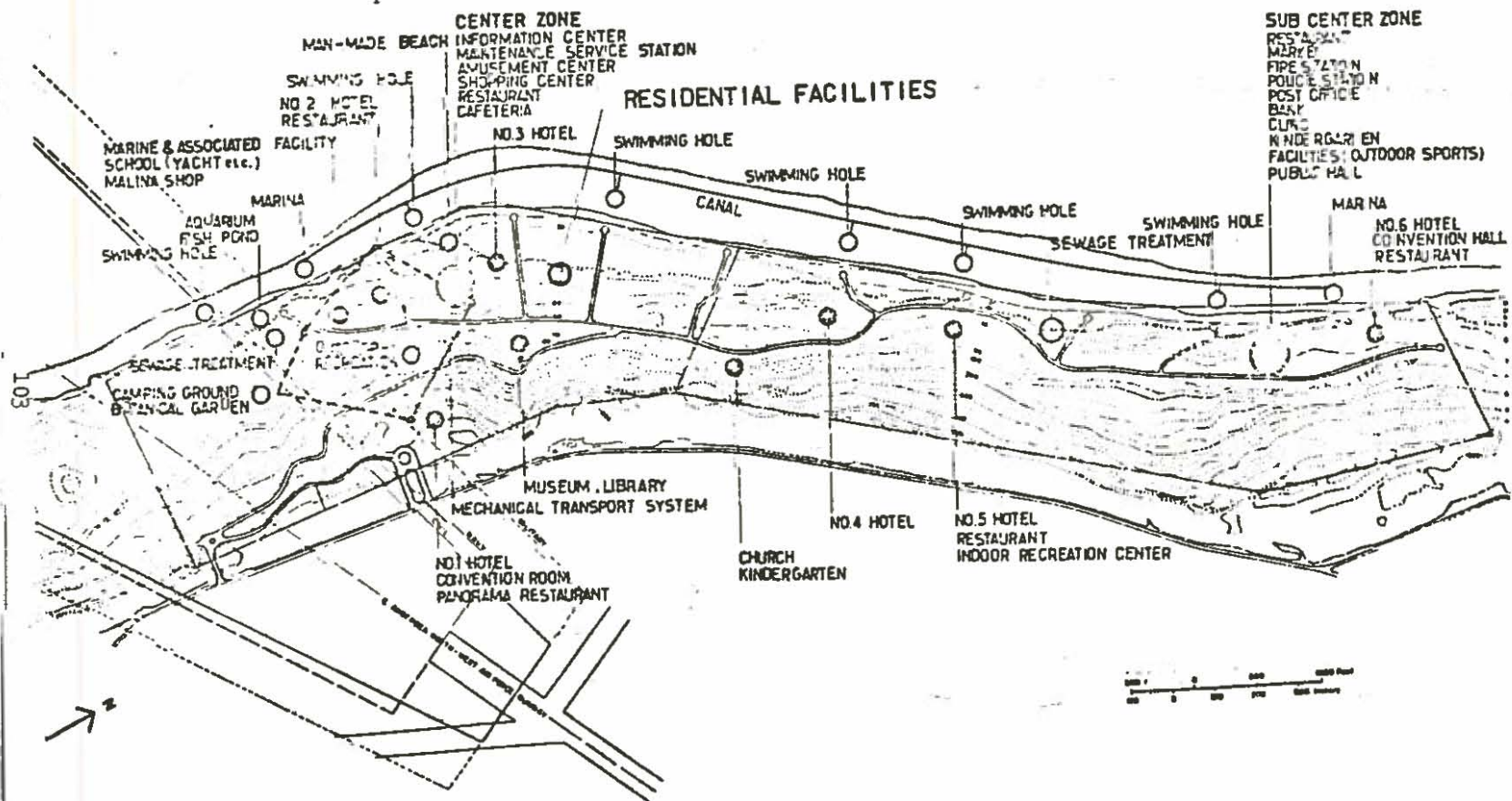
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FIGURES

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- 5 ULTIMATE DEVELOPMENT LAYOUT
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- 7 PHASE II DEVELOPMENT
- 8 PHASE III DEVELOPMENT
- 9 HYDROGRAPHIC SURVEY
- 10 TRAFFIC COUNT AT POITS JUNCTION
- 11 ACCESS ROUTES

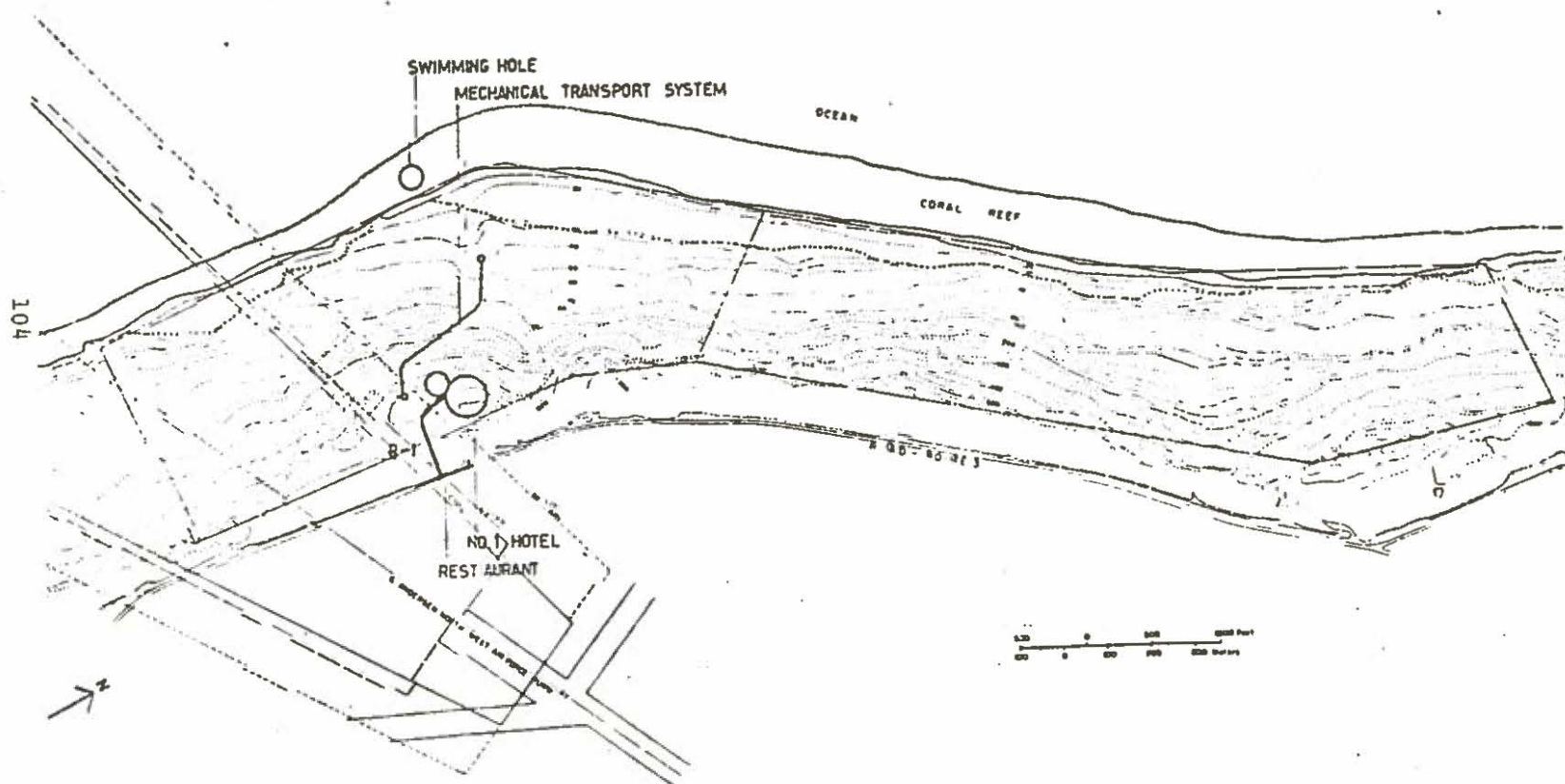
GUAM - GATEWAY TO MICRONESIA





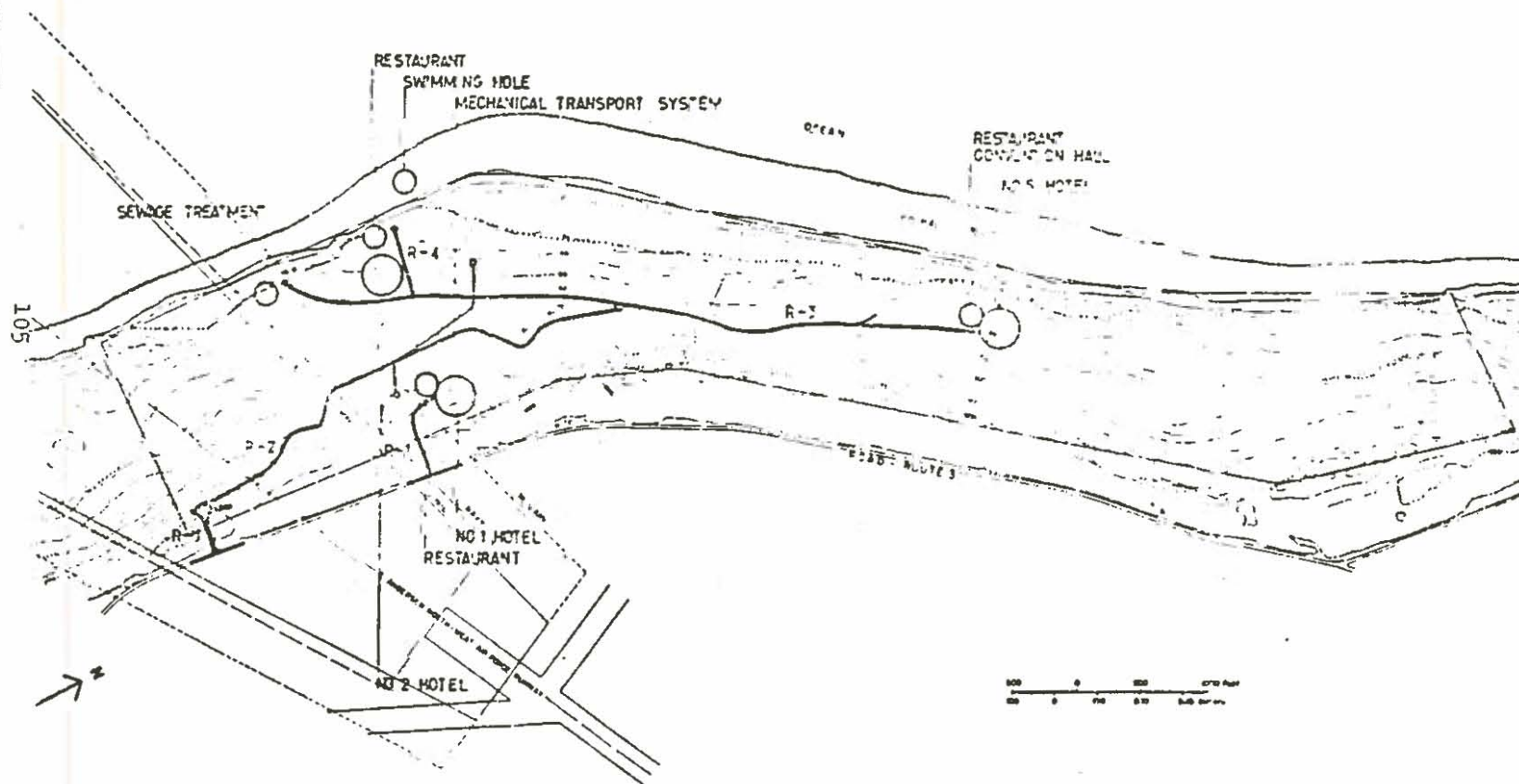
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GUAM, FOR SIG INC.

ULTIMATE DEVELOPMENT LAYOUT FIGURE 5

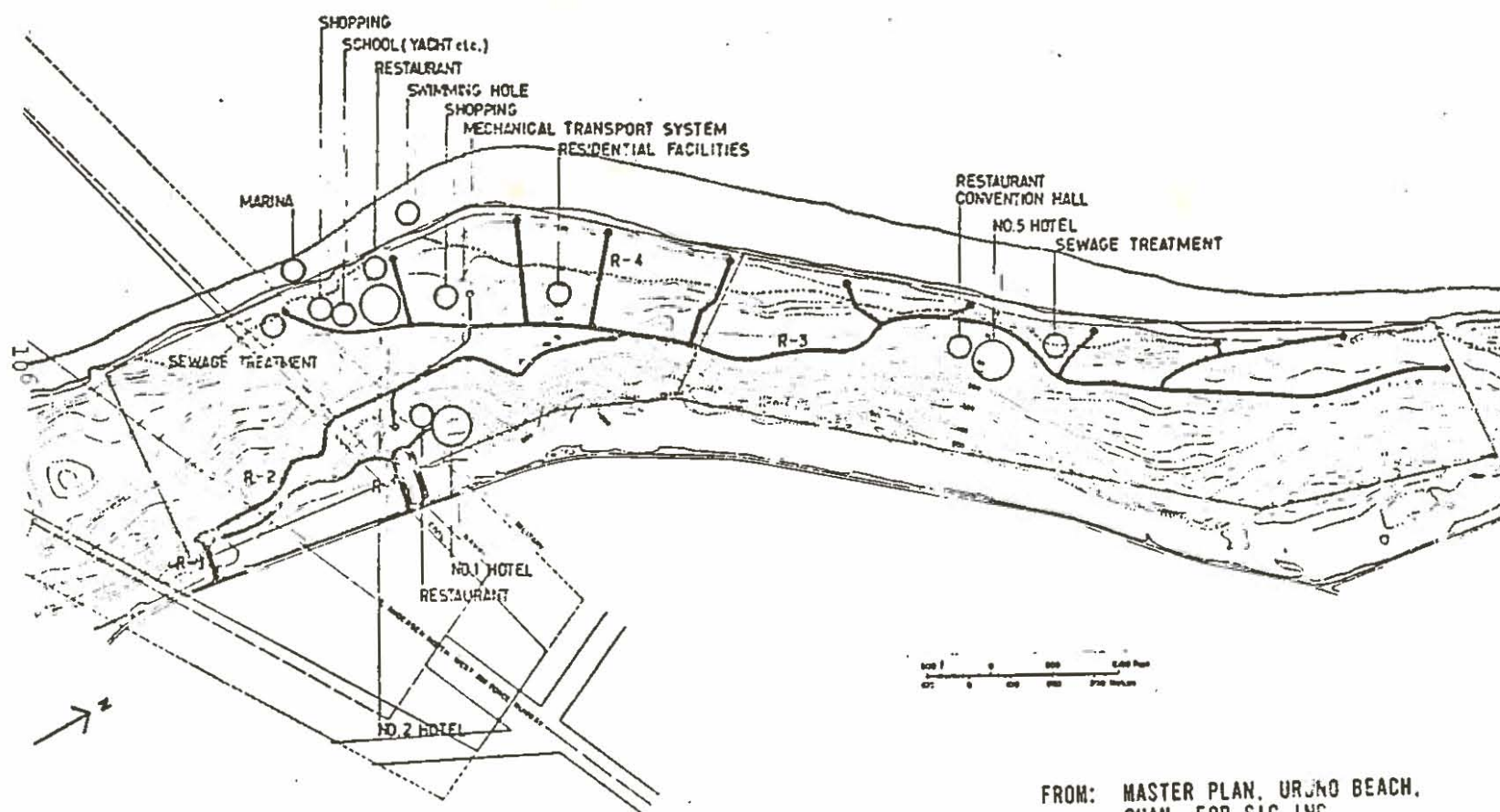


FROM: MASTER PLAN, URUNO BEACH,
GUAM, FOR SIG INC.

PHASE I DEVELOPMENT FIGURE 6



FROM: MASTER PLAN, URUNO BEACH,
GUAM, FOR SIG INC.
PHASE II DEVELOPMENT FIGURE 7



FROM: MASTER PLAN, URUNO BEACH,
GUAM, FOR SIG INC.
PHASE III DEVELOPMENT FIGURE 8

PHILIPPINE

E 192.000

-200

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REEF

SHORE LINE

BOUNDARY

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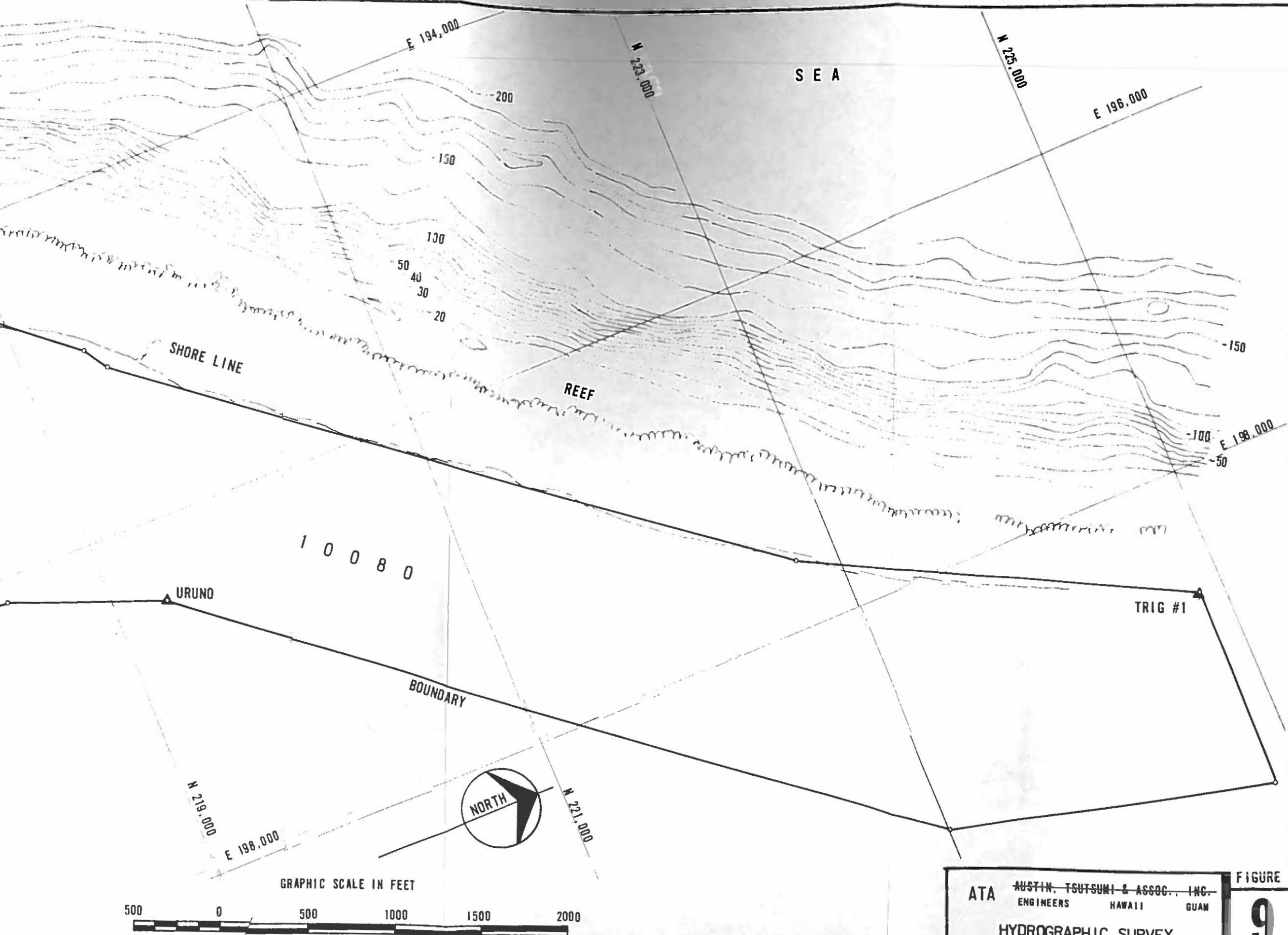
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ATA ~~AUSTIN, TSUTSUMI & ASSOC., INC.~~
ENGINEERS HAWAII GUAM
HYDROGRAPHIC SURVEY
MARCH 1975

FIGURE
9

POTTS JUNCTION 48-HOUR VEHICLE COUNT

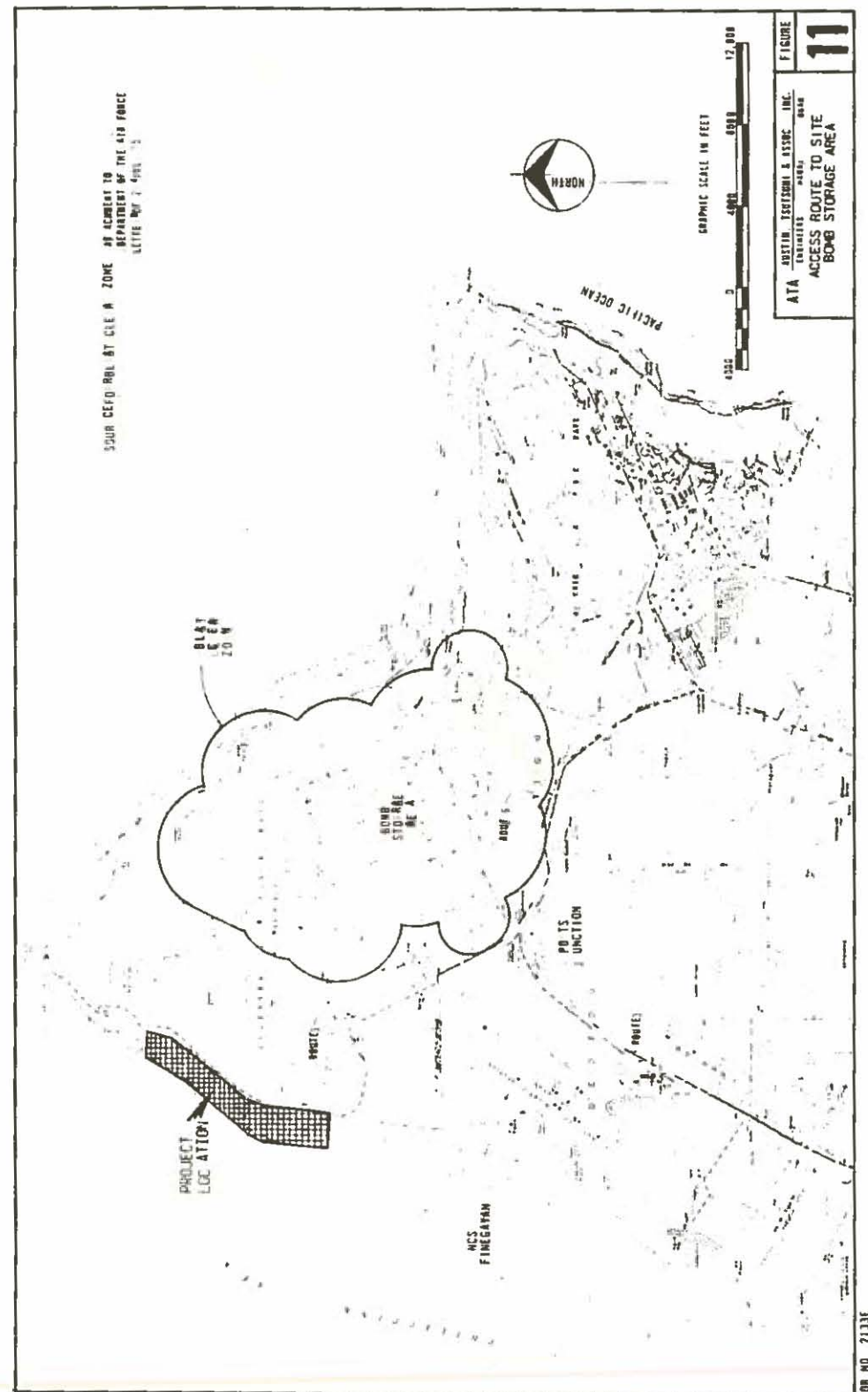
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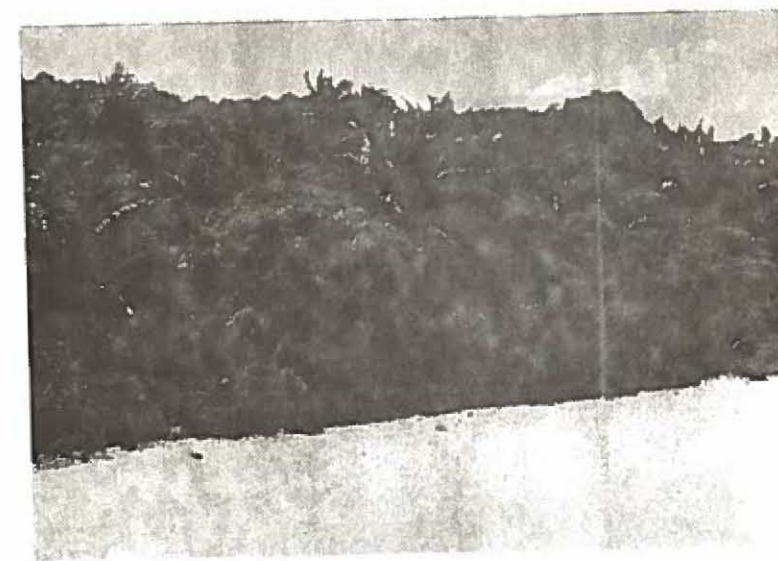
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	COUNT:	16	10	10	10	22	20	8	10	106
	HOUR:	9	10	11	12	13	14	15	16	
	COUNT:	35	37	11	5	6	3	5	5	107
	HOUR:	17	18	19	20	21	22	23	24	
	COUNT:	5	5	0	0	0	2	3	28	43
	HOUR:	25	26	27	28	29	30	31	32	
	COUNT:	31	28	16	11	30	3	25	0	144
	HOUR:	33	34	35	36	37	38	39	40	
	COUNT:	55	35	12	5	13	9	2	1	132
	HOUR:	41	42	43	44	45	46	47	48	
	COUNT:	6	2	0	1	0	0	3	7	19
21 May 75										

SOURCE: DEPT. OF THE AIR FORCE; MAY '5 1975
MEMORANDUM

FIGURE 10



Picture No. 1 - Typical view of dense growth in interior of site near proposed Phase I development.



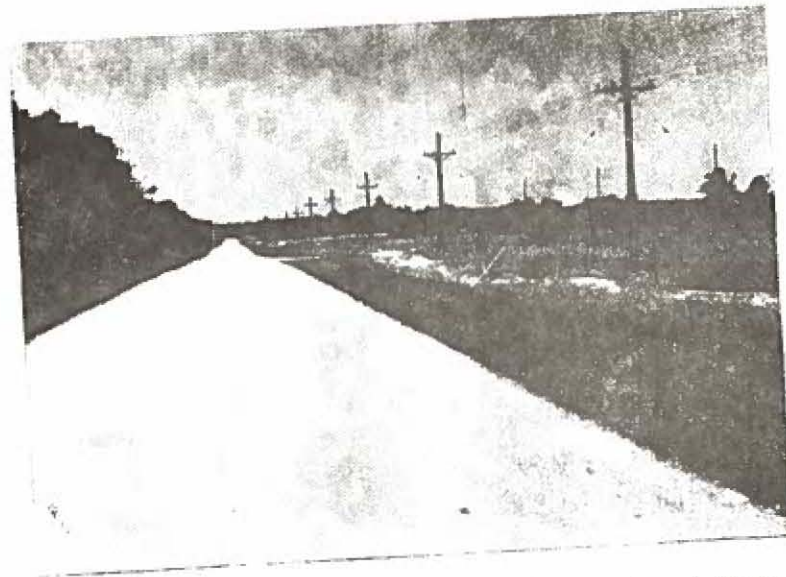
Picture No. 2 - View from beach, about midway along shoreline; illustrates typical dense growth extending from beach to cliff top, visible in background.



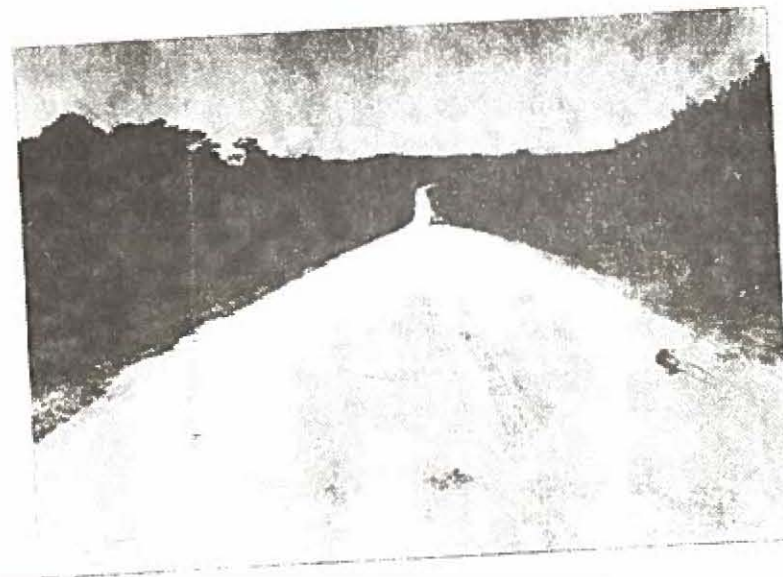
Picture No. 3 - View northward; first outcropping marks northern limit of project.



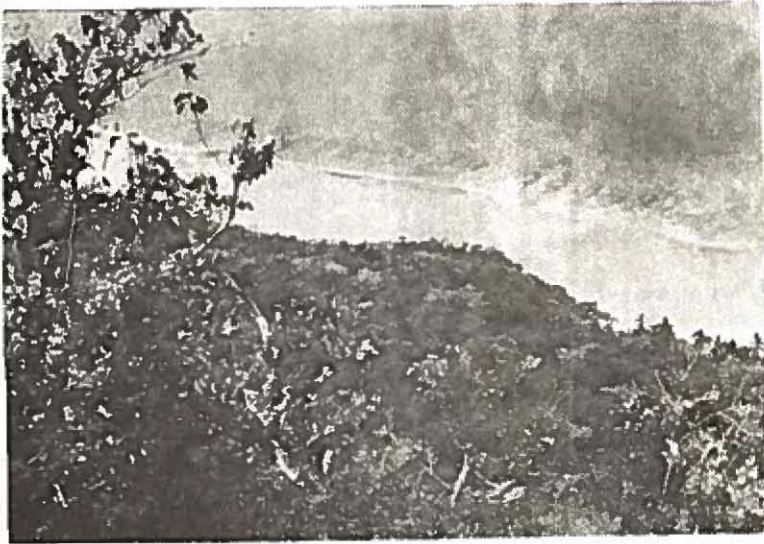
Picture No. 4 - View southward; most distant outcropping marks southern limit of site.



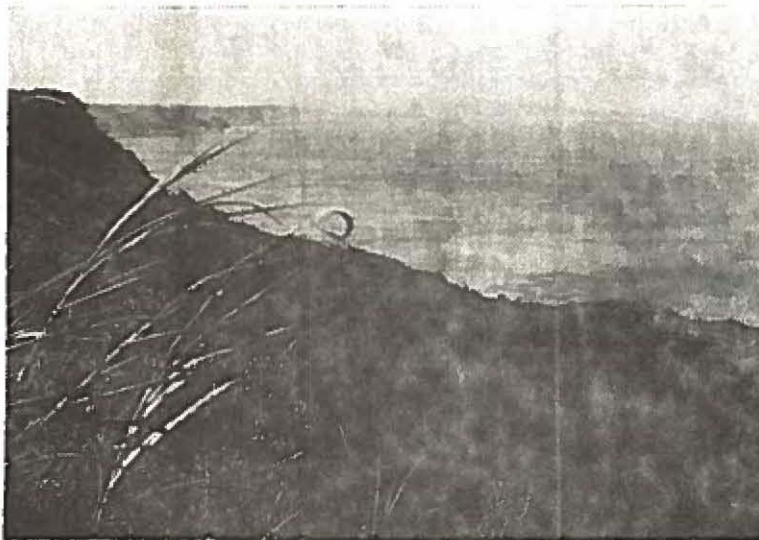
Picture No. 7 - Route 3 - North of sentry station at Potts Junction. Portion of route covered by easement request.



Picture No. 8 - Route 3 - Looking north at turnoff to area of proposed Phase I construction.



Picture No. 5 - Northern limit of site viewed from cliff top at Achae Point.



Picture No. 6 - Cliff top looking south, with southern end of Lot 10080 in foreground. Picture taken near site of proposed Phase I development.



Picture No. 9 - Uruno complex. Complete capstone and upright.



Picture No. 10 - Uruno complex. Side view of slender upright.



Picture No. 11 - Uruno complex latte set.



Picture No. 12 - Limestone latte capstone from Uruno complex.

APPENDIX A

BOTANICAL SURVEY OF URUNO POINT

BOTANICAL SURVEY OF URUNO POINT, GUAM

SUBMITTED TO: AUSTIN, SMITH & ASSOCIATES, INC.
HARMON PLAZA, GUAM

BY: PHILIP H. MOORE

MARCH, 1975

At the request of representatives of Austin, Smith and Associates, Inc., the site of proposed construction at Uruno Point was investigated for evaluation of the plant community (March, 1975). It was discovered that the native vegetation of the area can be divided into four zones (fig. 1) and is fairly uniform within each zone, with the exception of zone 3. The forest is in a stage of development one step short of climax and can thus be called a "typhoon forest" as it is held indefinitely in this stage due to major typhoons that occur on the average of about once every 100 years.

Zone 3 may be divided into two segments, the northern two-thirds and the southern one-third or roughly north and south of the main trail from the escarpment to the sea. The southern part is covered by a lateritic clay soil to a depth of several inches and supports a diverse flora dominated by Aglaia, Pandanus ssp., Neiosperma and Cycas. The northern part is rocky with very little soil cover. The dominants here are Triplaris and Cycas with some larger trees here and there. The presence of Triplaris especially near the first cliffline, indicates a disturbance caused, perhaps, by a recent typhoon. A possible explanation could be that the prominent headland near the southern end of the property protected the southern part while the section north of the headland was exposed to heavy salt spray that killed much of the vegetation that would normally be covering the area.

Of the many species encountered in the four zones, six could be considered rare or quite rare on the island (see attached list). No endangered species were found.

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Of the many species encountered in the four zones, six could be considered rare or quite rare on the island (see attached list). No endangered species were found.

The impact of the proposed construction on the environment would be to destroy a large segment of undisturbed native vegetation and the habitats of several species of birds and mammals. Such destruction could be alleviated somewhat by careful supervision of work and minimal bulldozer activity. The large trees in each zone could be clearly marked for protection before bulldozing is done.

Recommended access to the area would be the existing road through the naval facility (if feasible) rather than the proposed road down the main escarpment. This escarpment should be preserved intact in order to save as much of the native vegetation and wildlife as possible.

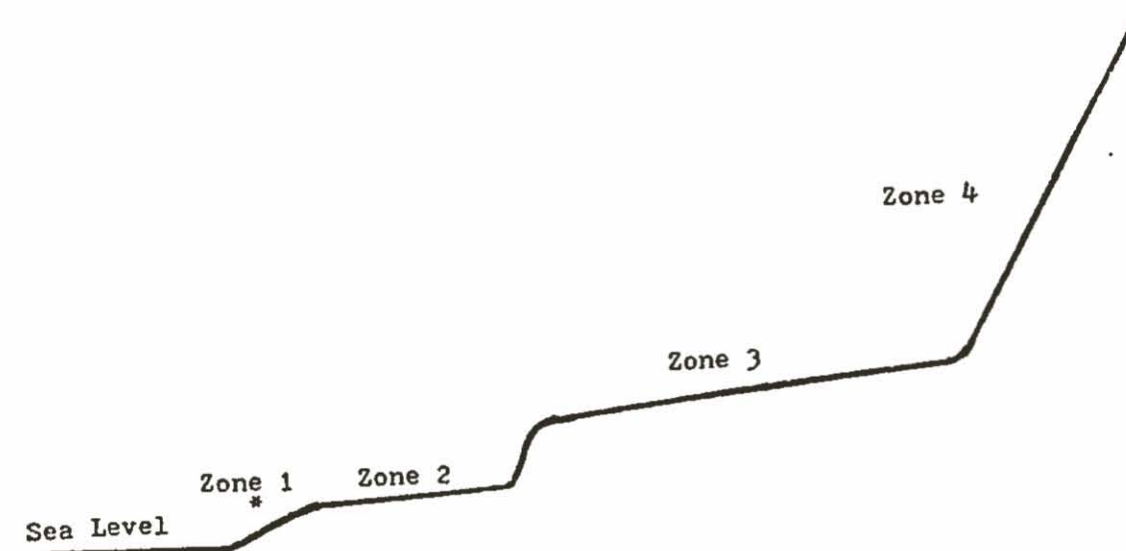


Fig. 1

List of Species (Zone 1)

Barringtonia asiatica
Bikkia mariannensis
Bleekeria mariannensis
Calophyllum inophyllum
Calopogonium mucunoides (vine)
Canavalia maritima (vine)
Casuarina equisetifolia
Colubrina asiatica
Hedyotis foetida
Hibiscus tiliaceus
Mammea odorata
Messerschmidia argentea (dom.)
Mucuna gigantea (vine)
Musa sapientum (planted)
Pemphis acidula
Scaevola taccada (dom.)
Terminalia littoralis
Thespesia populnea

List of Species (Zone 2)

Aglaia mariannensis
Alocasia macrorrhiza (herb)
Artocarpus mariannensis
Bambusa vulgaris
Canavalia maritima
Capparis cordifolia
Carica papaya
Cocos nucifera (dom.)
Cordia subcordata
Cycas circinalis (dom.)
Cynometra ramiflora
Elatostema calareum (herb)
Eugenia javanica
Eugenia reinwardtiana
Ficus prolixa
Ficus tinctoria
Flagellaria indica
Guamia mariannae
Guettarda speciosa
Hernandia nymphaeifolia (dom.)
Intsia bijuga
Macaranga thompsonii
Mammea odorata
Maytenus thompsonii
Morinda citrifolia
Neiosperma oppositifolia
Pandanus dubius
Pandanus fragrans (dom.)
Piper guahamense
Pisonia grandis
Premna obtusifolia
Psychotria mariana
Randia cochinchinensis
Triphasia trifolia

List of Species (Zone 3)

Aglaia mariannensis (dom.)
Artocarpus mariannensis
Caesalpinia major (vine)
Cordia subcordata
Cycas circinalis (dom.)
Dioscorea esculenta (wild yam)
Eugenia javanica
Eugenia reinwardtiana
Eugenia thompsonii
Ficus prolixa
Ficus tinctoria
Flagellaria indica (vine)
Guamia mariannae
Guettarda speciosa
Hibiscus tiliaceus
Intsia bijuga
Ixora triantha
Jasminum marianum (vine)
Macaranga thompsonii
Maytenus thompsonii
Melanolepis multi-landulosa
Morinda citrifolia
Mucuna gigantea (vine)
Neiosperma oppositifolia (dom.)
Pandanus dubius (dom.)
Pandanus fragrans (dom.)
Piper guahamense
Pisonia grandis
Planchonella obovata
Premna obtusifolia
Taeniophyllum mariannense (leafless orchid)
Triphasia trifolia (dom.)

List of Species (Zone 4)

Aglaia mariannensis (dom.)
 Annona reticulata (introduced)
 Artocarpus mariannensis
 Capsicum frutescens
 Carica papaya
 Cestrum diurnum (shrub)
 Claoxylon marianum
 Cordia subcordata (dom.)
 Cycas circinalis (dom.)
 Cynometra ramiflora
 Dischidia puberula (vine)
 Discocalyx megacarpa
 Elatostema calcareum (herb)
 Eugenia javanica
 Eugenia reinwardtiana
 Eugenia thompsonii
 Ficus prolixa
 Ficus tinctoria
 Flagellaria indica (vine)
 Guamia mariannae
 Guettarda speciosa
 Hernandia nymphaeifolia
 Intsia bijua
 Jasminum marianum (vine)
 Laportea interrupta (herb)
 Macaranga thompsonii
 Melanolepis multiglandulosa
 Melochia compacta (shrub)
 Morinda citrifolia
 Neiosperma oppositifolia (dom.)
 Pandanus dubius
 Pandanus fragrans
 Peperomia mariannensis (herb)
 Phyllanthus marianus (herb)
 Piper guaharense
 Pipturus argenteus
 Pisonia grandis
 Planchonella obovata
 Polyscias grandifolia
 Premna obtusifolia
 Procris pedunculata (herb)
 Psychotria mariana
 Randia cochinchinensis
 Spathoglottis plicata (ground orchid)
 Terminalia littoralis

Dominant Plants in each Zone

Zone 1

Messerschmidia argentea
 Scaevola taccada

Zone 3

Cycas circinalis
 Pandanus fragrans
 Aglaia mariannensis
 Neiosperma oppositifolia
 Triphasia trifolia
 Pandanus dubius

Zone 2

Cycas circinalis
 Pandanus fragrans
 Hernandia nymphaeifolia
 Cocos nucifera

Zone 4

Cycas circinalis
 Aglaia mariannensis
 Neiosperma oppositifolia
 Cordia subcordata

In addition to the species mentioned there are numerous herbs, mosses, ferns, lianas and epiphytes as well as native and introduced weeds. Among the most prominent ferns are the following:

Asplenium nidus
 Davallia solida
 Microsorium punctatum
 Phymatodes scolopendria
 Pyrrosia adnascens
 Thelypteris unita
 Vittaria elongata

Rare and Endangered Plants on the Island

Alyxia torresiana	rare
Angiopteris durvilleana	endangered
Barringtonia racemosa	rare (confined to 1 area)
Barringtonia samonensis	rare
Boehmeria tenacissima	rare
Canthium odorata	rare
Cerbera dilatata	rare
Cyathia lunulata	endangered
Discocalyx megacarpa	quite rare
Drypetes sp.	endangered
Eugenia javanica	rare
Eugenia thompsonii	rare
Eurya japonica	rare (if here-not found)
Excoecaria agallocha	quite rare
Fagraea galilao	rare (confined to 2 locations)
Grewia crenata	rare
Heritiera littoralis	quite rare
Heritiera longipetiolata	endangered
Hernandia ovigera	rare
Ixora triantha	quite rare
Lumnitzera littorea	quite rare (confined to 1 locatio
Merrilliodendron megacarpum	quite rare (confined to 2 locatio
Pisonia umbellifera	endangered
Planchonella obovata	rare
Serianthes nelsonii	endangered
Tabernaemontana rotensis	endangered (not found)
Tarennia sambucina	rare
Tephrosia mariana (legume)	not found
Terminalia littoralis	rare
Tristiropsis acutangula	rare
Xylocarpus moluccensis	rare
Xylosma nelsonii	rare (not found)

APPENDIX B

TECHNICAL REPORT NO. 19
UNIVERSITY OF GUAM MARINE LABORATORY

A CANDIDATE MARINE ENVIRONMENTAL IMPACT SURVEY
FOR THE POTENTIAL DEVELOPMENT OF THE URUMO POINT REEF AREA
ON GUAM, MARIANA ISLANDS

By
Richard E. Dickinson and Roy T. Tsuda

A CONTRACT REPORT

Prepared for
AUSTIN, SMITH AND ASSOCIATES, INC.

As per
MEMORANDUM OF UNDERSTANDING AND AGREEMENT
SIGNED ON MARCH 14, 1975

Technical Report No. 19
University of Guam Marine Laboratory
April 1975

B-1-1

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INTRODUCTION

Background

The Uruno Point area is at present a beautiful, completely unspoiled and relatively inaccessible coastline (ca. 2 mi. long) located on the northwest side of Guam (Fig. 1). Within the last two years, there has been much discussion for the development of a beach resort in this area. It has also been proposed that monies in excess of \$50 million will be spent in the proposed Uruno Beach Resort Development for construction of hotels, restaurants, marina, aquarium, and a botanical garden.

A letter dated August 31, 1973 from Mr. William A. McAlister (President, T. J. Davis, Inc.) to Dr. William V. Vitarelli (Vice-President of Research and Special Projects, University of Guam) provides a glimpse into the proposed development.

"It is the intent of the developers to retain and add to the natural beauty in order that the complex will present a unique, tropical, natural resort area with particular emphasis on the Chamorro culture, native flora and fauna, and the marine life in the waters adjacent to the beach area."

The fact that Marine Laboratory personnel were involved in the marine survey does not constitute an endorsement of the proposed Uruno Beach Resort Development Project by the authors, the Marine Laboratory, or the University of Guam. We felt the study was necessary and have approached all aspects in an unbiased manner. All opinions expressed herein are those of the authors.

Although the University of Guam Marine Laboratory has been participating in discussion on the environmental aspects of the proposed Uruno Resort Development since August 31, 1973, the final affirmative step of the Marine Laboratory's participation in this study was negotiated on March 14, 1975 in a Memorandum of Understanding and Agreement between Austin, Smith, and Associates, Inc. and the University of Guam.

Scope of Work

The Marine Laboratory was given a month to both complete the following studies and submit its findings and recommendations.

1. Prepare a biological survey for the development including:
 - A. Construction of three swimming pools on the reef flat.
 - B. Construction of a marina.
 - C. Construction of sewage outfall for discharge of secondary treated effluent at -60 feet.
2. Perform current studies (two 24 hour studies).

Personnel

Since time was limited, a large work force comprised of graduate students, undergraduate student, and marine technicians was mobilized to undertake the field work. Roy T. Tsuda, Ph.D., Director of the Marine Laboratory, served as Principal Investigator and Richard E. Dickinson, M.S. candidate in Biology, Marine Laboratory, served as the Student Project Leader. The actual report writing fell on these two individuals.

The students who contributed to the study were as follows:

Gerald A. Heslinga, Visiting Undergraduate from Harvard University; William J. Zolan, James E. Doty, Ronald D. Strong, Daniel S. Wooster, and William J. Tobias, all M.S. Candidates in Biology, University of Guam Marine Laboratory.

Marine technicians Frank Cushing and Pat Beeman, Marine Laboratory, also contributed their experience in the offshore current studies.

During certain stages of the project, specialists were asked to provide names to the multitude of reef organisms found in the study area. Dr. Steven S. Amesbury, Agricultural Experiment Station, University of Guam, provided us a checklist of fishes found on the reef flat; Dr. Frank Rowe, Australian Museum, provided us a checklist and quantitative information on the holothurians (sea cucumbers) present on the reef flat; and Dr. Masashi Yamaguchi, Marine Laboratory, University of Guam, identified the scleractinian corals collected from the area.

GENERAL DESCRIPTION OF REEF ZONES

Shoreline

The beach from Achu Point to just south of Falcona Beach is roughly 10-15 m wide, extending from the dense vegetation zone down a 30° slope to the ocean. The beach is composed mostly of unconsolidated bioclastic deposits of mollusc shells, foraminifera tests, and coral sand, similar to that described by Jones and Randall (1973) for an unconsolidated beach. The shoreline is interrupted by two small rocky headlands between Uruno Point and Falcona Beach. Remnant patches of raised limestone are also scattered along the shore.

Inner Reef Flat

The inner reef flat is roughly 10-15 m wide and consists of bioclastic beach deposits, mostly *Acropora* rubble, mollusc shells, foraminifera, and coral sand. The moat system is shallow, between 1-1.5 m deep and poorly developed. There are numerous small freshwater rivulets, especially noticeable at low tide, running from the shore and rocky headlands into the moat and there is an apparent layer of freshwater on the surface in many places.

Outer Reef Flat

The outer reef flat varies from 50 m to 160 m wide and has numerous scattered patches of exposed limestone. In deeper areas the substrate is covered by the staghorn coral, *Acropora* *hebes*. This coral forms dense, flat-topped thickets which grow upward to the low tide line and comprise the principal structure on the outer reef flat. Additionally, massive *Porites* microtolls can be found in the deeper pools and are scattered along the reef flat. There are large deposits of broken

Acropora branches and other coral debris creating small patches of sand-rubble substrata.

Randall and Holloman (1974) provides a general description of the reef flat and offshore zones.

"A narrow cuesta-type of algal ridge forms an elevated hummocky region at the reef margin. This ridge is solid and massive and is cut by short shallow surge channels. There is no room-and-pillar development at the reef margin and reef front zone comparable to that found on the southeast side of Ritidian Channel. The reef front is cut by a groove-and-spur system along most of the section, although at some locations considerable development of coral-algal knobs and bosses is taking place on the upper surfaces of spurs. The reef front appears to be somewhat in equilibrium as far as outward growth and erosion are concerned. The 55-foot submarine terrace is present along most of the section, but it is narrow and irregular. At some places there seem to be relic features such as grooves and channels at the seaward margin of the terrace which resemble a sunken reef-margin system.

The outer part of the reef front, submarine terrace, and seaward slope zone was heavily infested by Acanthaster planci in 1969 along this entire sector. Most of the reef-building corals were killed in all three fringing reef zones as a result of predation by

these starfish. Wave and surf action prevented intensive starfish damage in the reef margin and inner part of the reef front zones. Rich coral growth is more or less restricted to this narrow wave-assaulted region at the present time. Recent surveys show that recolonization of the dead coralla surface by calcareous red algae in the reef front zone has maintained the structural integrity of the colonies. New coral growth from planula settlement and small patches which survived the initial starfish predation was also evident in the affected zones during this survey."

METHODOLOGY

Water Circulation Studies

In an effort to obtain a general idea of the water movements over the reef flat and the current patterns off-shore, dye and drogue studies were conducted in the study area. Fluorescein dye was released over the inner and outer reef flat zones along each of the four reef flat transects (Fig. 2) during periods of high tide (April 5) and low tide (April 10). The water was flooding from 1.5 to 1.0 feet during the high tide study and ebbing from about .9 to .5 feet during the low tide study. The velocity of the water movement was obtained by measuring the dye patch movement per unit time (m/sec.) and the direction relative to shore was recorded. The speed and direction of the wind during each drop was also recorded.

The original proposal for the off-shore current studies was to carry out 24-hour drogue studies at two sites - one station north of Urano Point and the other station south of the Point. However, we were forced to resort to an alternative plan of only conducting studies during the daylight hours on two days, April 11 (0830-1700) and 12 (0930-1700). The uncompleted status of our negotiations (March 7-8) with the contractors, heavy seas (April 4-5), and the lack of a larger boat for overnight studies (April 11-12) forced us to carry out the alternative plan.

Thus, on April 11-12, pairs of drogues (1 m and 5 m) were cast at each of two stations both marked by buoys. Station 1 was located north of Urano Point about 130 m from the reef margin, while Station 2 was located south of the Point about 170 m from the reef margin.

Both stations were located in water over 20 feet deep. The direction and the distance traveled by the drogues were recorded each hour. In most cases, the pair of drogues were left to drift for two hours and then recast at their respective stations. Wind speed and direction were also recorded.

Biological Studies

Transects (Fig. 2) were established along the reef flat and off-shore to facilitate quantitative study of corals, algae, and holothurians and to provide a metered line for bottom profiles (Figs. 3-4).

The reef flat transects (1-4) were located perpendicular to shore and extended 70-80 m toward the reef margin. The selection of the transect sites was based on a desire to access the reef flat at potential marina and swimming areas; therefore, obstructed zones and rocky headlands were deliberately avoided.

The offshore transects, 5 & 6, were located perpendicular to the 60 foot terrace edge and extending 100 m toward the margin. The sites were chosen to provide data from both the more exposed windward reef north of Urano Point and the more protected reef south of the Point.

In addition the transects were used as a guide for the bottom profiles (Fig. 2).

Algae

The macroalgal community was quantified by a modified point method (Smith, 1972) utilizing a 25 cm x 20 cm quadrat randomly tossed 10 times in the inner reef flat, the outer reef flat and the reef margin. These tosses were made along Transects 1-4. The reef margin, however, was only sampled on Transects 1 and 2. Twenty-five tosses

were made along the reef terrace, two per every 10 m distance.

The quadrat frame was divided into a grid of 25 squares, each 5 cm x 5 cm, providing 16 interior "points" where the grid lines intersected. Each algal species was recorded at every "point" it occurred. If no alga was found under any of the "points" then whatever was present, e.g., sand, live coral, dead coral, was recorded. From this data, relative abundance and frequency were calculated for each species in their respective zones and transects. The percent algal cover in relationship to the amount of sand, live coral and dead coral, was calculated by considering every item recorded for all "points".

$$\text{Relative Abundance} = \frac{\text{No. of Points per Species}}{\text{No. of Points all Species}} \times 100$$

$$\text{Frequency} = \frac{\text{No. of Tosses a Particular Species Occurred}}{\text{Total No. of Tosses}} \times 100$$

All algal species seen in the various zones, i.e., inner reef flat, outer reef flat, reef margin, reef front, reef terrace and reef slope, were recorded.

Corals

Ten random tosses utilizing a 50 cm x 50 cm quadrat were made in the inner reef flat and the outer reef flat on all four reef flat transects. The modified point methods, similar to that used in the algal study, was used to obtain relative abundance, frequency, and percent coverage. This method differs from that used for quantifying the reef terrace corals because corals are more widely distributed on the reef flat and the point quarter method would not be practical.

The point quarter method (Cottam et al., 1953) was used in quantifying the corals on Transects 5 & 6 on the reef terrace. A series of points, 10 m

apart, were selected from the transect line and the area around each transect was divided into four equal quadrants. The coral nearest the transect point in each quadrant was located and its specific or generic name, diameter, and the distance from the center of the corallum to the transect point was recorded. Total coral density, frequency, and relative density were then determined from the above data.

$$\text{Total Density of All Species} = \frac{\text{Unit area}}{(\text{mean point-to-coral distance})^2}$$

$$\text{Relative Density} = \frac{\text{individuals of a species}}{\text{total individuals of all species}} \times 100$$

$$\text{Frequency} = \frac{\text{number of points at which species occurs}}{\text{total number of points sampled}} \times 100$$

In addition, a general collection of corals was made from the zones in the study area.

Fishes

Fishes were surveyed at three areas along the reef flat (Transects 1, 2, and 4). Two environmental zones, the inner reef flat with a substrate made up of sand with scattered limestone boulders and the outer reef flat with a substrate of limestone pavement and Acropora beds, were separately inventoried. Surveys were made by snorkeling in a meandering pattern for about 15 minutes through the zone under investigation.

RESULTS AND DISCUSSION

Water Circulation Studies

Reef Flat Water Movement

The dye studies carried out during high tide showed a northeasterly movement, parallel to shore (Figs. 6-9) at all transects. The inner reef flat zones showed stronger movement at Transects 1, 2, and 4. Water movement over the inner and outer reef flats at Transect 3 was relatively similar, with movement over the outer reef flat slightly faster. The dye at Transect 4 moved northeasterly and then exited at a rocky headland approximately 200 m northeast of the drop site. This outcrop diverts the water and is hazardous, especially during high tide, when volume transport is greatest.

The dye studies on April 5 were conducted during high surfs (5-7 feet) causing high turbulence which, in turn, increased the rate of water movement. In general, the dye studies indicate strong along shore movement, especially during high tides and heavy surf, creating hazardous swimming conditions as close as 30 feet from shore.

The low tide dye studies (Figs. 10-13) showed considerably less movement than during high tides. There was no movement of water at Transect 1 and the dye was visible for over one hour. With the exception of the dye patch dropped at Transect 2, water moved in a northeasterly direction parallel to shore. At Transect 2, the water moved in a southerly direction towards shore. The slow movement is primarily caused by the minimal drainage during low tides when extensive sections of the reef are exposed.

Offshore Currents

Drogue studies were conducted 1, 3, and 5 miles north of Ritidian Point by the Navy Oceanographic Office (Huddell et al., 1974) on February 24, 1971 and August 26, 1971. They state that "During February surface currents appeared to be relatively weaker; no movement at all was observed 5 miles (8 km) north of the point. Currents within a mile of Ritidian Point showed a more easterly component during both winter and summer than the currents further from shore. Surface currents north of Ritidian Point flowed against the prevailing winds and opposite to the North Equatorial Current as shown in both the current meter data and drogue tracking".

Our offshore current studied (Figs. 14 and 15) indicate a general southwesterly flow except for the morning drogues which moved north from both stations on the two days. Most drogues in our study were affected by the wind. The more protected location of Station 2 (south of Urano Point) probably accounts for the slower movement of these drogues as opposed to the northern drogues which moved in excess of 1 knot in one instance. None of the drogues ran aground on the reef, however, those from Station 1 traveled closely parallel to the reef margin.

The prevalent southwesterly trend follows the theory (Emery, 1962) that the North Equatorial Current splits northeast of Guam and continues south along the eastern and western sides to converge southwest of Guam. However, the Navy's study at Ritidian seems to contradict this.

In trying to correlate the peculiar northerly drifts with the tidal cycle (since the drogues were moving against the prevailing wind),

it appears that this northerly current exists approximately four hours out-of-phase with the tidal cycle. Our study included the hours when the tide was at its lowest point (Fig. 16). Further current studies should be made to include the hours when the tide is at its peak to see if a northerly current develops.

Water Movement At 50 Feet Depth

Dye was released in 50 feet of water at both Stations 5 and 6. The dye patch on Transect 5 moved seaward and diffused down the reef slope, while the dye patch on Transect 6 moved inshore toward the reef margin.

Biological Studies

Table 1 lists the 56 species of marine benthic algae, thus far, collected or observed in the six reef zones at the Uruno Point study area. This listing must be considered preliminary since collections and observations were carried out on only four days. Table 2 presents the relative abundance, frequency, and algal cover of the predominant algae in four - inner reef flat, outer reef flat, reef margin, and reef terrace-of the six reef zones.

The dominant algae on the inner reef flat are Cladophoropsis membranacea, Jania capillacea, Gelidiella acerosa, and Jania capillacea; the dominant algae on the outer reef flat are Microdictyon okamurai, Boodlea composita, and Polysiphonia sp. Turbinaria ornata is the obvious algae on the reef margin which is comprised predominantly of Porolithon onkodes. In those areas of the reef which possesses a distinctly raised reef margin, a golden-colored species of Gelidium is dominant.

The reef front is dominated by the larger algae, e.g., Halymenia durvillaei, Galaxaura oblongata, and Galaxaura marginata. Tolypiocladia glomerulata is the dominant alga on the reef terrace along both Transects 5 and 6. Halimeda discoidea is distributed sparsely on the reef slope which is covered with coralline algae.

When the benthic algae are considered as a whole, the turf community is by far the most dominant and seem to be in ample abundance to serve as food for the herbivorous fish population on the reef terrace.

Corals

Table 3 lists the species of corals collected or observed in three reef zones at the Uruno Point study area. The list is not complete since only three of the six reef zones were sampled. Table 4 shows the relative abundance, frequency and percent coverage for the inner and outer reef flat corals and Table 5 presents the relative density, frequency, and total density for the reef terrace corals.

Small branches of Acropora hebes and a few small Porites colonies comprise most of the living coral in the inner reef flat. This zone is mostly rubble and sand. The dominant coral on the outer reef flat is Acropora hebes where colonies form extensive thickets. The other more common species are Goniastrea retiformis, Pocillopora damicornis, and Psammocora contigua. The flat elevated limestone areas were devoid of coral and are mostly a sand-algal cover.

The reef terrace is sparsely populated with live coral. The predominant coral is an encrusting Montipora conicula. Another encrusting form, Montipora tuberculosa is also common. These two corals form broad encrusting patches on the substrata and are vividly colored

blue and red in their natural state. Other common corals are Favia pallida, Platygyra rustica, Porites lichen, and Pocillopora sp.

The reef terrace experienced heavy Acanthaster planci predation (Chesher 1969, Tsuda, 1971) and numerous dead coral colonies are evident.

Fishes

The reef flat area of Uruno Point contains a varied assemblage of typical tropical reef fish species (Table 6). Tourist-oriented development in this area should take advantage of this very accessible "natural aquarium" by preserving it for the enjoyment of snorklers and divers. The opportunity to observe such colorful fishes as the butterflyfishes (Chaetodontidae), damselfishes (Pomacentridae), surgeonfishes (Acanthuridae) and triggerfishes (Rhinecanthus rectangulus), the well-known "humuhumu-nukunuku-a-pua'a" of Hawaii in their natural setting could develop into a considerable tourist attraction.

Holothurians

Table 7 includes a list of the holothurians found in the study area. Holothuria (Halodeima) atra is the dominant holothurian of the inner reef flat. It is typically found on, but not restricted to, sandy areas. The second most visually dominant holothurian is Stichopus chloronotus, which seems to be more abundant here than on other reef flats. S. chloronotus is restricted to solid substrates and is generally more abundant in the outer reef flat.

The relatively inconspicuous Holothuria (Platyperona) difficilis was found associated with thickets of dead Acropora hebes in the outer

reef flat of Transect 3. In these areas it is the most numerous holothurian - reaching estimated concentrations of over 75 individuals per 10 m². Precise counts were not possible at the time of the survey, however, these holothurians are quite interesting in that their distribution seemed very distinct (Figs. 17 and 18). This may indicate narrow habitat requirements for this organism.

Bohadschia bivittata and B. aros are present in moderate numbers in the sandy areas. These species are notable for their irritability and habit of releasing sticky cuvarian organs at the slightest disturbance. This has been known to cause annoyance to swimmers and waders. Actinopyga echinites and the large Holothuria (Microthcle) nobilis are also present in moderate numbers.

Finally, one specimen each of Holothuria (S. perothuria) cinerascens and Holothuria (Thymiosycia) hilla were collected. Notably, no synaptids were seen. These are common on reefs elsewhere on Guam.

Other Macroinvertebrates

A checklist of the other common macroinvertebrates can be found in Table 7.

CONCLUSIONS

The reef flat of the study area does not have an extensive moat system nor did we notice any exceptionally deep areas. The deepest water is within 35 meters of shore and averages 4-5 feet at MHHW. Dye studies indicate strong reef flat currents during high tides and especially when influenced by high surf. At such times, swimming would be hazardous.

The outer reef flat is not particularly rich in coral growth and snorkelling would be possible only at high tide when conditions are hazardous. Additionally, no broad sandy areas were noted and the substrate has much coral debris, thus requiring footwear for snorkellers or reef walking.

There are no natural coves in the study area and a marina is not feasible without extensive dredging of the reef flat and construction of a retaining wall for added protection.

The offshore current studies showed a consistent west southwest drift with the notable exception of a northerly drift for morning drogues. Drogues from Station 1 moved faster probably due to their more exposed location and were greatly influenced by the wind.

The water directly off Uruno Point is considerably rougher than north toward Achae Point or south to Falcona Beach. We believe currents sweeping down from the north are forced offshore at Uruno Point.

The reef structure between areas north and south of Uruno Point are markedly different. The northern (Transect 5) reef terrace is considerably narrower than that of the south and the reef front is

characterized mostly by a groove and spur development. The southern reef terrace (Transect 6) is broad and has numerous wide surge channels and is pocketed with coves and steep pinnacles providing beautiful SCUBA diving. Underwater trails would be ideal here.

Dye patches released at 50 foot depth on the terrace of both stations also differed. Station 1 dye patch moved seaward and diffused down the reef slope while dye from Station 2 moved directly shoreward.

The Uruno Point study area includes the most extensive stretch of undisturbed beach on Guam. Because the area has been inaccessible in the past it retains a virtually undisturbed environment and any alteration must be carefully evaluated to ensure minimal changes to its natural beauty.

RECOMMENDATIONS

A candidate environmental impact survey of the marine environment conducted within a 30-day period is obviously piecemeal since it does not consider the seasonal variation of the organisms and the variable current patterns during a yearly cycle. Thus, the following recommendations which are the results of discussions among project participants must be accepted with caution.

1. If swimming holes must be dredged, they should be located in the deeper moat areas of the inner reef flat within 30 to 40 m from shore. Although the dye studies on the inner reef of the southern side of Urano Point show greater water movement, these swimming holes should be situated on this more protected side. When the exact locations of the swimming holes are pinpointed, further dye studies should be carried out at each side.
2. It is not feasible to construct a marina on the reef flat. The construction of an inland marina connected by a channel through the reef flat is the better alternative. This again should be located south of Urano Point as tentatively planned.
3. Based on the limited offshore current studies, the most suitable location to release the sewage effluent seems to be directly off Urano Point. We further recommend that the effluent be released through multiple diffusers on the reef slope which lies in about 60 feet of water.

Engineering studies will no doubt cite this depth as too excessive if the sewerage is to be secondarily treated. However, a safety measure must be included in case the treatment plant malfunctions, thus, by-passing raw sewage into the nearshore waters. Further drogue studies must be carried out over the reef slope directly off Urano Point at different times of year.

4. Rigorous control over exploitation of reef resources, e.g., fishes, lobsters, and shells, must be established to preserve the natural environment since easy access to this once relatively inaccessible area will be provided if this Resort Development becomes a reality. These controls should not be enforced on those traditional fishermen who have always fished in this area.

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Table 1. Checklist of marine algae recorded from the Bruno Point study area.

Species	Inner		Outer		Reef Margin	Reef Front	Reef Terrace	Reef Slope
	Reef Flat	Flat	Reef Flat	Flat				
CYANOPHYTA (blue-green algae) - 3 spp.								
<u>Microcoleus lyngbyaceus</u> (Kütz.) Crouan			X			X	X	X
<u>Schizothrix calcicola</u> (Ag.) Gomont	X		X		X	X	X	X
<u>Schizothrix mexicana</u> Gomont			X		X			
CHLOROPHYTA (green algae) - 20 spp.								
<u>Boergesenia forbesii</u> (Harv.) Feldmann	X		X					
<u>Boodicia coarctata</u> (Harv.) Grand	X		X			X		
<u>Caulerpa antioensis</u> Yanada	X		X					
<u>Caulerpa racemosa</u> (Forsk.) J. Ag.	X		X		X			
<u>Caulerpa verticillata</u> (Forsk.) J. Ag.	X		X		X			
<u>Chlorodesmus fastigiatum</u> (C. Ag.) Ducker	X		X		X			
<u>Cladophora moniliformis</u> (Ag.) Boerg.	X		X					
<u>Dictyota fragilis</u> (Forsk.) Boerg.	X		X			X	X	
<u>Enteromorpha flexilis</u> (W. V. Bosse)	X		X					
<u>Enteromorpha linzhai</u> (Forsk.) Ag.	X		X					
<u>Halimeda capillaris</u> (Forsk.) Ag.								X
<u>Halimeda discoidea</u> (Forsk.) Ag.					X		X	X
<u>Halimeda incrassata</u> (Forsk.) Lamx.					X		X	X
<u>Halimeda pinnatifida</u> (Forsk.) Lamx.					X		X	X
<u>Neomeris amplexans</u> (Forsk.) Setch.	X		X					
<u>Neomeris vanderzeei</u> (Forsk.) Setch.	X		X					
<u>Valoniopsis boweri</u> (Martens) Boerg.	X		X					
<u>Valoniopsis boweri</u> (Martens) Boerg.	X		X					
PHAEOPHYTA (brown algae) - 10 spp.								
<u>Dictyota bartschii</u> Lamx.	X							
<u>Dictyota friabilis</u> Setch.						X	X	X
<u>Feldmannia</u> (Forsk.) Lamx.								

Table 2. Relative abundance (RA) and frequency (F) of the benthic algae quantified on the inner reef flat, outer reef flat, reef margin, and reef terrace based on six transects at the Uruno Point study area. See Fig. 2 for locations of Transects 1 - 6.

Species	Transects							
	1		2		3		4	
	RA	F	RA	F	RA	F	RA	F
<u>INNER REEF FLAT</u>								
<u>CYANOPHYTA</u>								
<u>Schizothrix calcicola</u>					5	20		
<u>CHLOROPHYTA</u>								
<u>Borgesenia forbesii</u>							23	70
<u>Caulerpa antoensis</u>					19	40	14	30
<u>Caulerpa serrulata</u>	10	30	5	20	5	10		
<u>Cladophoropsis membranacea</u>	20	20					5	20
<u>Enteromorpha clatirata</u>	6	10						
<u>Halimeda cruentia</u>	12	30	4	20			7	20
<u>Microdictyon okamurai</u>	4	20						
<u>Monomeris vanbrosseae</u>					1	10		
<u>Valonia aegagropila</u>	8	40	1	10				
<u>PHAEOPHYTA</u>								
<u>Lobophora variegata</u>	4	20	16	60	1	10		
<u>Padina minor</u>							1	10
<u>Palisia pandensis</u>							1	10
<u>Turbinaria ornata</u>	4	30			1	10		
<u>RHODOPHYTA</u>								
<u>Galaxaura oblongata</u>					1	10	10	30
<u>Gelidium acerosa</u>			4	20	65	80		
<u>Gelidium pusillum</u>							3	20
<u>Jania capillacea</u>	14	50	61	60			30	60
<u>Polysiphonia sp.</u>	6	10	4	20	2	10		
<u>Porolithon onkodes</u>	12	60	6	40			6	30
Algal Cover (%)	48		53		63		80	

Table 2. (continued)

Species	Transects							
	1		2		3		4	
	RA	F	RA	F	RA	F	RA	F
<u>OUTER REEF FLAT</u>								
<u>CYANOPHYTA</u>								
<u>Schizothrix calcicola</u>	1	10			9	30		
<u>CHLOROPHYTA</u>								
<u>Borgesenia forbesii</u>					1	10		
<u>Codium composita</u>					14	30		
<u>Caulerpa antoensis</u>	1	10			5	10	24	40
<u>Caulerpa serrulata</u>	7	30	6	20				
<u>Cladophoropsis membranacea</u>	8	40	3	20			23	20
<u>Halimeda cruentia</u>	6	40	2	20	12	40	4	10
<u>Microdictyon okamurai</u>	56	100	41				18	40
<u>Monomeris vanbrosseae</u>					2	20		
<u>Valonia aegagropila</u>	4	30	3	40				
<u>PHAEOPHYTA</u>								
<u>Padina minor</u>							2	20
<u>Turbinaria ornata</u>	2	70	2	20				
<u>RHODOPHYTA</u>								
<u>Gelidium acerosa</u>			22	60	20	30	9	20
<u>Gelidium pusillum</u>	2	20					6	10
<u>Jania capillacea</u>			19	50			10	20
<u>Polysiphonia sp.</u>					37	50		
<u>Porolithon onkodes</u>	3	30	2	30			4	30
Algal Cover (%)	63		81		69		73	

Table 2. (continued)

Species	Transects			
	1		2	
	RA	F	RA	F
<u>REEF MARGIN</u>				
CYANOPHYTA				
<u>Schizothrix calcicola</u>	9	10		
<u>Schizothrix mexicana</u>			1	10
CHLOROPHYTA				
<u>Caulerpa serrulata</u>	3	20		
<u>Halimeda opuntia</u>			5	20
<u>Microdictyon okamurai</u>			19	60
PHAEOPHYTA				
<u>L. Bonphora variegata</u>			1	10
<u>Turbinaria ornata</u>	65	80	13	60
RHODOPHYTA				
<u>Gelidium acerosa</u>			3	10
<u>Gelidium intricata</u>			7	20
<u>Jania capillacea</u>	18	40	15	20
<u>Polysiphonia sp.</u>			33	40
<u>Porolithon onkodes</u>	5	30	2	20
Algal Cover (%)	71		61	

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Table 2. (continued)

Species	Transects			
	5		6	
	RA	F	RA	F
<u>REEF TERRACE</u>				
CYANOPHYTA				
<u>Microcoleus lyngbyaceus</u>	6	32	12	41
<u>Schizothrix calcicola</u>	2	4	2	4
CHLOROPHYTA				
<u>Caulerpa antoensis</u>			2	9
<u>Caulerpa racemosa</u>			<1	4
<u>Dictyota striata cavernosa</u>	2	18	<1	4
<u>Dictyota striata versluysii</u>	1	9	2	4
<u>Halimeda discoida</u>			1	9
<u>Halimeda armulata</u>			<1	4
<u>Halimeda vahbosseae</u>			1	4
PHAEOPHYTA				
<u>Dictyota friabilis</u>	5	36	5	23
<u>Feldmannia radicata</u>			<1	4
<u>Leptoglossum variegata</u>	16	54	6	27
<u>Polysiphonia sp.</u>	1	9	1	9
<u>Sargassum tribuloides</u>	6	18		
RHODOPHYTA				
<u>Agardhiella fragilissima</u>			<1	4
<u>Clinaria sp.</u>	6	32		
<u>Galaxaura marginata</u>			2	14
<u>Gelidium coulteri</u>	6	18	11	23
<u>Jania capillacea</u>	6	36	2	9
<u>Polysiphonia sp.</u>	4	18	22	41
<u>Porolithon onkodes</u>	13	45		
<u>Polysiphonia proliferata</u>	26	50	26	45
"coralline"			4	4
Algal Cover (%)		83		72

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Table 3. Checklist of corals recorded from the Uruno Point study area.

Species	Inner Reef Flat	Outer Reef Flat	Reef Terrace
<i>Acanthastrea echinata</i> (Dana)			X
<i>Acropora abrotensis</i> (Lamarck)			X
<i>A. aspera</i> (Dana)		X	
<i>A. hebes</i> (Dana)	X	X	
<i>A. humilis</i> (Dana)			X
<i>A. tubicinaria</i> (Dana)		X	
<i>Astropora listeri</i> (Bernard)			X
<i>A. myriophthalma</i> (Lamarck)			X
<i>Coscinarca columna</i> (Dana)			X
<i>Cyphastrea chalcidicum</i> (Forskaal)			X
<i>C. serailia</i> (Forskaal)			X
<i>Favia pallida</i> (Dana)			X
<i>F. stelligera</i> (Dana)			X
<i>Favites virens</i> (Dana)		X	
<i>Fungia fungites</i> var. <i>incisa</i> Doederlein			X
<i>Goniastrea pectinata</i> (Lamarck)			X
<i>G. retiformis</i> (Lamarck)	X	X	X
<i>Helopora coerulea</i> (Pallas)			X
<i>Leptastrea purpurea</i> (Dana)			X
<i>Leptoria phrygea</i> Ellis & Solander			X
<i>L. sp.</i>		X	
<i>Millepora dichotoma</i> Forskaal		X	
<i>M. exoeca</i> Forskaal			X
<i>M. platyphylla</i> Hemprich & Ehrenberg			X
<i>Montipora conicula</i> Wells			X
<i>M. floweri</i> Wells			X
<i>M. tuberculosa</i> (Lamarck)			X
<i>M. verrucosa</i> (Lamarck)			X
<i>Oulophyllia crispa</i> (Lamarck)			X
<i>Pavona clavus</i> (Dana)			X
<i>P. varians</i> (Verrill)		X	
<i>Platygyra rustica</i> (Dana)			X
<i>Pocillopora damicornis</i> (Linnaeus)	X	X	
<i>P. verrucosa</i> (Ellis & Solander)			X
<i>P. sp.</i>			X
<i>Porites lichen</i> (Dana)			X
<i>P. lutea</i> Milne Edwards & Haime	X	X	X
<i>Psammocora contigua</i> (Esper)	X	X	
<i>Stylophora mordax</i> (Dana)			X

Table 4. Relative abundance (RA), frequency (F) and percent coverage for the reef flat corals quantified on the inner and outer reef flat based on four transects at the Uruno Point study area. See Fig. 2 for locations of Transects 1-4.

SPECIES	TRANSECTS							
	1	2	3	4	1	2	3	4
	RA	F	RA	F	RA	F	RA	F
INNER REEF FLAT								
<i>Acropora hebes</i>			40	10	100	20	50	10
<i>Goniastrea retiformis</i>	8	10	2	10				
<i>Pocillopora damicornis</i>			20	10				
<i>Porites lutea</i>	54	20					50	10
<i>Psammocora contigua</i>	38	10	20	10				
Per Cent Coverage (%)	18		12		13		13	
OUTER REEF FLAT								
<i>Acropora aspera</i>					4	10		
<i>A. hebes</i>	79	70	52	50	78	70	28	20
<i>A. tubicinaria</i>							4	10
<i>Favites virens</i>							9	10
<i>Goniastrea retiformis</i>	13	20	40	40			18	10
<i>Leptoria sp.</i>	3	10						
<i>Millepora dichotoma</i>							14	10
<i>Pavona varians</i>					2	10		
<i>Pocillopora damicornis</i>			3	10	8	20	9	20
<i>Porites lutea</i>	3				8	10	14	10
<i>Psammocora contigua</i>	2	10	5	10			4	10
Per Cent Coverage (%)	24		26		26		14	

Table 6. Checklist of fishes recorded from the Urano Point study area. Symbols:
+ - species present; * - species made up more than 10% of total number
of fishes observed on one or more of the surveys in the indicated
environmental zone.

Species	Inner Reef Flat	Outer Reef Flat
ACANTHURIDAE		
<i>Acanthurus olivaceus</i> Bloch and Schneider		
<i>A. lineatus</i> (Linnaeus)		+
<i>A. nigrofasciatus</i> Forskaal	+	+
<i>A. triostegus</i> (Linnaeus)	+	+
<i>Urolophus</i> Bloch and Schneider	+	+
APOGONIDAE		
<i>Cheilodipterus quinquelineatus</i> Cuvier and Valenciennes	+	
BALISTIDAE		
<i>Rhinecanthus rectangulus</i> (Bloch and Schneider)		+
BLEMNIIDAE		
<i>Cirrhipectus</i> sp.	+	
BOTHIDAE		
unidentified bothid	+	
CANTHIGASTERIDAE		
<i>Canthigaster solandri</i> (Richardson)		+
CHAETODONTIDAE		
<i>Chaetodon auriga</i> Forskaal	+	+
<i>C. citrinellus</i> Cuvier	+	+
<i>C. echinatus</i> Cuvier		+
<i>C. quadrimaculatus</i> Gray		+
<i>Neaprotodon strigatus</i> (Gmelin)		+

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Table 5. Relative density (RD), frequency (F) and total density for the reef terrace corals quantified on the reef terrace based on two transects at the Urano Point study area. See Fig. 2 for locations of Transects 5 and 6.

SPECIES	TRANSECTS			
	RD	5 F	RD	6 F
<i>Acanthastrea echinata</i>	03	10	03	10
<i>Acropora abrottenoides</i>	05	20	03	10
<i>A. humilis</i>	03	10		
<i>Astropora listeri</i>	02	10	03	10
<i>A. myriophthalma</i>	02	10		
<i>Coscinarea columna</i>			02	10
<i>Favia palida</i>	12	40	02	10
<i>Goniastrea retiformis</i>	08	30		
<i>Heliopora coerulea</i>			02	10
<i>Leptastrea purpurea</i>			13	50
<i>Millepora exaesa</i>	05	10	05	20
<i>Montipora conicula</i>	20	40	37	90
<i>M. tuberculosa</i>	07	30	05	20
<i>M. verrucosa</i>	05	20	10	30
<i>Oulophyllia crispa</i>	02	10		
<i>Platygyra rustica</i>	08	30	05	10
<i>Pocillopora</i> sp.	10	30		
<i>Porites lichen</i>	08	30	10	40
TOTAL DENSITY		.15/m ²		.16/m ²

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Table 6. (continued)

Species	Inner Reef Flat	Outer Reef Flat
CIRRHITIDAE		
<u>Cirrhitus pinnulatus</u> (Bloch and Schneider)	+	+
GOBIIDAE		
<u>Elettrides strigatus</u> (Broussonet)	+	
HOLOCENTRIDAE		
<u>Adioryz</u> sp.	+	
LABRIDAE		
<u>Cirrhilabrus</u> sp.	*	*
<u>Gomphosus varius</u> Lacepede		+
<u>Halichoeres hortulanus</u> (Lacepede)		+
<u>H. melanostomus</u> Puppell	+	*
<u>H. trimaculatus</u> (Quoy and Gaimard)	*	+
<u>Pemidius fasciatus</u> (Bloch)		+
<u>H. malapterus</u> (Bloch)		+
<u>Labroides dimidiatus</u> (Cuvier and Valenciennes)		+
<u>Stethopomis axillaris</u> (Quoy and Gaimard)	+	+
<u>Thalassoma larwicki</u> (Bennett)	+	+
<u>T. purpuraceum</u> (Forsk.)		
LUTJANIDAE		
<u>Scolopsis cancellatus</u> (Cuvier and Valenciennes)		+
MUGILOIDIDAE		
<u>Parapercis cephalopunctatus</u> (Seale)	+	
MULLIDAE		
<u>Mullidichthys auriflamma</u> (Forsk.)		+
<u>M. saepepinnis</u> (Günther)		+
<u>Parupeneus picturatus</u> (Bennett)		+

Table 6. (continued)

Species	Inner Reef Flat	Outer Reef Flat
POMACENTRIDAE		
<u>Abudefduf amabilis</u> (De vis)	*	*
<u>A. dicki</u> (Liénard)		+
<u>A. glaucus</u> (Cuvier and Valenciennes)	*	*
<u>A. leucopomus</u> (Lesson)	*	*
<u>A. teleostoma</u> (Bleeker)		+
<u>A. scopas fasciatus</u> (Cuvier and Valenciennes)	+	+
<u>A. sordidus</u> (Forsk.)	+	*
<u>Chromis caeruleus</u> (Cuvier and Valenciennes)	*	*
<u>Dascyllus aruanus</u> (Linnaeus)	+	*
<u>Pomacentrus amboinensis</u> Bleeker	+	
<u>P. nigriceps</u> (Lacepede)	+	+
<u>P. vaigiensis</u> (Jordan and Seale)	+	
SCARIDAE		
<u>Xanthurus margaritatus</u> (Cartier)		+
juvenile scarid		+
unidentified scarid	+	
TETRAODONTIDAE		
<u>Arctopoma bipidus</u> (Lacepede)		+
Number of species	28	41
Total number of species observed=50		

Fig. 2. Location of Transect 1 to 6.

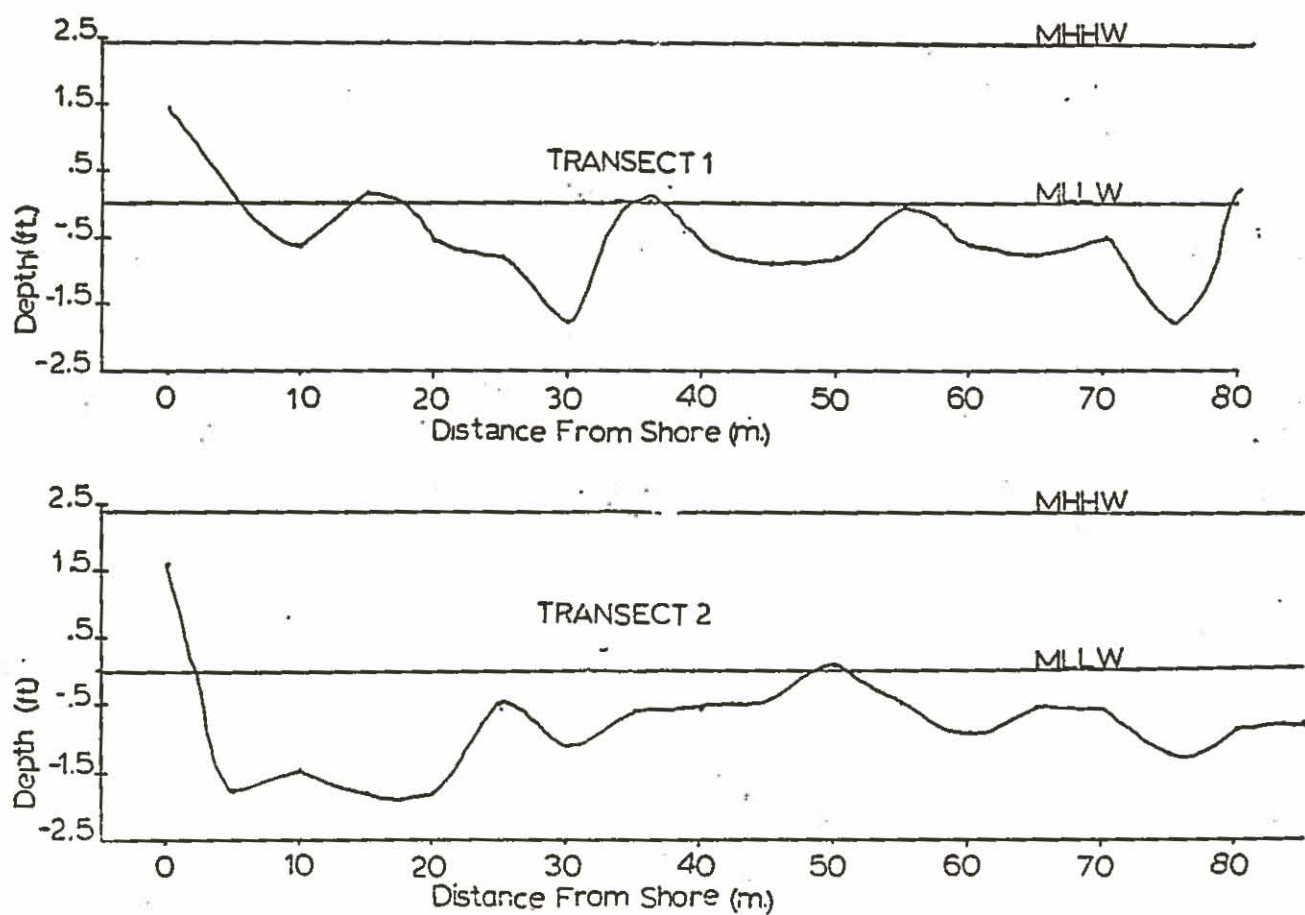
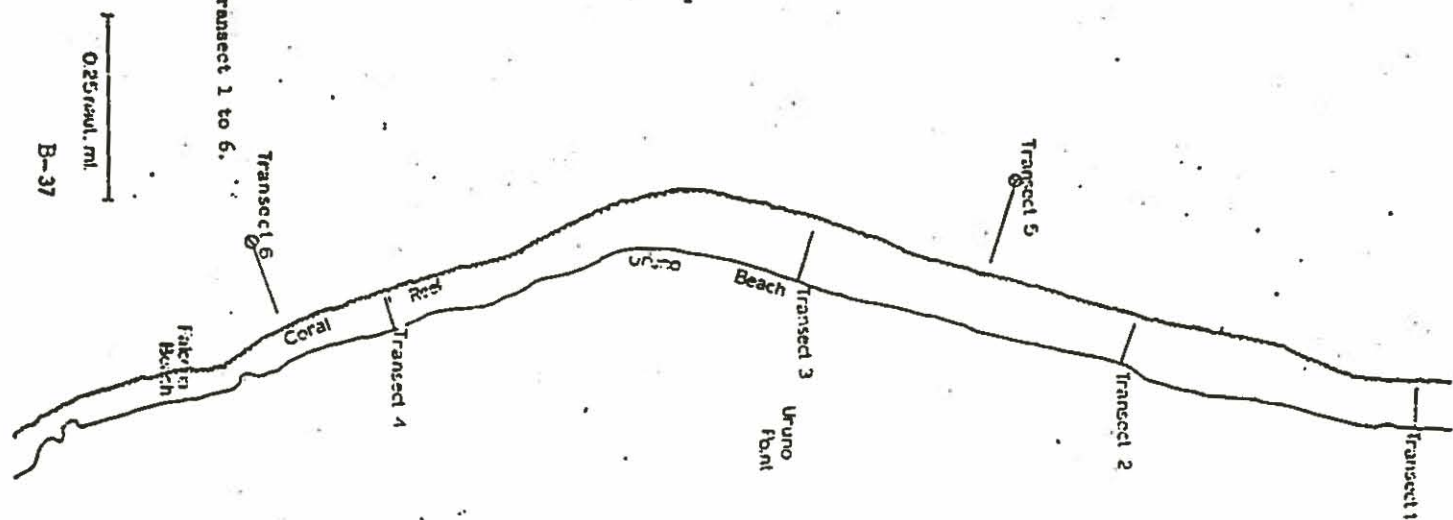


Fig. 3. Vertical profile of Transects 1 and 2 in relation to MLLW and MHHW.

B-39

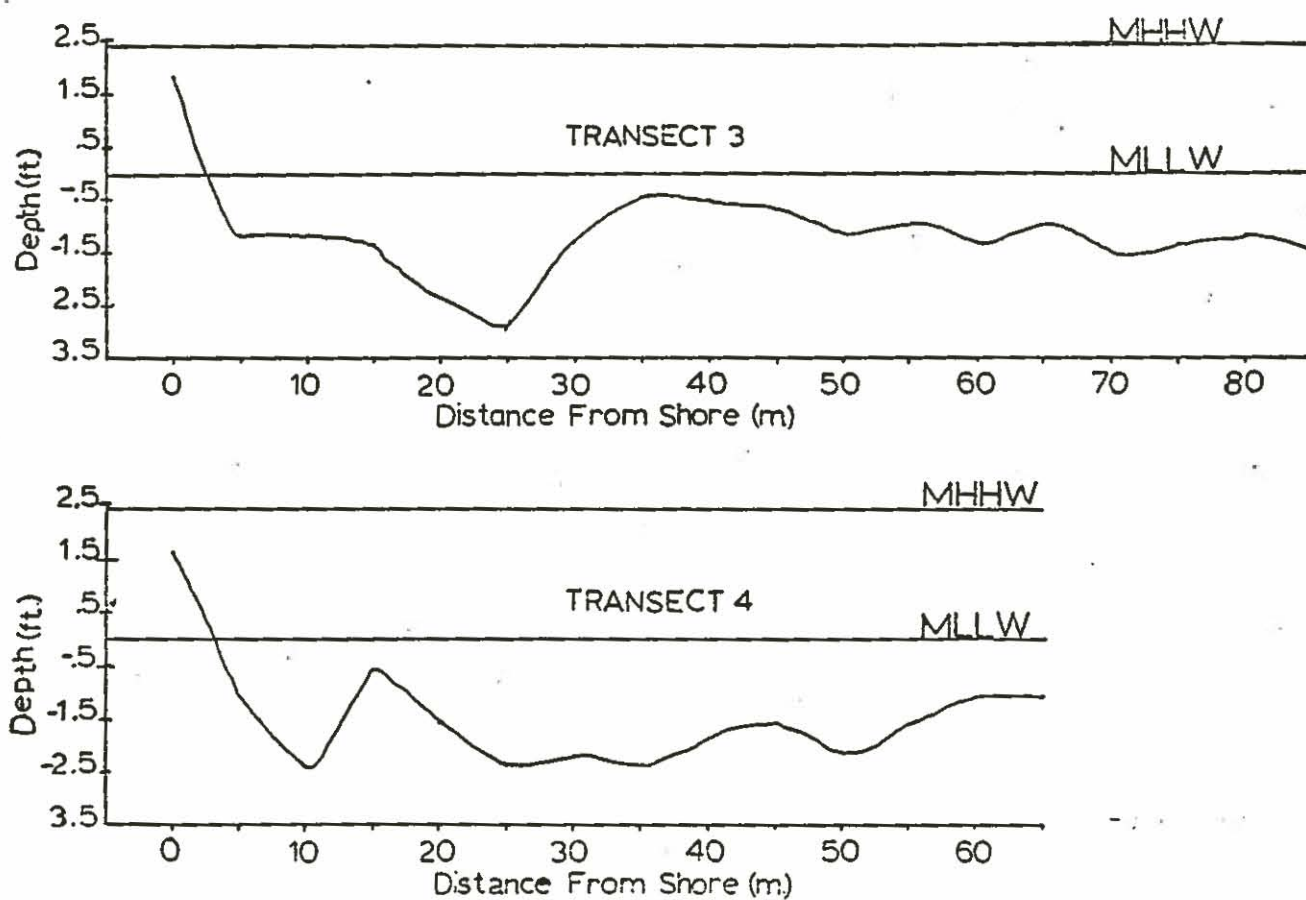


Fig. 4. Vertical profile of Transects 3 and 4 in relation to MLLW and MHHW.

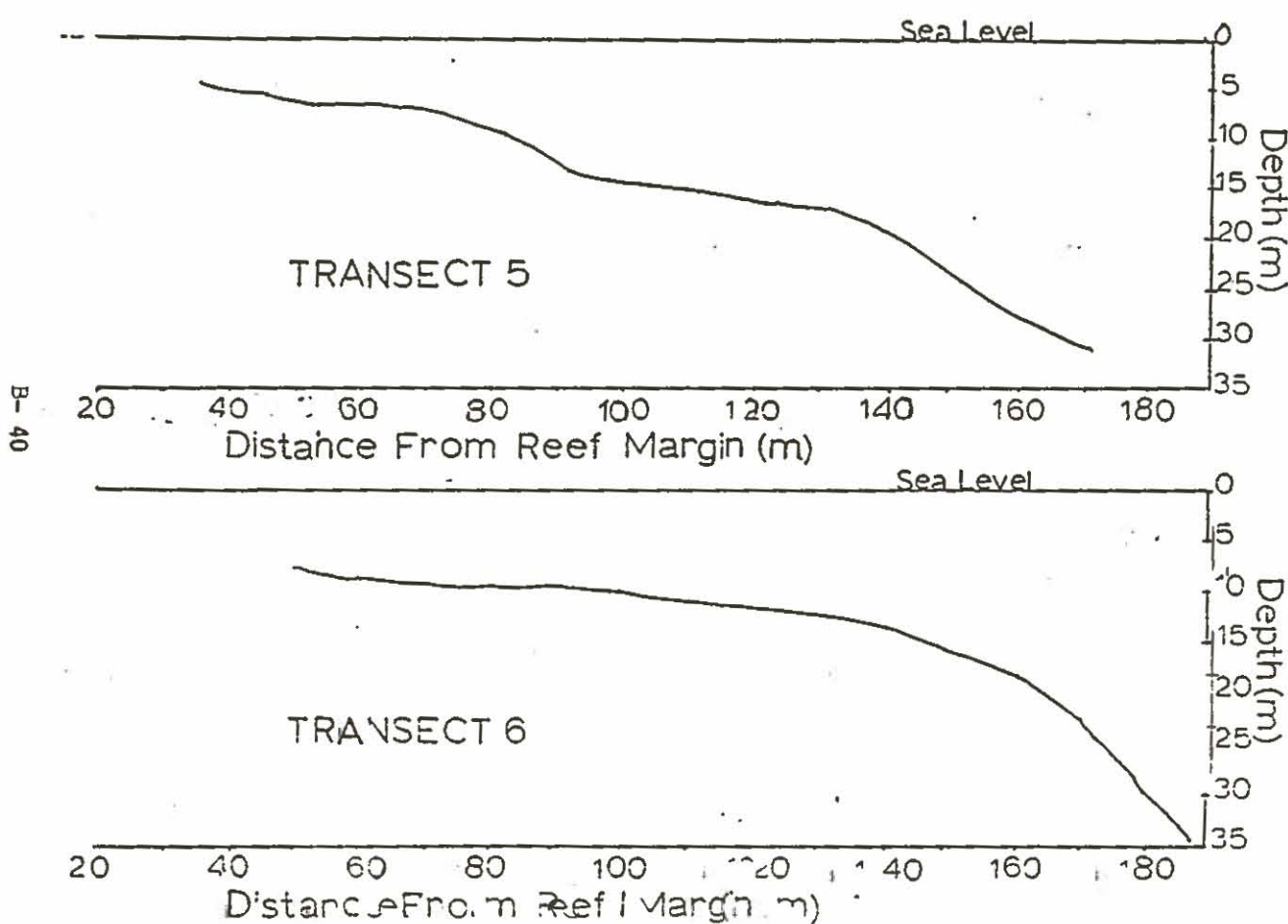


Fig. 5. Vertical profile of Transects 5 and 6 in relation to MLLW and MHHW.

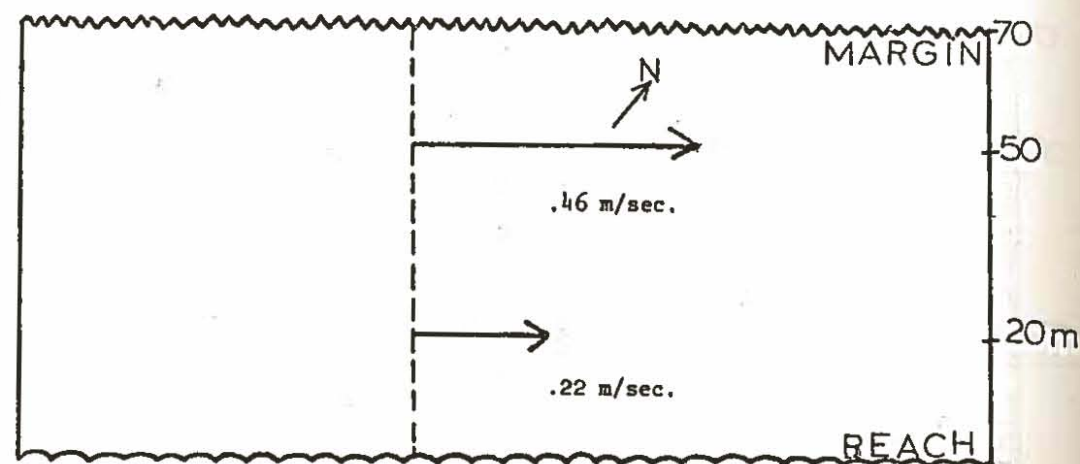


Fig. 6. Vectors indicating velocity of dye movement over inner and outer reef flat at Transect 1 during high tide. April 5, 1975; 0940. Wind 13 kts., direction 090°.

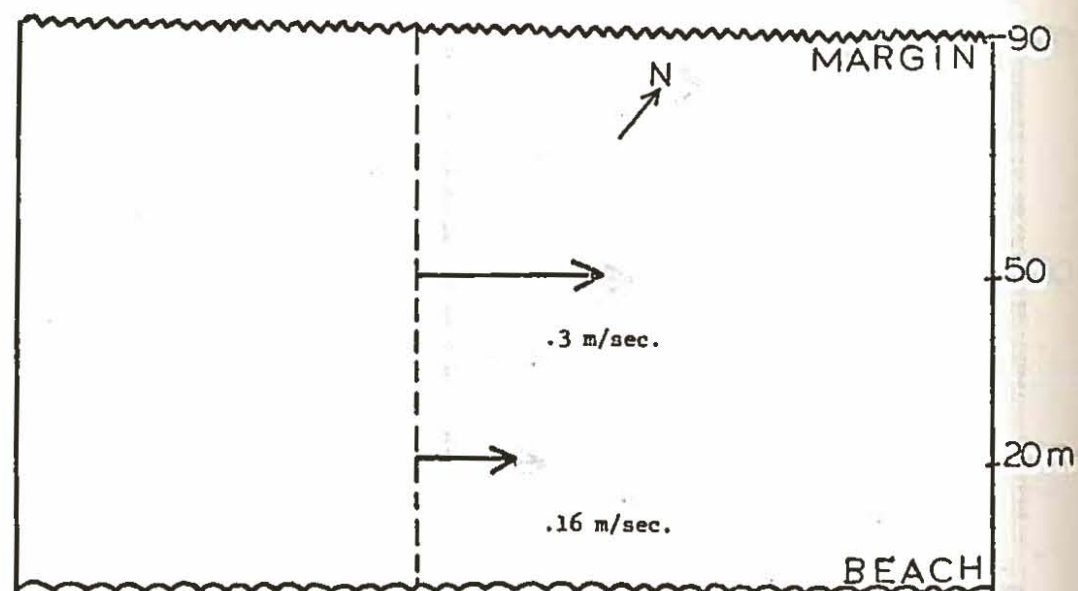


Fig. 7. Vectors indicating velocity of dye movement over inner and outer reef flat at Transect 2 during high tide. April 5, 1975; 1100. Wind 11 kts., direction 090°.

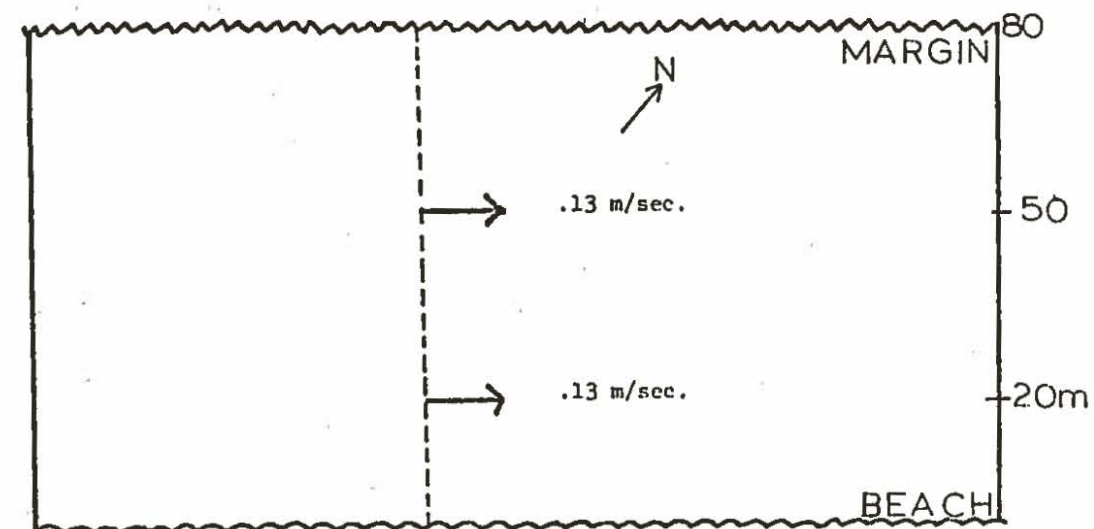


Fig. 12. Vectors indicating velocity of dye movement over inner and outer reef flat at Transect 3 during low tide. April 10, 1975; 1400. Wind 10 kts., direction 087°.

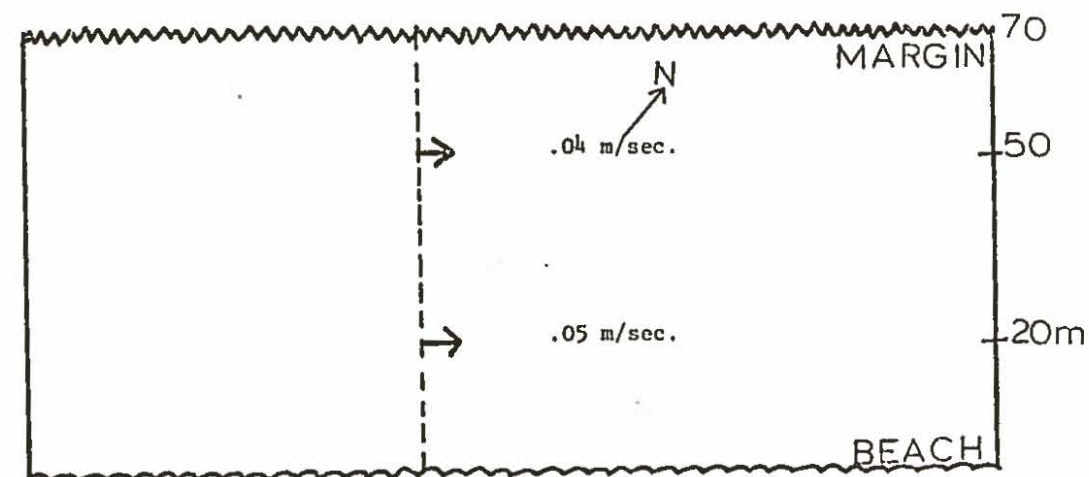
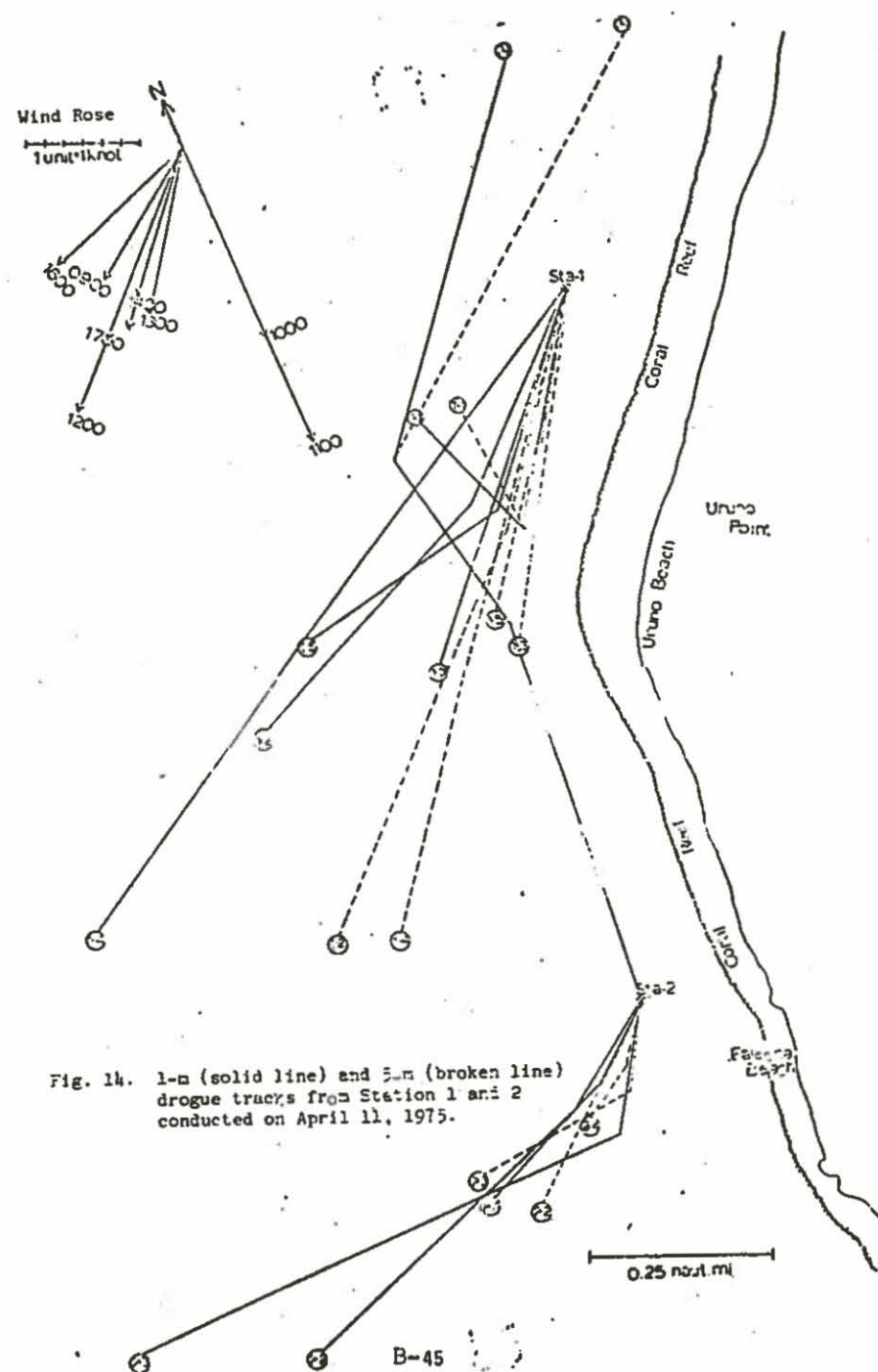


Fig. 13. Vectors indicating velocity of dye movement over inner and outer reef flat at Transect 4 during low tide. April 10, 1975; 1335. Wind 9 kts., direction 087°.



DRIFT DATA, APRIL 11, 1975

Station 1

1-meter Drogues

Drift	Start	ΔT	Distance (Naut. Mi.)	Speed (Knots)
1-1	0900	2	.55	.28
1-2	1100	2	.76	.38
1-3	1300	1	.56	.56
1-4	1400	1	1.1	1.1
1-5	1500	2	.64	.32

5-meter Drogues

1-1	0900	2	.53	.27
1-2	1100	2	.95	.48
1-3	1300	1	.5	.5
1-4	1400	1	.94	.94
1-5	1500	2	.47	.23

Station 2

1-meter Drogues

Drift	Start	ΔT	Distance (Naut. Mi.)	Speed (Knots)
2-1	0840	2.3	1.4	.6
2-2	1100	2	.66	.33
2-3	1300	2.5	.97	.39
2-4	1530	1.5	.34	.23

5-meter Drogues

2-1	0840	2.3	1.5	.64
2-2	1100	2	.32	.16
2-3	1300	2.5	.36	.14
2-4	1530	1.5	.19	.12

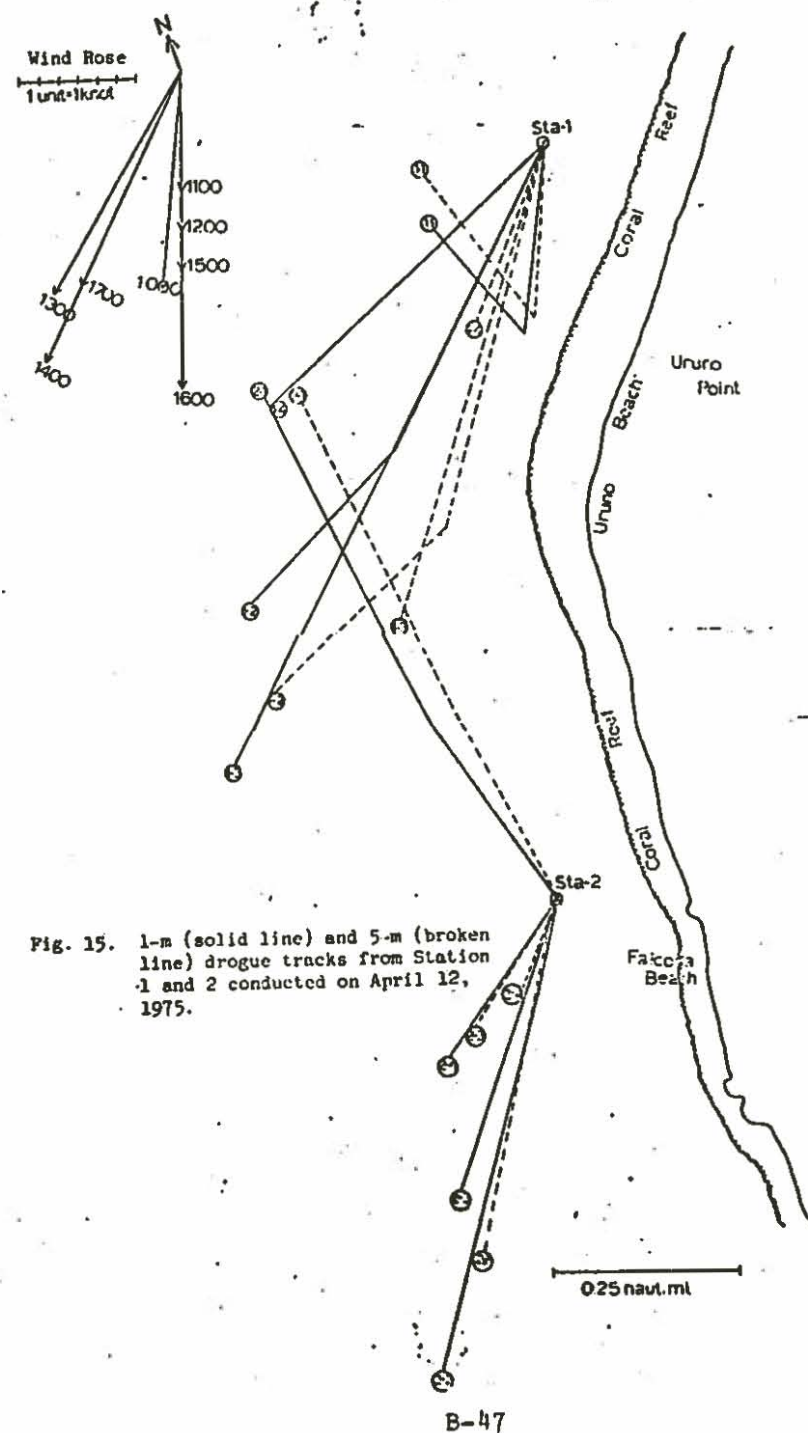


Fig. 15. 1-m (solid line) and 5-m (broken line) drogue tracks from Station 1 and 2 conducted on April 12, 1975.

DRIFT DATA, APRIL 12, 1975

Station 1

1-meter Drogues

Drift	Start	ΔT	Distance (Naut. Mi.)	Speed (Knots)
1-1	0930	2	.44	.27
1-2	1130	2	.73	.36
1-3	1400	1.25	.92	.74
1-4	1530	1.5	.52	.36

5-meter Drogues

1-1	0930	2	.47	.24
1-2	1130	2	.84	.42
1-3	1400	1.25	.66	.52
1-4	1530	1.5	.25	.17

Station 2

1-meter Drogues

Drift	Start	ΔT	Distance (Naut. Mi.)	Speed (Knots)
2-1	0930	2	.80	.40
2-2	1130	2.5	.64	.26
2-3	1400	1.5	.40	.27
2-4	1530	1.5	.26	.18

5-meter Drogues

2-1	0930	2	.76	.38
2-2	1130	2.5	.48	.20
2-3	1400	1.5	.21	.14
2-4	1530	1.5	.13	.09

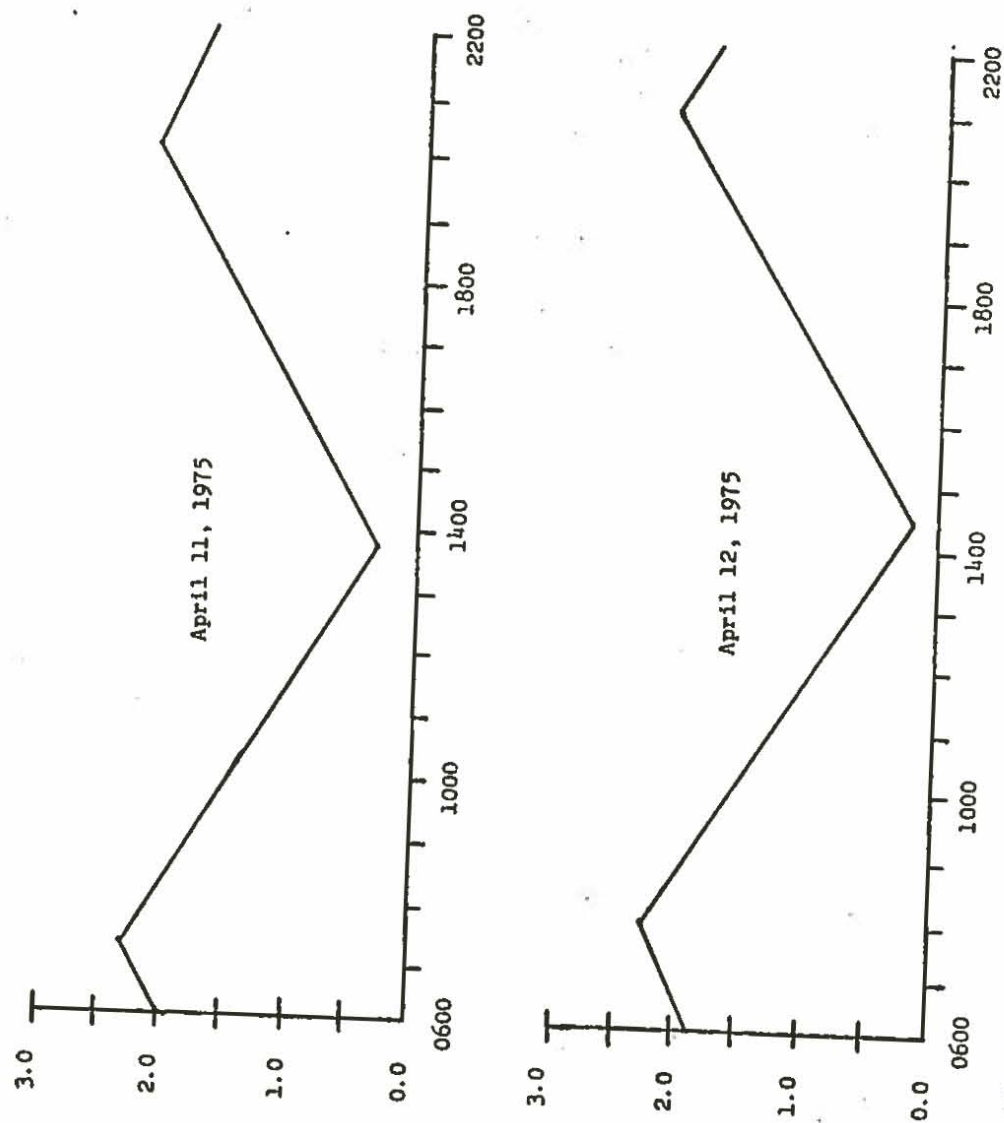


Fig. 16. Predicted tide changes between 0600 and 2200, April 11 and 12, 1975.

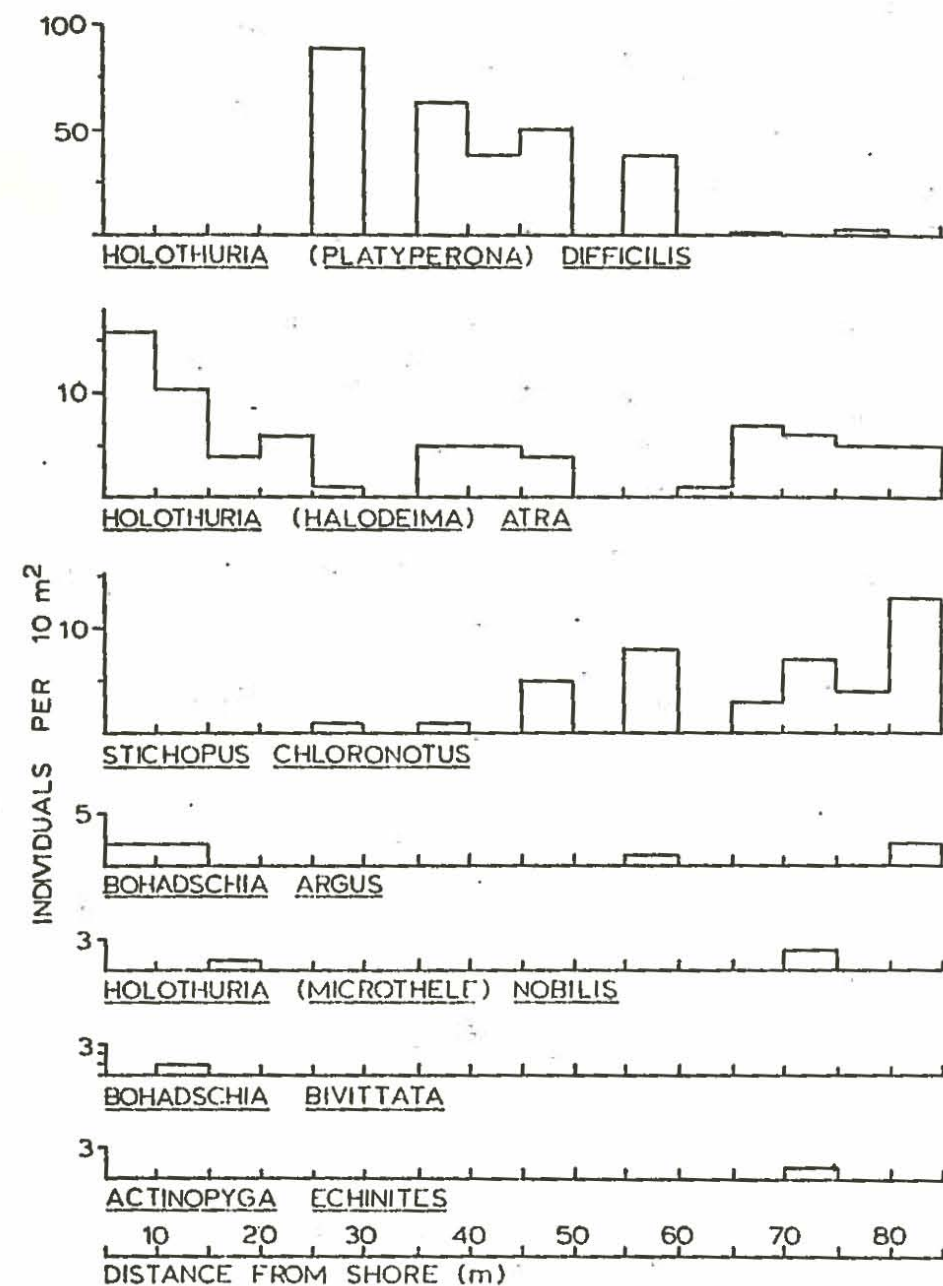


Fig. 17. Distribution of holothurian species along Transect 3. Data are numbers of individuals per 2 m x 5 m quadrat oriented with the long axis parallel to the transect. The numbers of Holothuria (Platyperona) difficilis are approximate.

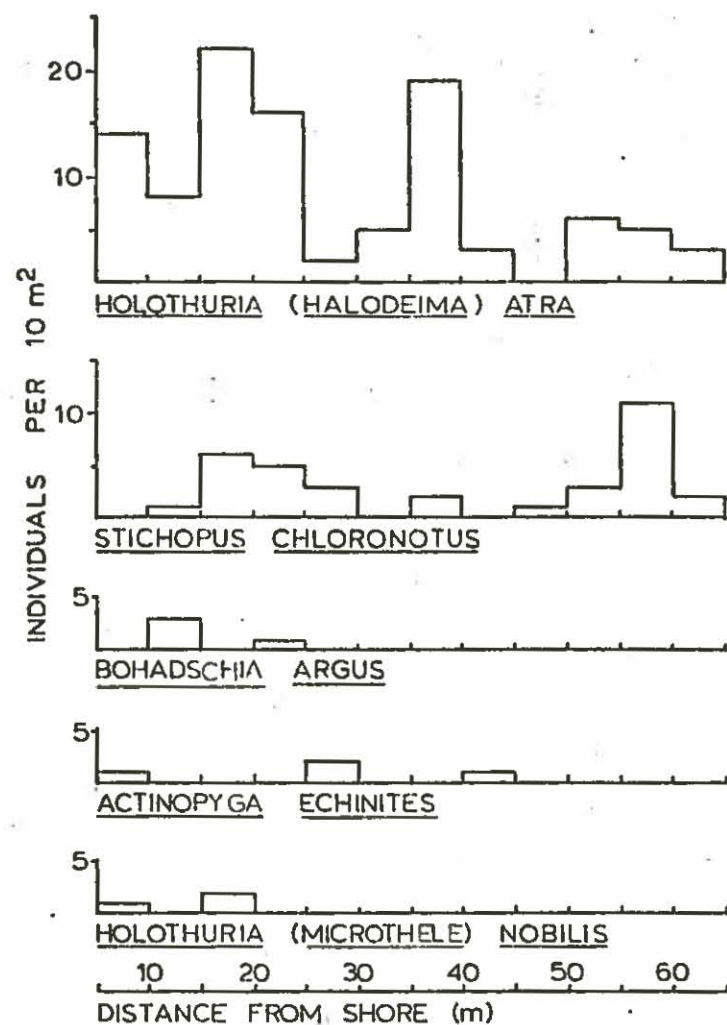


Fig. 18. Distribution of holothurian species along Transect 4. Data are numbers of individuals per 2 m x 5 m quadrat oriented with the long axis parallel to the transect. Also seen in this area were *Bohadschia bivittata*, *Holothuria (Semperothuria) cinerascens*, and *Holothuria (Thymocysia) hilla*.

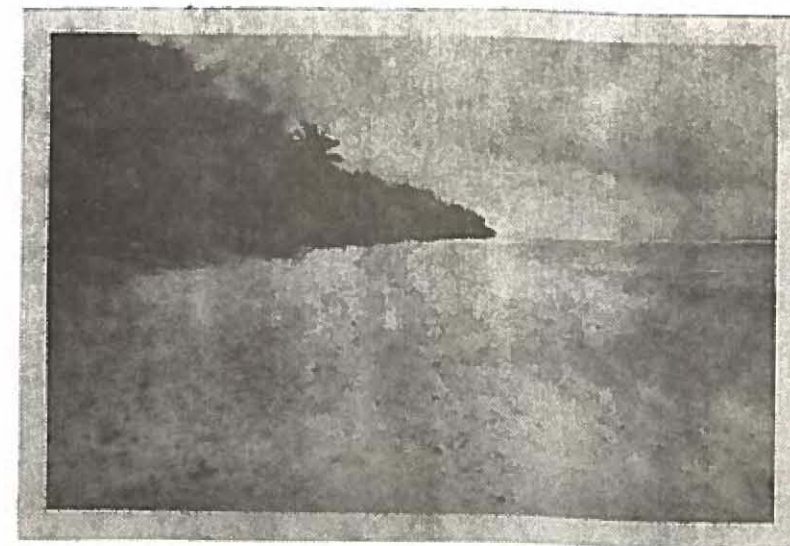


Fig. 1. View of shoreline facing south toward Uruno Point.

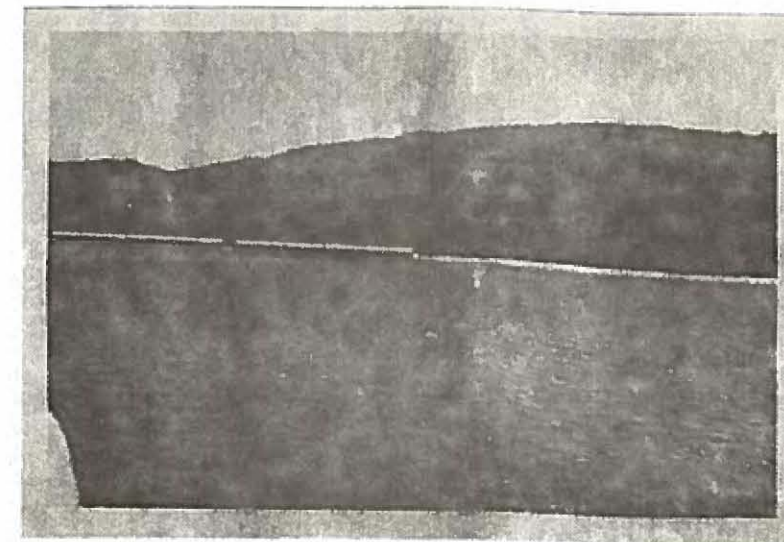


Fig. 2. View of terrain on the southern side of Uruno Point. Buoy marks Station 2 where drogues were cast as well as the area where Transect 6 was run.

PLATE II

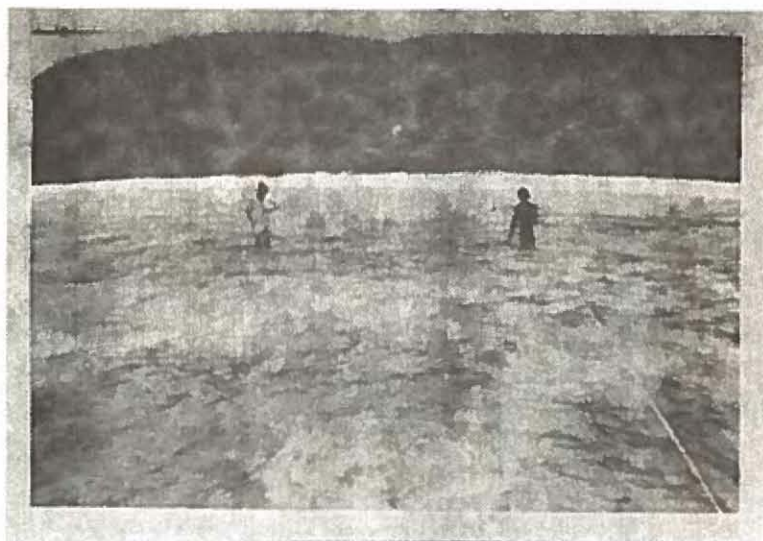


Fig. 1. Technique used in measuring and timing the dye movement over the outer reef flat.

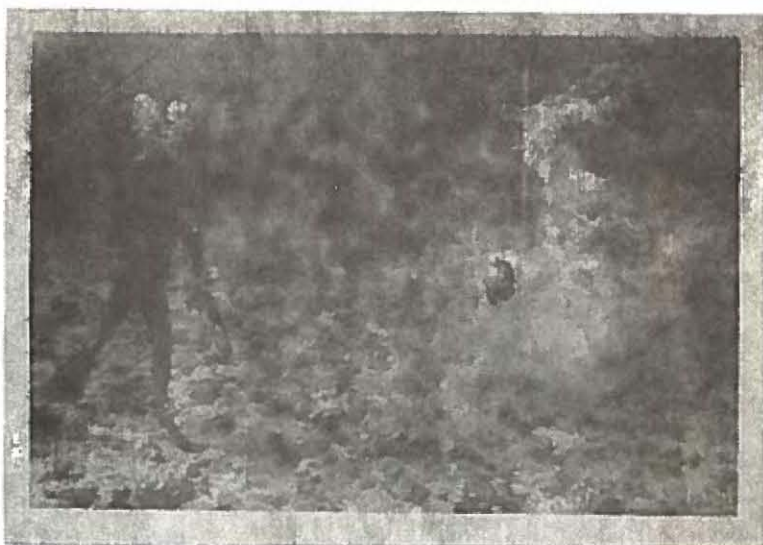


Fig. 2. Release of fluorescein dye in 50 feet of water. The general movement of the dye was then observed.

PLATE III

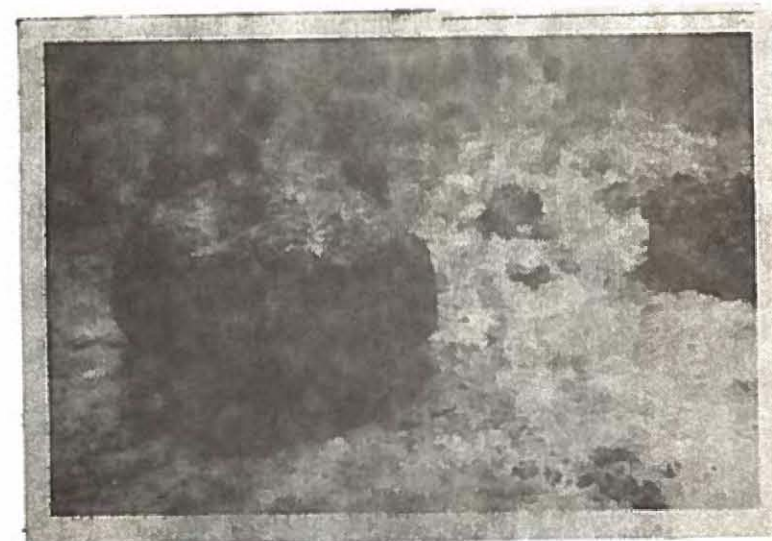


Fig. 1. A massive colony of *Porites* in 3 ft. of water on the outer reef flat.

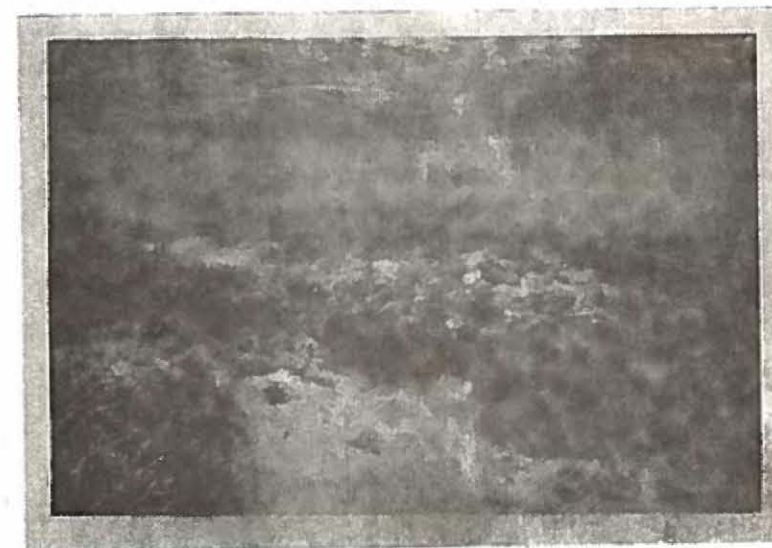


Fig. 2. *Porites* and *Acropora* colonies in 3 ft. of water on outer reef as seen during high tide.

PLATE II



Fig. 1. Technique used in measuring and timing the dye movement over the outer reef flat.

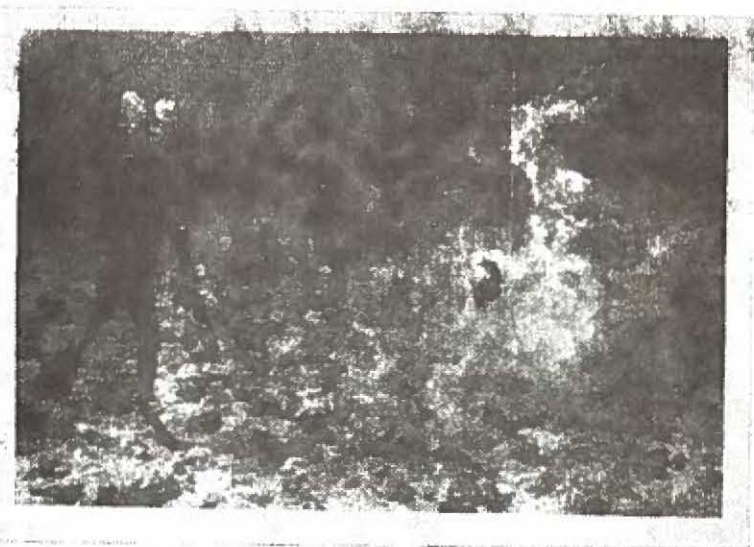


Fig. 2. Release of fluorescein dye in 50 feet of water. The general movement of the dye was then observed.

PLATE III

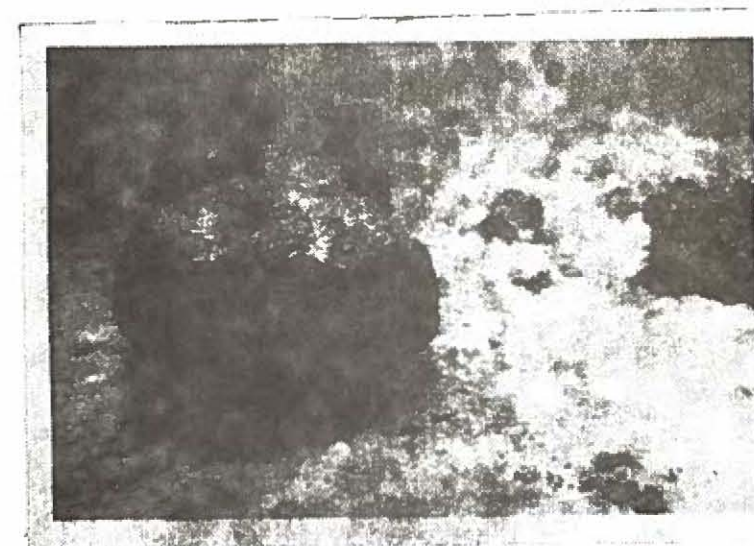


Fig. 1. A massive colony of Porites in 3 ft. of water on the outer reef flat.

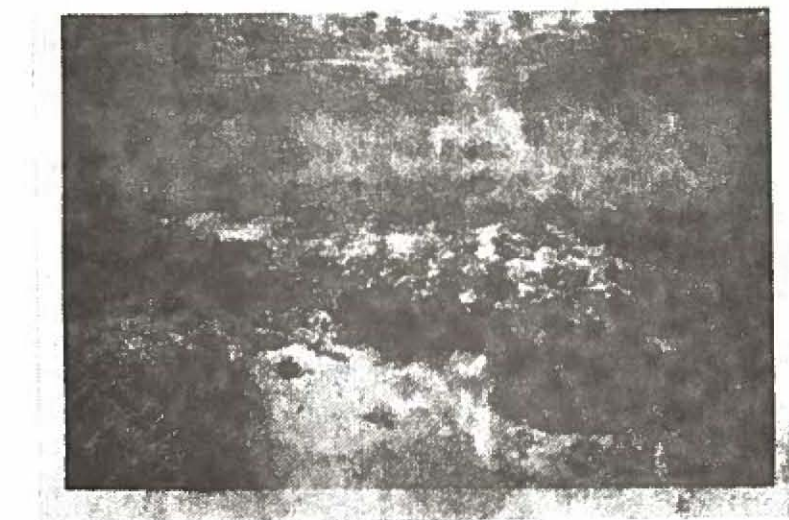


Fig. 2. Porites and Acropora colonies in 3 ft. of water on outer reef as seen during high tide.

PLATE IV

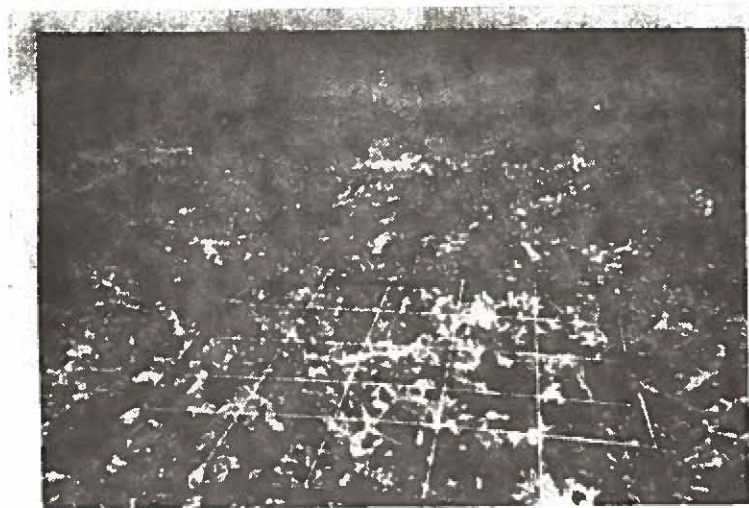


Fig. 1. Quadrat (50 cm x 50 cm) with 16 interior points, used to quantify corals, on portions of an Acropora thicket on the outer reef flat.



Fig. 2. View of the corals Porites and Acropora, as well as the brown alga Turbinaria and the sea cucumber Stichopus, on the outer reef flat near the reef margin.

PLATE V



Fig. 1. Reeling out the 100 m transect line on the reef terrace.



Fig. 2. Applying the point-quarter method in quantifying corals on the reef terrace.

PLATE VI



Fig. 1. Quantifying marine algae on the reef terrace.

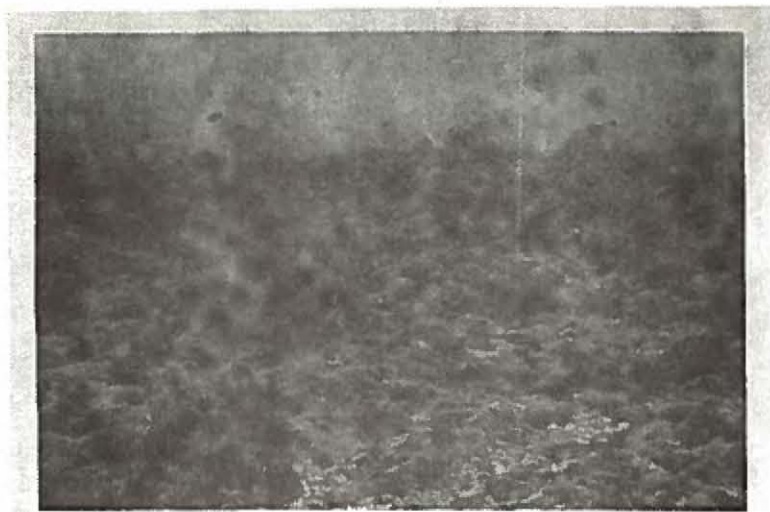


Fig. 2. View taken from 100 ft. looking up at the reef slope. Gorgonians and surgeonfishes can be seen in the background.

APPENDIX C

GUAM REGISTER OF HISTORIC PLACES
INVENTORY DATA FORMS 66-08-0009/10/11

GUAM REGISTER OF HISTORIC PLACES
INVENTORY DATA FORM

66 08 0009



1 NAME

Common: Falcona Beach
And/or Historic: Falcona or Falconan
Type of Site: Habitation, Settlement

2 LOCATION

Street/Number
Lot or Estate No.: Lot no. 10080
Municipality: Lededo
Land Square and Section: square 3, section 4
GSA Code Number: 0300
Local Place Name: Falcona Beach
Site Identification Number: 66 - 08 - 0009

3 CLASSIFICATION

Category: ☐ District ☒ Site ☐ Building ☐ Structure ☐ Object
(check one)
Ownership: ☐ Government of Guam ☒ Private ☐ Federal
(check one or more as appropriate)
Status: ☐ Occupied ☐ Unoccupied ☐ Preservation Work In Progress
(check one or more as appropriate)
Accessible to Public: ☐ No ☒ Yes, Restricted ☐ Yes, Unrestricted
(check one)
Present Use: (check one or more as appropriate)
☐ Agricultural ☐ Industrial ☐ Religious
☐ Commercial ☐ Military ☐ Scientific
☐ Conservation ☐ Museum ☐ Transportation
☐ Education ☐ Park ☒ Unused
☐ Entertainment ☐ Residence ☐ Other
☐ Government ☐ Ranch

Additional Comments On Present Use:

C-2

4 OWNER OF PROPERTY

Owners Name(s): Jose C. Artero, Antonio C. Artero, and Consuelo A. Calvo
Street/Number:
Mailing Address: P.O. Box 752 Agana, Guam 96910
Municipality: Agana Telephone Number:
Leasee's Name(s):
Leasee's Address:
Owner's Attitude: ☒ Unrestricted Research Allowed ☐ Restricted Research Allowed ☐ No Research Allowed
Additional Information on Locating Owner: (Contact person, etc.)

5 LOCATION OF LEGAL DESCRIPTION

Government Agency: Dept. of Land & Natural Resources
Street/Number: Administration Building
Mailing Address: Agana, Guam 96910

6 REPRESENTATION IN EXISTING SURVEYS

Title of Survey: Notes on an Archaeological Survey of Guam, Marianas Islands
Author/Participant: Dr. Fred H. Meinman
Date of Survey: 1965-66
Type of Survey: ☐ GovGuam ☒ Private ☐ Federal
Survey Records Located At: Dept. of Commerce, Agana, Guam
Artifacts Located At:

7 DESCRIPTION

Known Pressures On Site: ☐ Yes ☒ No
Destruction: ☒ No Known Future Danger ☐ Possible Future Danger
☐ Future Danger Certain ☐ Present Danger ☐ Presently Being Destroyed
Condition: ☐ Excellent ☐ Good ☒ Fair ☐ Deteriorated ☐ Ruins
(check one) ☐ Unexposed
Integrity: ☐ Altered/Original Location ☐ Altered/Moved
(check one) ☒ Unaltered/Original Location ☐ Unaltered/Moved

C-3

8 SIGNIFICANCE

3F Period: (check one or more as appropriate)
☒ Pre-Magellan ☐ 16th Century ☐ 17th Century ☐ 18th Century
☐ 19th Century ☐ 20th Century

3. Specific Dates: (If applicable and known)

3: Areas of Significance: (check one or as appropriate)

☒ Aboriginal/Prehistoric	☐ Literature
☐ Aboriginal/Historic	☐ Military
☐ Agriculture	☐ Music
☐ Architecture	☐ Political
☐ Art	☐ Religion/Philosophy
☐ Commerce	☐ Science
☐ Communications	☐ Sculpture
☐ Conservation	☐ Social/Humanitarian
☐ Education	☐ Theater
☐ Engineering	☐ Transportation
☐ Industry	☐ Urban Planning
☐ Invention	☐ Other (specify)
☐ Landscape Architecture.	

3 Importance As Example of Type Site: ☒ Good ☐ Moderate ☐ Poor
 (check one)

40 Susceptibility to Interpretation: ☒ Good ☐ Moderate ☐ Poor
 (check one)

4. Research Potential: ☒ Good ☐ Moderate ☐ Poor
 (check one)

4 Local Attitudes About Site: ☐ Valuable ☐ Moderate Value ☐ Low Value
 (check one) ☐ Ambivalent ☐ Unknown

42 Staff Evaluation: ☐ High Value ☐ Valuable ☒ Reserve ☐ Marginal
 (check one)

44 Recommended Disposition: ☐ Nominate National Register ☒ Guam Register
 (check one or more) ☐ Staff files

4 Suggested Themes:
 Micronesia - Guam, Settlement patterns, Habitat

4 Additional Comments:

Signature: *John M. Kemman*

Evaluator:

Title: Project Director

C-4

66-08-0009

Guam Quad Identification
Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; materials used; condition; surface artifacts or midden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

Description: This site is located on the NW coast of Guam and is listed as Falcona Leach on LCC Hawaiian Point Quadrangular map (1968). It is the property of Jose G. Artero of Agaña. The site can be reached by driving N on Highway 3, 3.2 miles from the junction to a paved but badly deteriorated road ca. .5 mile W of Bruno Point (N. 881) then leading N to the top of the cliffs. A steep trail leads from this area down the cliffs to the beach. The site is along the sand .2 mile around a rocky point.

The site is approximately 300-350 m long and 50 m wide, running in a generally N-S direction along the 10 to 15 foot contours. A small rock ledge comes down nearly to the water's edge in the southern part forming a second small entanglement. Both are included in the site area. The entire site area is filled with dense plant growth, primarily coconut trees. Pottery is scattered throughout the site area with the heaviest concentrations near the cliffs which form the eastern side of the site. Numerous rock shelters occur in these cliffs and a large cave, ca. 5 feet deep occurs near the center of the site. The floor of the cave is wet and sandy. A few fragments of human bone and scattered pottery occur on the floor. Scattered fragments of latte uprights and capstones occur on the site, but all except one are completely broken and displaced. A single small set with only 4 uprights in place occurs ca. 30 m from the S end of the site. All the uprights were broken off about 20 cm above the ground surface. This set appeared to have been oriented in a nearly E-W direction or perpendicular to the beach ca. 20-25 m W of the structure. East of the structure ca. 10 m was a small rock shelter with a good midden area and numerous pottery sherds on the ground.

The soil of the site is a brown to black sand containing scattered pottery as well as shells, limestone pebbles, and other beach debris. Vegetation consists primarily of coconut (*Cocos* sp.), although *Pandanus* sp., *Triplaris* sp., *Ficus* sp., and *Acacia* sp. are also present.

Significance: This small area may be the site of a small former settlement called either Falcona or Fagonan, the latter name used locally for this area today. One or the other, or both, may apply to the Bruno site immediately to the N, but it is difficult to be certain. Rock shelters, a cave, and the remains of now destroyed latte suggest that a small settlement formerly occurred in the area, but the extent of the remains indicate that the occupation was much less intensive than in the site areas immediately to the N. Nevertheless, the area warrants test excavations and a few of the rock shelters contain relatively heavy sherd and midden deposits which could provide useful information for the reconstruction of Guamanian Prehistory.

Recommended: Reserve status

Signed: *John M. Kemman*

C-5

Date: 5-21-74

SCALE IN

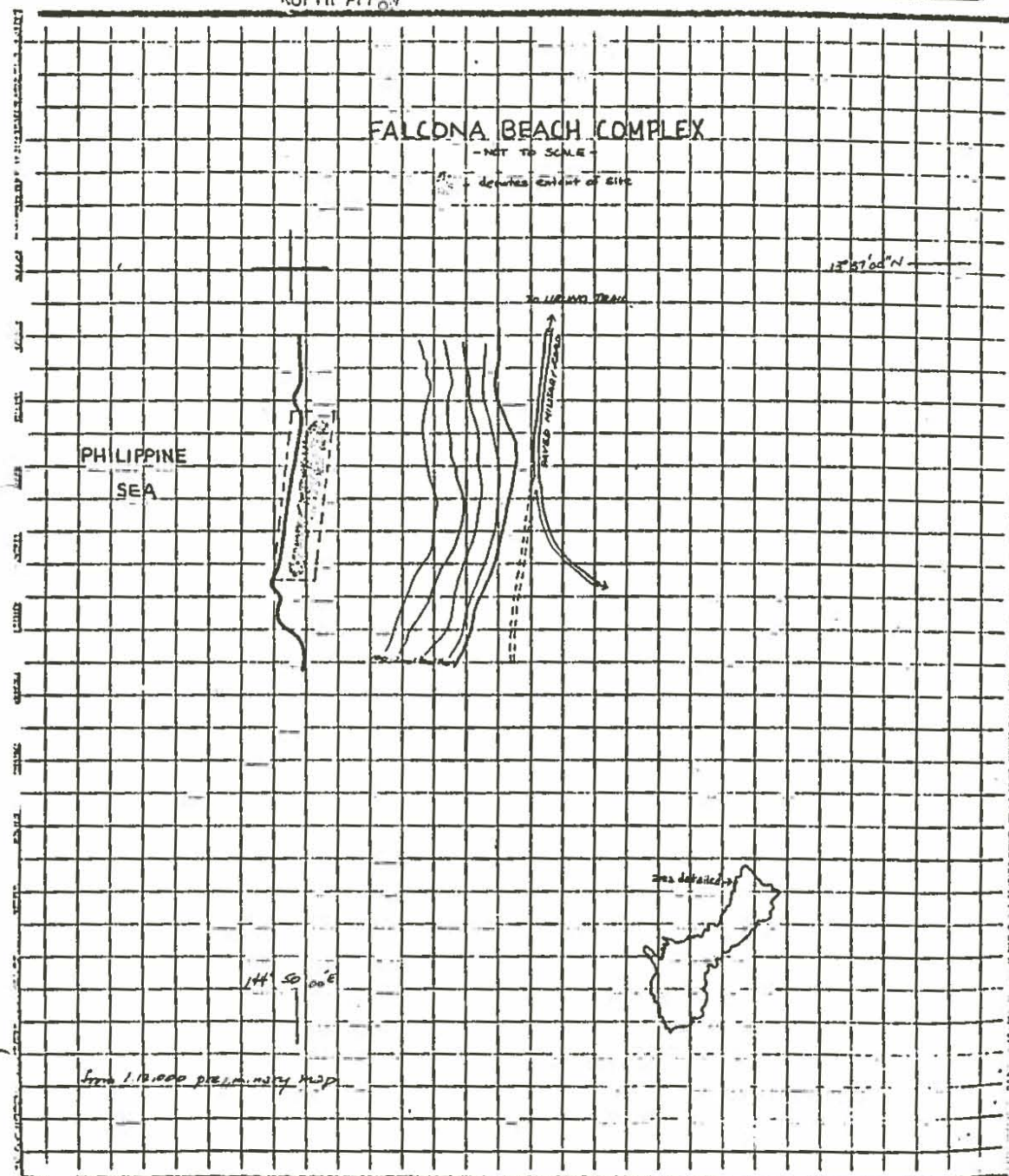


North Arrow

SITE MAP FORM

6 6 - 0 8 - 0 0 0 9
ISLAND QUAD IDENTIFICATION NO.

MAPPING TECHNIQUE:



C-6

Identification No. 66-08-0009

GUAM REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form.
(Number all entries)



G-MaG(a)-2:22

FALCONA BEACH COMPLEX
66-08-0009 - general
view of Falcona Beach
site from top of cliff

C-7

9 MAJOR BIBLIOGRAPHICAL REFERENCES

- 17 Legendary Materials Known: ☐ Yes ☒ No
(If Yes, state title of legend and attach copy if available)
- 48 Written Historical Materials: ☐ Yes ☒ No
- 49 List Any References: (Especially those mentioned in any portion of forms)
possible (?) site of historic village of Falcona listed as abandoned
on map of 1852 A.D.
Coello, D. Francisco
1852 A.D. Atlas de Espana y Sus Posesiones de Ultramar,
Madrid

10 GEOGRAPHIC DATA

- 50 Approximate acreage: ca. 4.3 acres
- 51 Latitude and Longitude Coordinates Defining a Rectangle Locating the
Property if More Than 10 Acres
- | Corner | Latitude | | | Longitude | | |
|--------|----------|---------|---------|-----------|---------|---------|
| | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |
| NW | 13° | 36' | 49" N | 144° | 50' | 00" W |
| NE | 13° | 36' | 49" N | 144° | 50' | 03" E |
| SE | 13° | 36' | 36" N | 144° | 50' | 02" E |
| SW | 13° | 36' | 36" N | 144° | 49' | 58" E |
- 52 Latitude and Longitude Coordinates Defining the Central Point of a
Property of Less Than 10 Acres
- | Latitude | | | Longitude | | |
|----------|---------|---------|-----------|---------|---------|
| Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |

11 FORM PREPARED BY

- 53 Name and Title: Guam Inventory Team
- 54 Organization: Bernice Pauahi Bishop Museum
- 55 Street/Number: 1355 Kalihi Street - P.O. Box 5037
- 56 City/Municipality: Honolulu
- 57 State: Hawaii
- 58 GSA Code: 2300

C-8

12 GOVERNMENT OF GUAM REVIEW RECORD AND EVALUATION

- Name of Reviewer: David T. Lotz
- Title: Planner
- 61 Category: ☐ High Value ☒ Valuable ☐ Low Value ☐ Marginal
- 62 Significance: ☐ National ☒ Local
- 63 Recommended Disposition: ☐ Nominate National Register ☒ Guam Register
☐ Staff File
- 64 Recommended Themes: Micronesian - Guam
- 65 Reviewer's Comments:

13 REVIEW BOARD EVALUATION RECORD

- 6 Date Reviewed: July 3, 1974 Recorder David T. Lotz
- Official Category: ☐ High Value ☐ Valuable ☐ Reserve
☐ Marginal
- 8 Official Significance: ☐ National ☐ Local
- 69 Official Disposition: ☐ Nominate National Register ☒ Guam Register
☐ Staff Files
- 70 Review Board Comments:
- 71 Voting Record (Yes, No, Abstention, or Absent)
- | | |
|--|--|
| Yes/ ☐ History (Carano) | Yes/ ☐ Architecture (Jones) |
| Yes/ ☐ Archaeology (Birkedal) | Yes/ ☐ Tourism (Unpingco) |
| Absent/ ☐ Planning (Gilliam) | |
- 72 Date submitted to National Register:
- 73 Date entered on National Register:

C-9

ARCHAEOLOGICAL SITE SURVEY RECORD

66-08-0001

Map 3162 I NE, AMS 1843

Site Ma(12-5) (Falcona Beach) Grid coordinates 655058
Location Second cove south of Urumo Pt. (immediately south of Urumo site on Joe Artero's ranch).

Contour elevation 5-10 m.

Previous site designation Not certain but may be Pugu site

Owner(s) Unknown, Jose C. Artero?

Address Agana, Guam

Present tenant Use by Artero but generally unoccupied Attitude toward excavation Probably favorable

Site description Sandy beach site with rock outcrop coming down near water at about middle of area; forms two shallow bays. Remains of 1 small or partial latte set.

Area 50 x 350 m. Depth of deposit Soil of site sand

Vegetation coconut and pandanus

Previous excavation None known

Surface features, roads, bldgs., etc. Partial latte remains (1); trail at back of second cove up to cliff.

Artifacts Pottery, stone and shell tools

Burials

Remarks Light scatter of pottery in central area; rockshelters around periphery and very large wet cave in center of site.

Date of survey 9-55 Recorded by Reiman Photos No

Sketch or site map Site Map Publ. references If Pugu noted by Osborne and Hornbostel

GUAM REGISTER OF HISTORIC PLACES
INVENTORY DATA FORM

66 08 0010



1 NAME

Common: Urumo

And/or Historic: Falcona, Pasonan, Pason

Type of Site: Settlement area, Habitation

2 LOCATION

Street/Number

Lot or Estate No.: Lot no. 10080

Municipality: Dededo

Land Square and Section: square 2, section 2; square 3, section 4

GSA Code Number: 0300

Local Place Name: Urumo Beach

Site Identification Number: 66 - 08 - 0010

3 CLASSIFICATION

Category: District ☒ Site ☐ Building ☐ Structure ☐ Object
(check one)

Ownership: Government of Guam ☒ Private ☐ Federal
(check one or more as appropriate)

Status: Occupied ☒ Unoccupied ☐ Preservation Work In Progress
(check one or more as appropriate)

Accessible to Public: No ☐ Yes, Restricted ☒ Yes, Unrestricted
(check one)

Present Use: (check one or more as appropriate)

☐ Agricultural	☐ Industrial	☐ Religious
☐ Commercial	☐ Military	☐ Scientific
☐ Conservation	☐ Museum	☐ Transportation
☐ Education	☐ Park	☐ Unused
☐ Entertainment	☐ Residence	☐ Other
☐ Government	☒ Ranch	

Additional Comments On Present Use:

4 OWNER OF PROPERTY

Owners Name(s): Jose C. Artero, Consuelo A. Galvo, and Antonio C. Artero

Street/Number:

Mailing Address: P.O. box 752

Municipality: Agana, Guam

Telephone Number:

Leasee's Name(s):

Leasee's Address:

Owner's Attitude: ☒ Unrestricted Research Allowed ☐ Restricted Research Allowed ☐ No Research Allowed

Additional Information on Locating Owner: (Contact person, etc.)

5 LOCATION OF LEGAL DESCRIPTION

Government Agency: Dept. of Land Management

Street/Number: Administration Building

Mailing Address: Agana, Guam 96910

6 REPRESENTATION IN EXISTING SURVEYS

Title of Survey: Notes on an Archaeological Survey of Guam, Marianas Islands

Author/Participant: Dr. Fred H. Reinman

Date of Survey: 1965-66

Type of Survey: ☐ GovGuam ☒ Private ☐ Federal

Survey Records Located At: Dept. of Commerce Agana, Guam

Artifacts Located At:

7 DESCRIPTION

Known Pressures On Site: ☐ Yes ☒ No

Destruction: ☒ No Known Future Danger ☐ Possible Future Danger
☐ Future Danger Certain ☐ Present Danger ☐ Presently Being Dest.

Condition: ☐ Excellent ☒ Good ☐ Fair ☐ Deteriorated ☐ Ruins
(check one) ☐ Unexposed

Integrity: ☐ Altered/Original Location ☐ Altered/Moved
(check one) ☒ Unaltered/Original Location ☐ Unaltered/Moved

8 SIGNIFICANCE

Period: (check one or more as appropriate)

☒ Pre-Magellan ☒ 16th Century ☒ 17th Century ☒ 18th Century
☒ 19th Century ☐ 20th Century

Specific Dates: (If applicable and known)

may be historic village of Falcona or Pasonan abandoned by 1852

Areas of Significance: (check one or as appropriate)

☒ Aboriginal/Prehistoric	☐ Literature
☒ Aboriginal/Historic	☐ Military
☐ Agriculture	☐ Music
☐ Architecture	☐ Political
☐ Art	☐ Religion/Philosophy
☐ Commerce	☐ Science
☐ Communications	☐ Sculpture
☐ Conservation	☐ Social/Humanitarian
☐ Education	☐ Theater
☐ Engineering	☐ Transportation
☐ Industry	☐ Urban Planning
☐ Invention	☐ Other (specify)
☐ Landscape Architecture.	

Importance As Example of Type Site: ☒ Good ☐ Moderate ☐ Poor
(check one)

Susceptibility to Interpretation: ☒ Good ☐ Moderate ☐ Poor
(check one)

Research Potential: ☒ Good ☐ Moderate ☐ Poor
(check one)

Local Attitudes About Site: ☐ Valuable ☐ Moderate Value ☐ Low Value
(check one) ☐ Ambivalent ☒ Unknown

Staff Evaluation: ☒ High Value ☐ Valuable ☐ Reserve ☐ Marginal
(check one)

Recommended Disposition: ☒ Nominate National Register ☒ Guam Register
(check one or more) ☐ Staff files

Suggested Themes:
Micronesia - Guam, Settlement patterns, Habitation

Additional Comments:

Signature: *Fred H. Reinman*

Evaluator:

Title: Project Director

SITE DESCRIPTION

66 - 0 6 - 0 1 0

Guam Quad Identification
Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; material used; condition; surface artifacts or hidden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

Location: The Urano site is located on the NW coast of Guam, 7 mile SW of Urano Point (19° 17' N, 154° 31' E), 3 mile N of Falcona Beach on USGS Ritidian Point quadrangle map (19° N). It is on the property of Jose C. Artero of Agaña, Guam. The site is reached by driving N on Highway 3, 3.2 miles from Potts Junction to a paved but badly deteriorated road .5 miles S of Urano Point which leads to the cliffs. A steep trail leads from this area down the cliffs to the beach and enters the central part of the site at Mr. Artero's ranch.

The site is ca. 500-550 m long and 100 m wide running N/S along the 10 to 40 foot coast line. Most of the structures, wells and hidden remains occur on the lower elevations of the site although scattered pottery occurs on the limestone shelf above the main site area. At least 6 structures formerly occurred here, 4 of which are potentially restorable. In large stone faced wells also occur, one each in the northern and southern halves of the site. Rock shelters, a cave, and numerous hidden areas as well as pottery and broken stone and shell tools occur throughout the site area.

The soil of the site is generally a brown to black sand containing limestone pebbles and other beach debris as well as artifacts, although the eastern upper contours of the site are primarily broken limestone and clay.

Vegetation is primarily *Cocos* sp., but *Triplasia* sp., *Prunus* sp., *Carica* sp., *Ficus* sp., *Colocasia* sp., and *Alocasia* sp., as well as various vines and ferns occur.

Significance: The Urano site is an important and valuable site area. Although larger than the Apato site, it has many of the same characteristics that enhance its importance. First it may be the site of an historic village called either Falcona or Fasoman, both apparently abandoned by 1852. Further, much of the early archaeological work done on the island by Hans Hornbostel occurred at this site. One structure (66 06 0010 C1) had a latte upright and brain coral cap removed by him. It is now on display at the Bishop Museum in Honolulu. Artifacts recovered are in the collection at the same museum, some of which are reported on by Laura Thompson (1932). At least 4 of the latte structures are restorable, all in the central part of the site and 2 potentially restorable wells occur with these latte. Finally, the extent of the hidden and artifact materials, the presence of rock shelters and caves, and their interpretive potential all combine to make this an important site for the reconstruction of village habitation and settlement patterns on the island. Extensive excavations are recommended both for the restoration and the reconstruction of the early to historic village patterns.

Recommended: High value status

Ann. R.

C-14

Date: 5-21-74

GUAM REGISTER OF HISTORIC PLACES

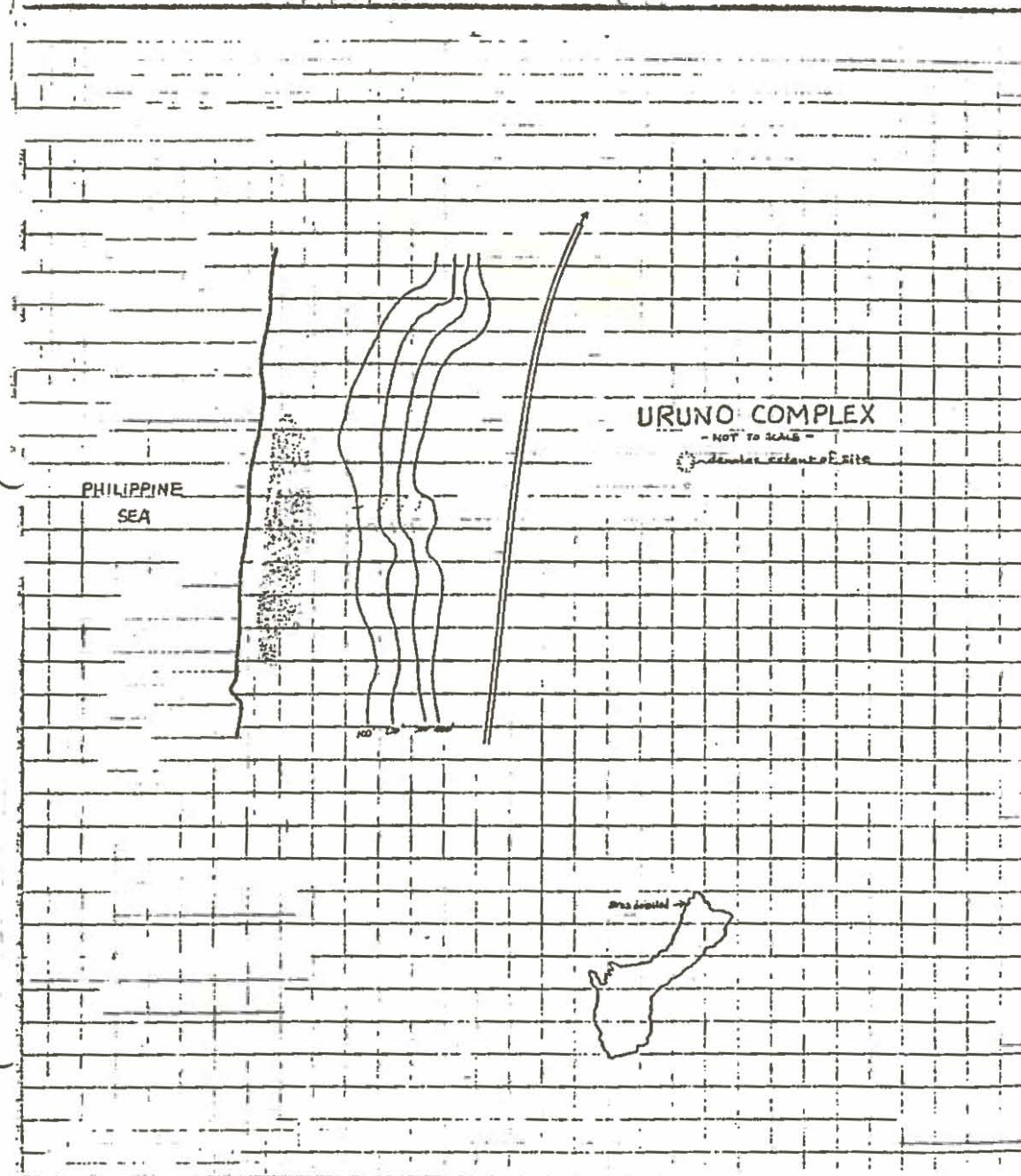
SITE MAP FORM

SCALE IN

N 11 E 20 W

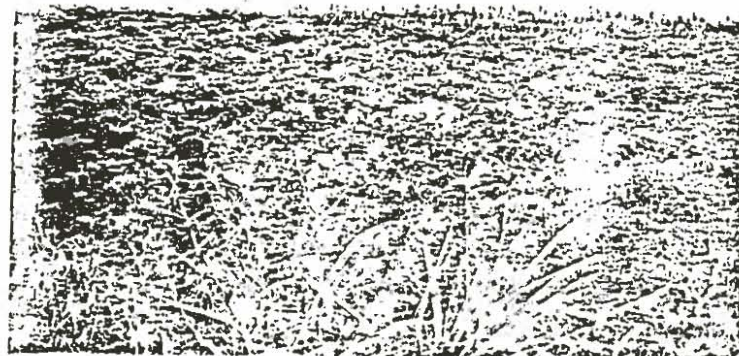
6 6 - 0 8 - 0 0 1 0
QUAD IDENTIFICATION NO.

MAPPING TECHNIQUE:



C-15

(Number all entries)



URUNO COMPLEX
66-08-0010 General
view of Uruno Complex
from top of cliff

C-HaG(a)-23

C-16

SHIPPED BY
FEDEX INTERNATIONAL

66 - 0 8 - 1 1 - 1 1 - 1 1

Case	Quad	Identification	Feature
		Number	Number

VFPGA DESCRIBE 1 100%

locate feature; to identify; include pertinent data (e.g., bearings and sources used to used; condition; surface and vegetation; size; shape; construction techniques; material; artifacts or mounds visible).

1. SIGNIFICANCE STATEMENT in artifacts or midds, visible, construction techniques; inter-
 2. prevalence; interpretive value; research potential; evaluation of the site's importance
 3. as a representative of its class; recommendations for register category.

[illegible]

The structure was evaluated by James H. Heston in the 1970's (1977), and a single right-side support was recommended to be added to the right side of the structure. The structure was found to be in good condition. Additional evaluation was recommended in the vicinity of the structure, and a properly in the vicinity of the structure. The structure is in good condition and could be restored.

INITIAL PLATE VARIATION: 2.50000000

Date: 5-21-72

C-17

KEY TO MAP SYMBOLS:

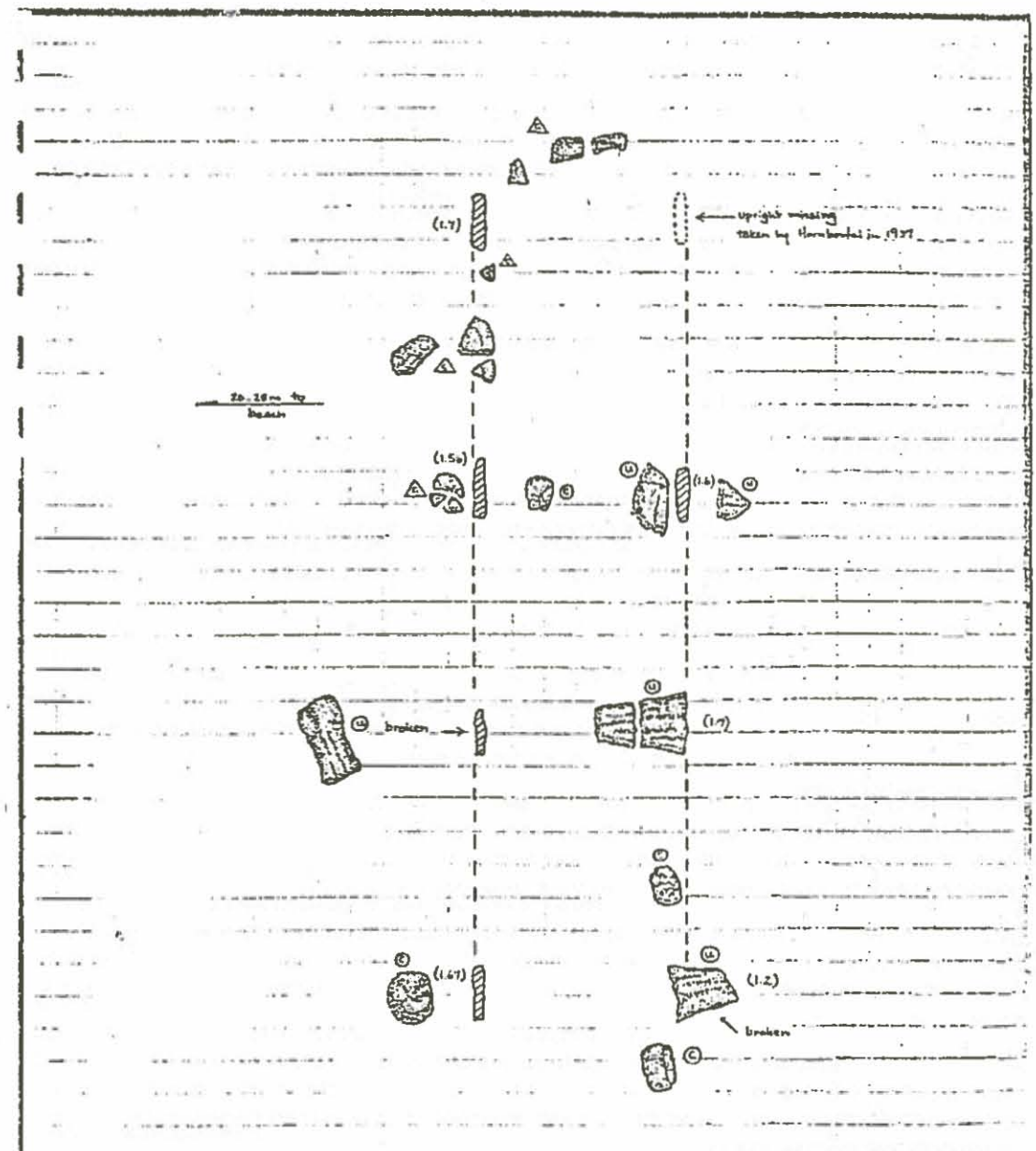
-  standing upright
-  fallen upright
-  fallen cap stone
-  cap stone fragment
-  basalt mortar
-  limestone mortar
-  rubble
-  pit, depression
-  mound
-  indicates alignment
-  slope, narrow end points down
-  heights entered in meters

GUAM REGISTER OF HISTORIC PLACES SUPPLEMENTARY FEATURE MAP FORM

0 1 2
SCALE IN m

6 6 - 0 8 - 0 0 1 0 - 0 1
QUAD IDENTIFICATION NO. FEATURE NUMBER

MAPPING TECHNIQUE: _____



Identification No. 66-08-0010-01

GUAM REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form.

(Number all entries)

URUHO COMPLEX
66-08-0010-01
latte set-note
slender uprights



G-MaG(a)-2:6

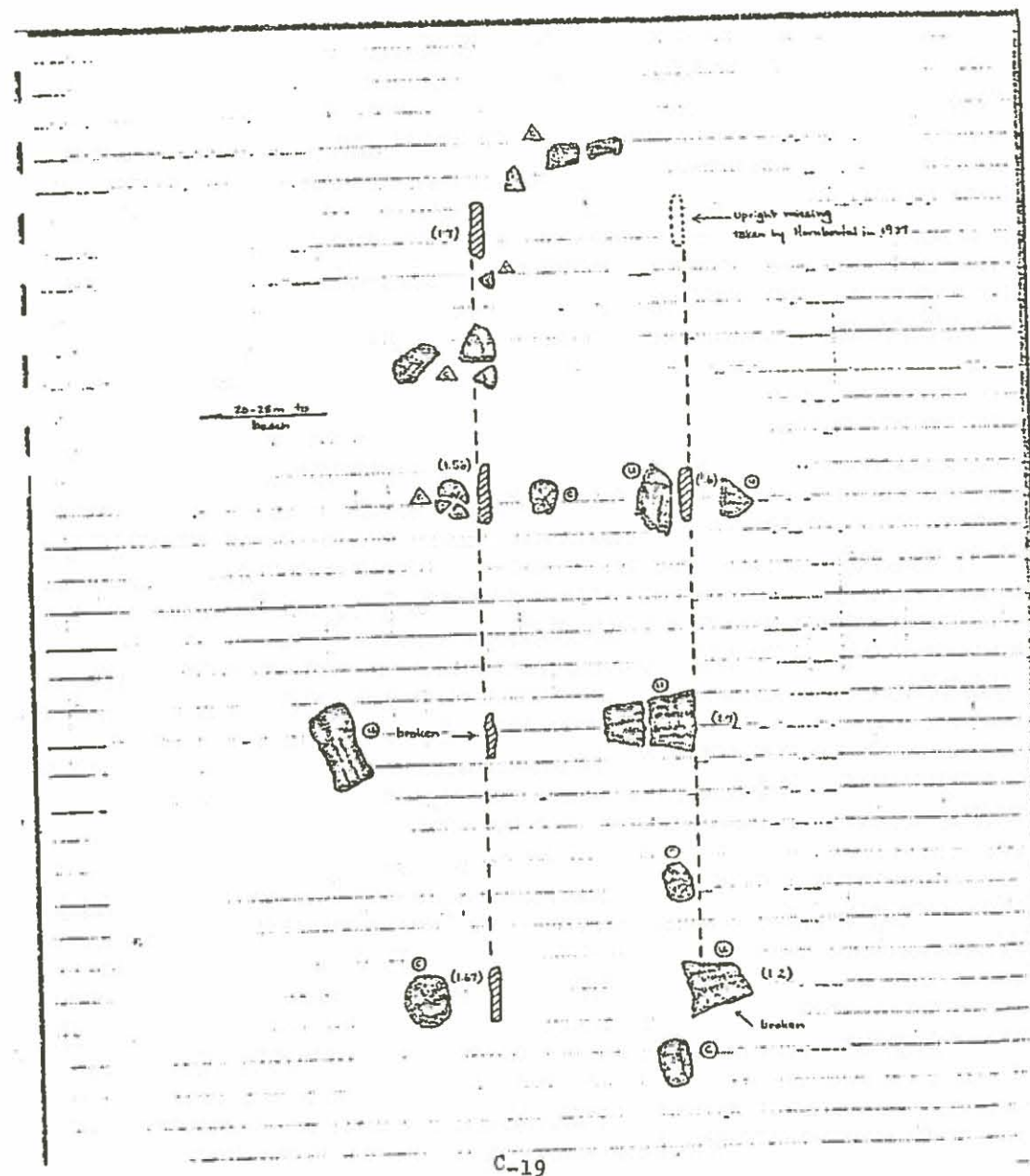


URUHO COMPLEX
66-08-0010-01
limestone upright
side view

G-MaG(a)-2:7 C-20

GUAM REGISTER OF HISTORIC PLACES
SUPPLEMENTARY FEATURE MAP FORM

66-08-0010-01
QUAD IDENTIFICATION NO. FEATURE NUMBER
SCALE IN m
MAPPING TECHNIQUE:
North Arrow



C-19

Identification No. 66-04-0-0-1-0-0

GUYANA REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form.

(Number all entries)

URUNO COMPLEX
66-09-0010-01
latte set-nots
slender uprights



G-1aG(a)-2:6



URUNO COMPLEX
66-08-0010-01
limestone upright
side view

G-1aG(a)-2:7

C-20

66-04-0-0-1-0-0

66-04-0-0-1-0-0

66-04-0-0-1-0-0

VERBAL DESCRIPTION MUST INCLUDE: PERTINENT DATA ON bearings and courses used to locate feature; terrain and vegetation; type, height, construction technique; material used; condition; surface artifacts or other visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; possibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendation for register category.

This latte is an example of the Uruno Complex. It is oriented N/S and is 10 m long and 3.3 m wide. The structure is 12 m long, 3.3 m wide (interior dimensions). The height of the uprights is 1.5 m. All of the uprights are 1.5 m high and are made of limestone. The uprights are arranged in a circular pattern. The top of the uprights is covered with a layer of dark brown sand containing pottery, bone, and other artifacts. The base of the uprights is covered with a layer of black sand. The surrounding area is covered with dense tropical vegetation.

The vegetation is primarily coconut palm. The structure is in good condition. The adjacent area is covered with dense tropical vegetation.

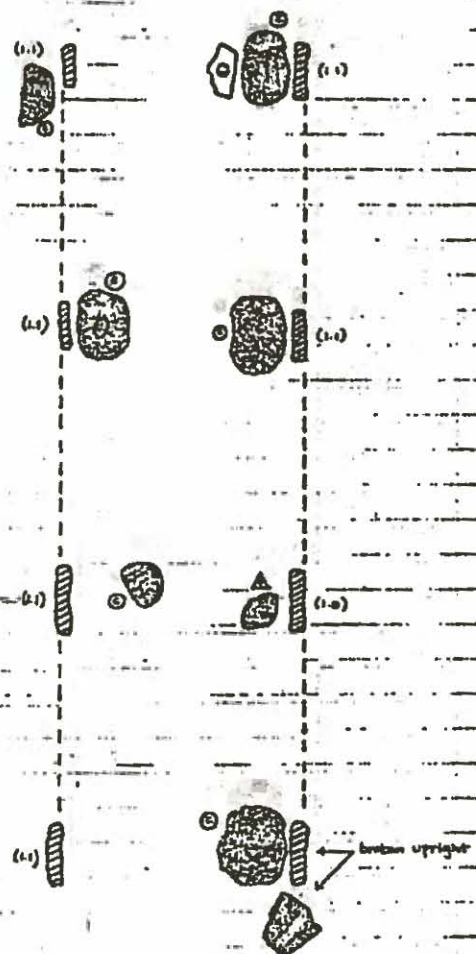
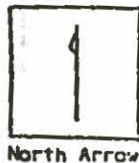
INDIVIDUAL FEATURE EVALUATION: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 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1677. 1678. 1679. 1680. 1681. 1682. 1683. 1684. 1685. 1686. 1687. 1688. 1689. 1690. 1691. 1692. 1693. 1694. 1695. 1696. 1697. 1698. 1699. 1700. 1701. 1702. 1703. 1704. 1705. 1706. 1707. 1708. 1709. 1710. 1711. 1712. 1713. 1714. 1715. 1716. 1717. 1718. 1719. 1720. 1721. 1722. 1723. 1724. 1725. 1726. 1727. 1728. 1729. 1730. 1731. 1732. 1733. 1734. 1735. 1736. 1737. 1738. 1739. 1740. 1741. 1742. 1743. 1744. 1745. 1746. 1747. 1748. 1749. 1750. 1751. 1752. 1753. 1754. 1755. 1756. 1757. 1758. 1759. 1760. 1761. 1762. 1763. 1764. 1765. 1766. 1767. 1768. 1769. 1770. 1771. 1772. 1773. 1774. 1775. 1776. 1777. 1778. 1779. 1780. 1781. 1782. 1783. 1784. 1785. 1786. 1787. 1788. 1789. 1790. 1791. 1792. 1793. 1794. 1795. 1796. 1797. 1798. 1799. 1800. 1801. 1802. 1803. 1804. 1805. 1806. 1807. 1808. 1809. 1810. 1811. 1812. 1813. 1814. 1815. 1816. 1817. 1818. 1819. 1820. 1821. 1822. 1823. 1824. 1825. 1826. 1827. 1828. 1829. 1830. 1831. 1832. 1833. 1834. 1835. 1836. 1837. 1838. 1839. 1840. 1841. 1842. 1843. 1844. 1845. 1846. 1847. 1848. 1849. 1850. 1851. 1852. 1853. 1854. 1855. 1856. 1857. 1858. 1859. 1860. 1861. 1862. 1863. 1864. 1865. 1866. 1867. 1868. 1869. 1870. 1871. 1872. 1873. 1874. 1875. 1876. 1877. 1878. 1879. 1880. 1881. 1882. 1883. 1884. 1885. 1886. 1887. 1888. 1889. 1890. 1891. 1892. 1893. 1894. 1895. 1896. 1897. 1898. 1899. 1900. 1901. 1902. 1903. 1904. 1905. 1906. 1907. 1908. 1909. 1910. 1911. 1912. 1913. 1914. 1915. 1916. 1917. 1918. 1919. 1920. 1921. 1922. 1923. 1924. 1925. 1926. 1927. 1928. 1929. 1930. 1931. 1932. 1933. 1934. 1935. 1936. 1937. 1938. 1939. 1940. 1941. 1942. 1943. 1944. 1945. 1946. 1947. 1948. 1949. 1950. 1951. 1952. 1953. 1954. 1955. 1956. 1957. 1958. 1959. 1960. 1961. 1962. 1963. 1964. 1965. 1966. 1967. 1968. 1969. 1970. 1971. 1972. 1973. 1974. 1975. 1976. 1977. 1978. 1979. 1980. 1981. 1982. 1983. 1984. 1985. 1986. 1987. 1988. 1989. 1990. 1991. 1992. 1993. 1994. 1995. 1996. 1997. 1998. 1999. 2000. 2001. 2002. 2003. 2004. 2005. 2006. 2007. 2008. 2009. 2010. 2011. 2012. 2013. 2014. 2015. 2016. 2017. 2018. 2019. 2020. 2021. 2022. 2023. 2024. 2025. 2026. 2027. 2028. 2029. 2030. 2031. 2032. 2033. 2034. 2035. 2036. 2037. 2038. 2039. 2040. 2041. 2042. 2043. 2044. 2045. 204

GUAM REGISTER OF HISTORIC PLACES
SUPPLEMENTARY FEATURE MAP FORM

0 1 2
SCALE IN 7m

6 6 0 8 - 0 0 1 0 - 0 2
QUAD IDENTIFICATION NO. FEATURE NUMBER

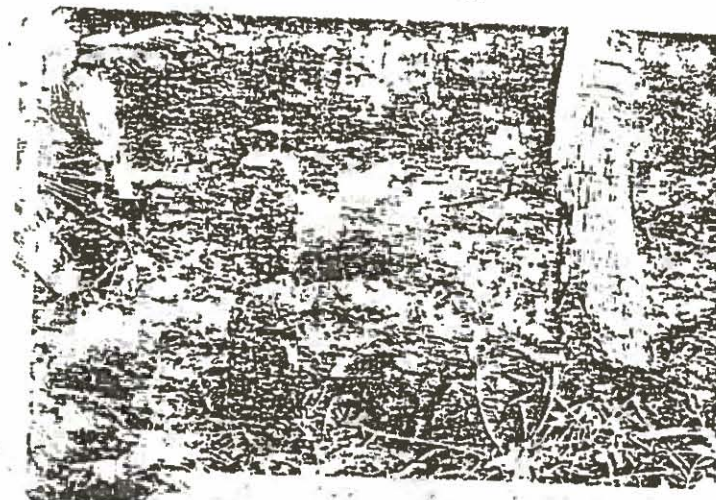
MAPPING TECHNIQUE: _____



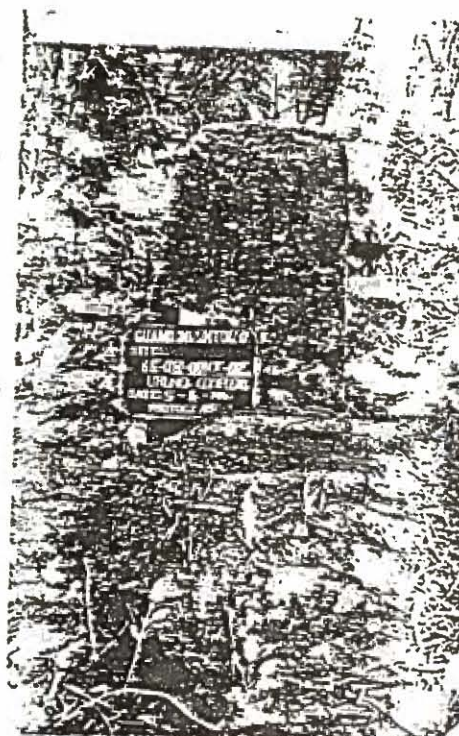
C-22

Identification No. 6 0 0 0 1 0 0 2
GUAM REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form
(Number all entries)



G-MaG(a)-2:3



URUNO COMPLEX
66-08-0010-02
limestone upright
and brain-coral cap-
stone-note carved slot
in capstone

G-MaG(a)-2:9

C 2

Supplementary Form
FEATURE IDENTIFICATION FORM

66 0 0 0 1 0 0 3
Guam Quad Identification Feature Number Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; materials used; condition; surface artifacts or hidden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

This structure is a relatively large stone latrine located ca. 10-15 m directly E of 66 00 00 02, 20-25 m E of the beach and ca. 10 m W of the cliffline. It is oriented N-S and is 3.1 m long, 3.1 m wide (interior dimensions), with standing uprights about 1.3 m in height. The uprights are trapezoidal in plan with capstones that have a slot-like base. A single capstone is still in place on the central upright in the eastern row of stones. Both the uprights and capstones are made from limestone reef rock.

The soil at the structure is brown and contains scattered pottery, limestone pebbles, and other beach debris. A black sand dune lies N of the structure 2 m forming a low ridge.

The vegetation of the site is primarily *Coconut*, *Pisonia*, and various vines and ferns, all unidentified.

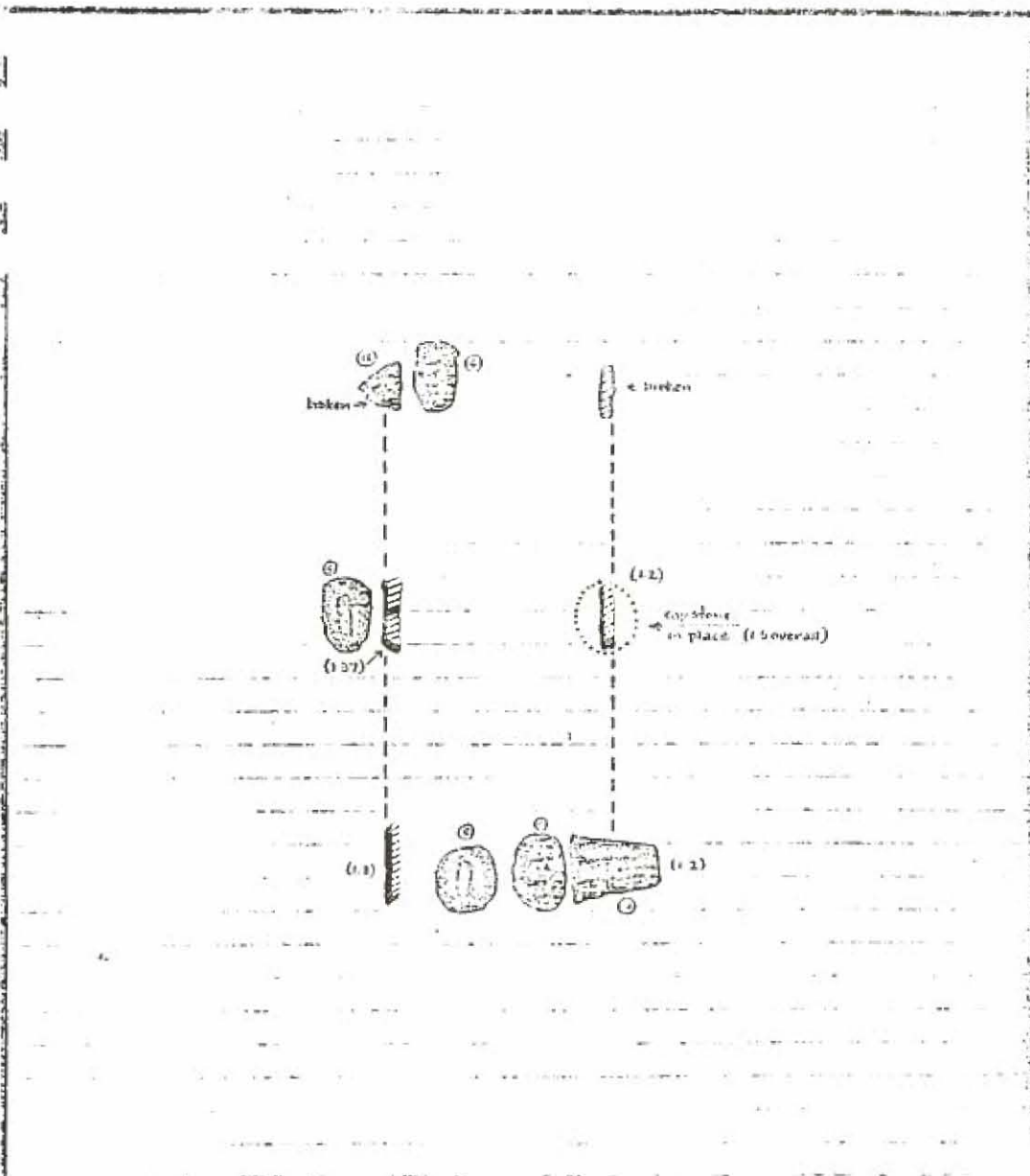
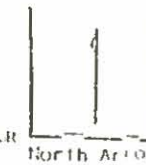
This is another of the structures described by Hornbostel in the 1930's and notes in the Hornbostel library suggest that he placed the capstone on the latrine at this structure. Artifacts from the structure are now in the museum collection. Excavations in the vicinity of the structure and the adjacent dune are warranted and the structure is potentially restorable.

Supplementary Form
FEATURE IDENTIFICATION FORM

66 0 0 0 1 0 0 3
Guam Quad Identification Feature Number Number

0 1 2
SCALE IN M

MAPING TECHNIQUE:



FIELD - FEATURE EVALUATION - EXCAVATION UNIT, SALVAGE UNIT

Conducted: J. M. Pearson

C-24

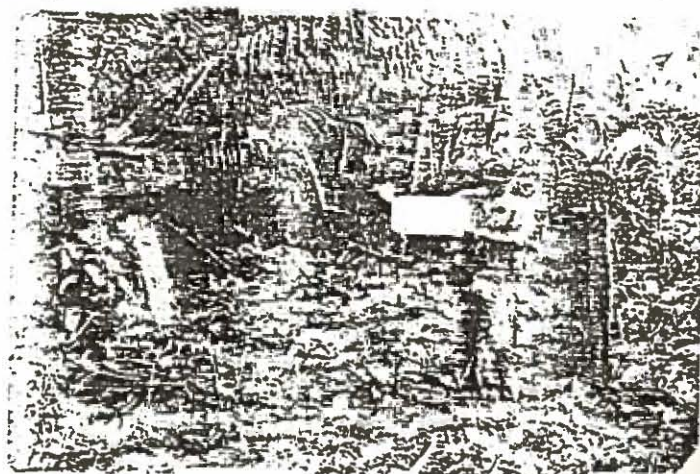
Date: 5-21-74

C-25

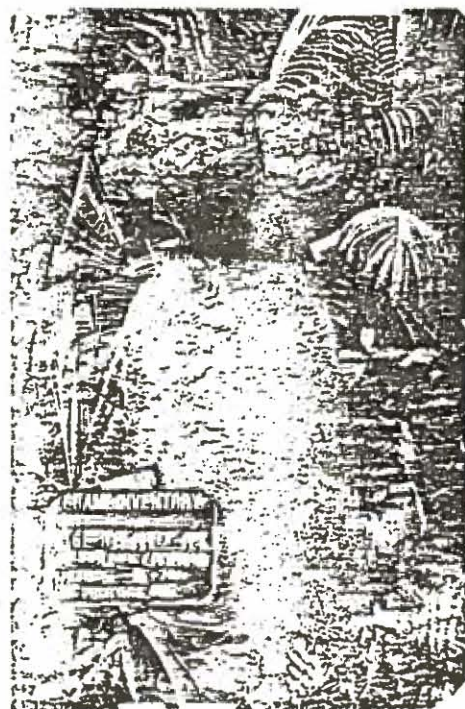
Use this sheet as necessary to explain any item on any form.

(Number all entries)

URUNO COMPLEX
66-08-0010-03
latte set
note intact
capstones and
upright
(replaced by
Hornbostel)



G-MaG(a)-2:12



URUNO COMPLEX
66-08-0010-03
complete capstone
and upright (replaced
by Hornbostel)

G-MaG(a)-2:11

Use this sheet as necessary to explain any item on any form.
(Number all entries)



URUNO COMPLEX
66-08-0010-03
limestone capstone
note carved slot for
fitting with upright

G-MaG(a)-2:12

FEATURE DESCRIPTION FORM

66 - 0 8 - 0 0 1 0 - 0 4

Guam Quad Identification Feature Number Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; materials used; condition; surface artifacts or midden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

This feature is a large circular depression located 20-30 m SW of latte structures 66 02 0010 02 and 66 02 0010 03. It is 10 m E of the beach and 20-25 m W of the cliff-line. The feature is 10 m in diameter in a N/S line and has a maximum depth below ground surface of 1.6 m. Somewhat disturbed, it still has the remains of at least 2 faced courses of limestone reef rock in it, and was in all probability used as a well for water. It is now filled with sand and coconut trees of various sizes.

The soil in the feature and in the immediate vicinity is brown sand with scattered pottery, limestone pebbles and other midden debris in it. Three m to the W of the feature is a small, low mound of black sand midden with a heavy concentration of pottery, shells, and an occasional broken shell tool.

The vegetation in the feature and vicinity is primarily *Cocos* sp. although some *Colocasia* sp. and *Alocasia* sp. occur to the E and NE. These wells appear to be a common feature of sites along the NW coast of the island. Nearly all are identical in size and use of stone facing. They undoubtedly were an important component of these site areas, and excavation and restoration are recommended.

INDIVIDUAL FEATURE EVALUATION: A RESTORATION UNIT, RESEARCH UNIT, PRESERVATION UNIT

Signed: *Art M. Linneman*

G-28

Date: 5-21-74

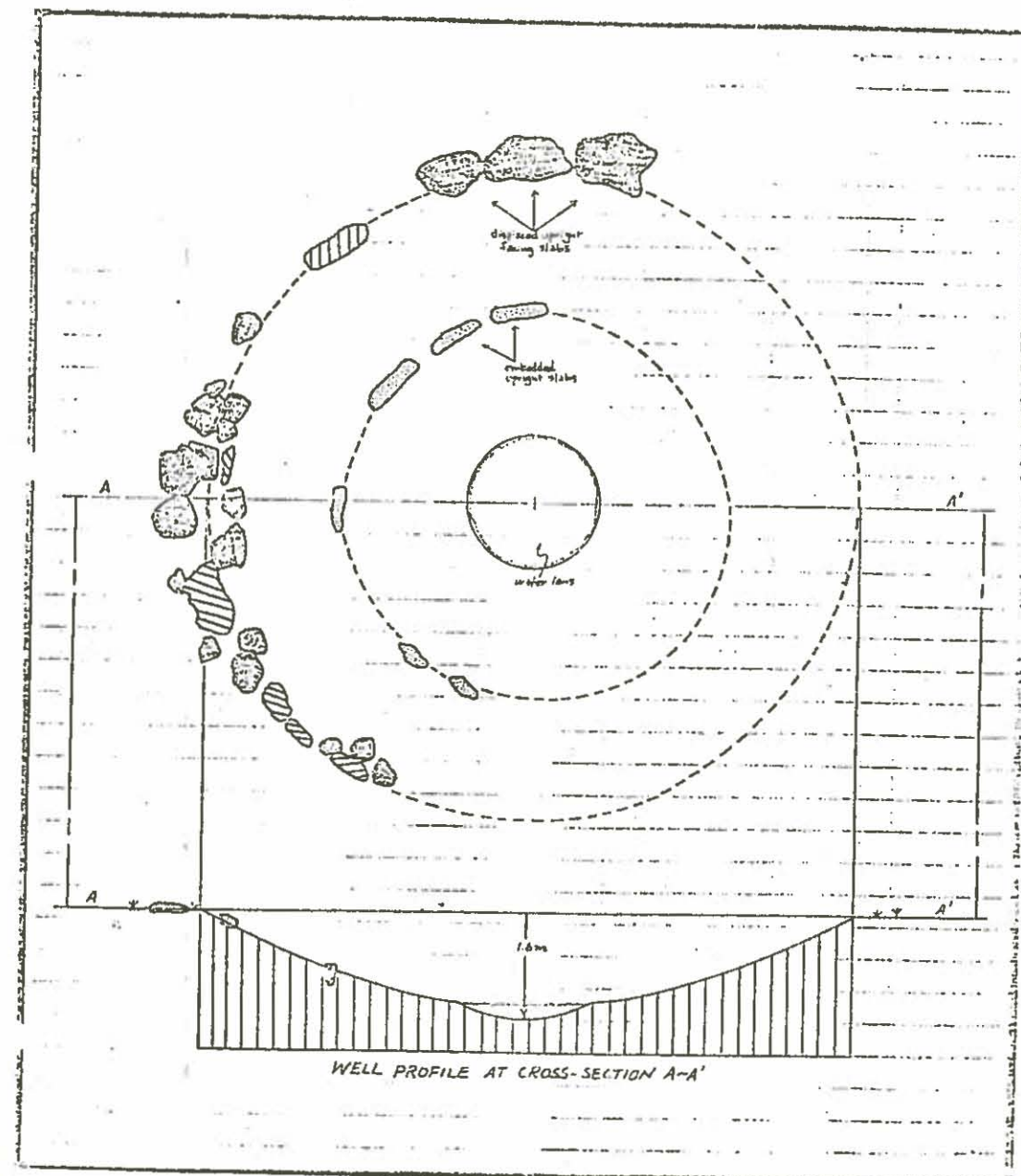
GUAM REGISTER OF HISTORIC PLACES SUPPLEMENTARY FEATURE MAP FORM

66 - 0 8 - 0 0 1 0 - 0 4
QUAD IDENTIFICATION NO. FEATURE NUMBER

SCALE IN meters

MAPPING TECHNIQUE:

North Arrow

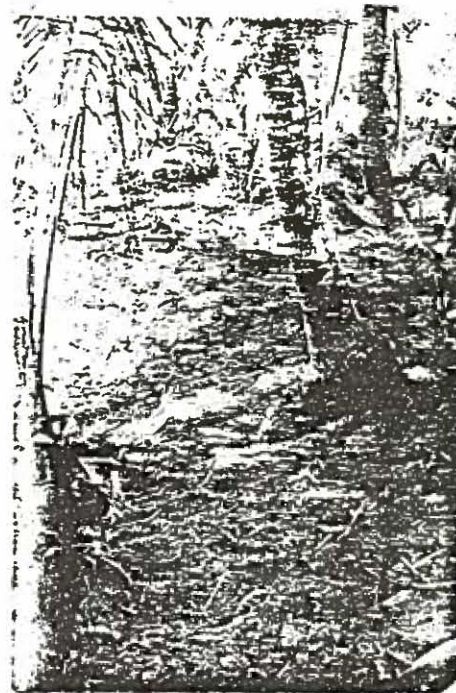


G-29

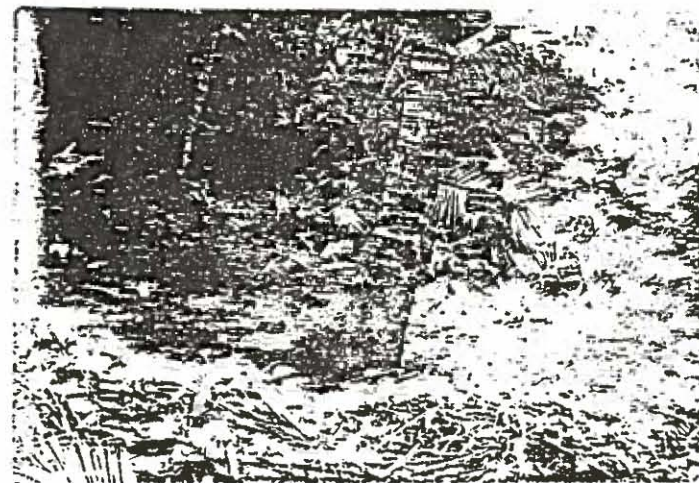
Use this sheet as necessary to explain any item on any form.

(Number all entries)

URUNO COMPLEX
66-08-0010-04
freshwater
well



G-MaG(a)-2:1

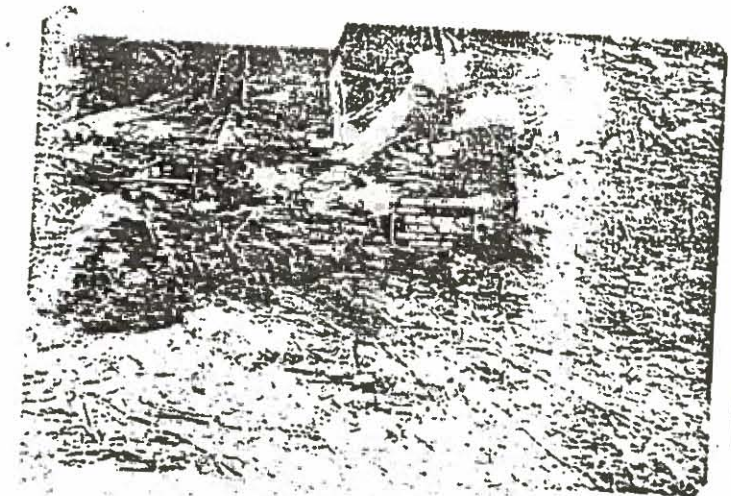


URUNO COMPLEX
66-08-0010-04
center of well
depression

G-MaG(a)-2:14

Use this sheet as necessary to explain any item on any form.

(Number all entries)



G-MaG(a)-2:15

URUNO COMPLEX
66-08-0010-04
limestone upright slabs
which line perimeter of
the well

FEATURE DESCRIPTION FORM

66-08-0010-05

Guam Quad Identification Feature Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature, terrain and vegetation; size; shape; construction technique; materials used; condition; surface artifacts or midden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

This latte is a large stone structure located 10 m N of structure 66-08-0010-01; it is 5 m of the cliffs, 2-25 m E of the beach. Oriented N/S it is 12 m long, 3 m wide (interior dimension), it is standing uprights .9 to 1.2 m in height. The uprights are thin slabs of limestone reef rock, trapezoidal in form while the capstones are mixed brown corals and reef rock with slotted layers, and some with carved lips. A large stone lined well is located 10 m W of the latte in a bamboo grove.

The soil of the site is 10 m sand with limestone pebbles, pottery, and other beach debris in it. A black sand midden with a heavy concentration of pottery begins immediately E of the structure and runs to the base of the cliff. A large wet cave occurs in the cliff behind the latte. A black sand midden also is found N and S of the structure.

The vegetation is mixed *Coccoloba* sp., *Triplaris* sp., and *Parsonsia* sp. A few papaya (*Carica* sp.) as well as unidentified ferns and vines were also noted.

The structure is also potentially restorable. The adjacent well, archaeological midden, rock shelters, and cave are all recommended for excavation and/or restoration.

INDIVIDUAL FEATURE OR SITE OR ANTHROPOLOGICAL UNIT, OR NATURAL UNIT, SALVAGE UNIT

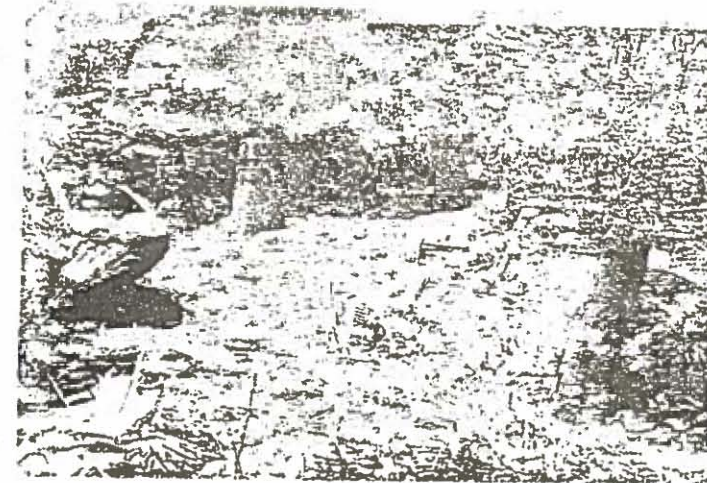
Signed: *W. M. Remmon*

C-32

Date: 5-21-74

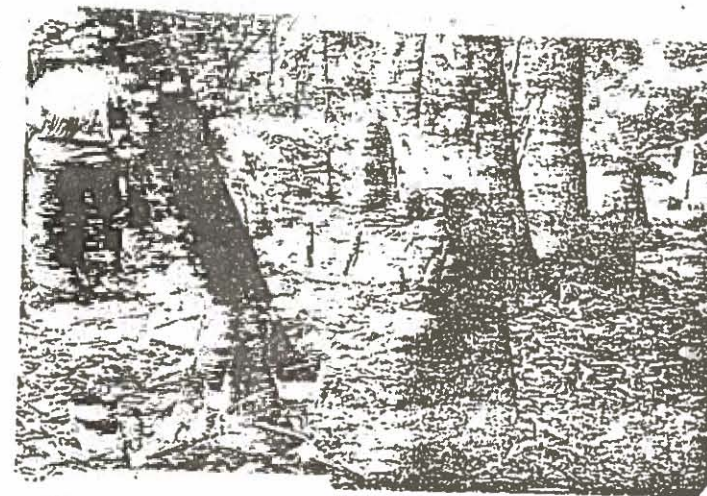
Id at f: for 10 66-01-01-0-0-5
REG. OF HIST. & MON. PLACES
CONSTITUTIONS
TI LA H'FE

Use this sheet is necessary to explain any of the following
(Number all entries)



URUJO COMPLEX
66-08-0010-05
latte set

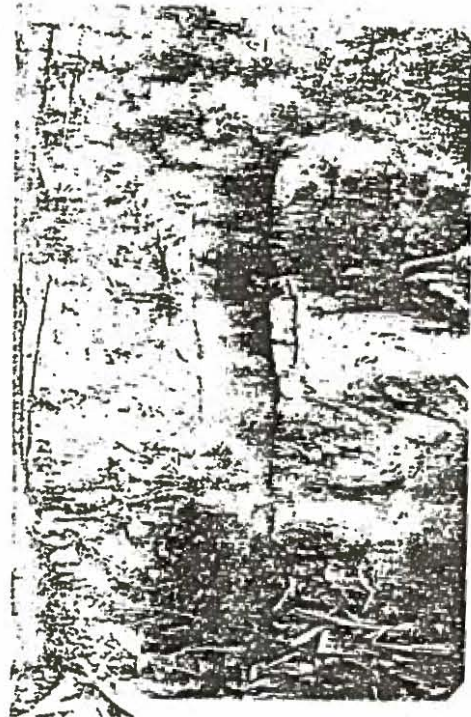
G-26(a)-2:16



URUJO COMPLEX
66-08-0010-05
latte set

G-26(a)-2:19

Use this sheet as necessary to explain any item on any form.
 (Number all entries)



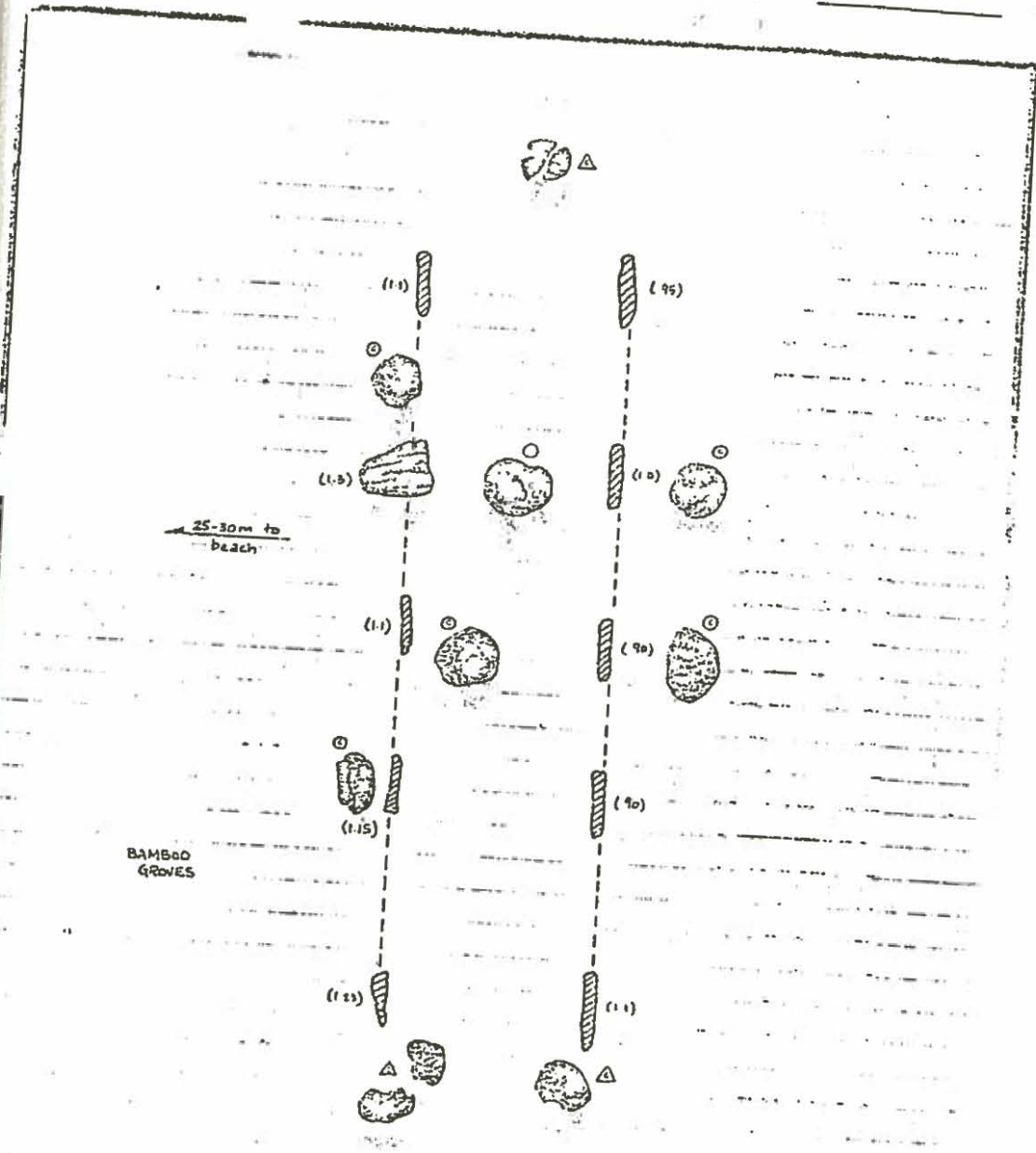
G 2G(2)-2:17
 URUNO COMPLEX
 66-08-0010-05
 silhouette side-
 view of slender
 upright

6 6 - 0 8 - 0 1 1 1
 QUAD, TITHE, GRID NO. FEATURE NUMBER

SCALE IN

MAPPING TECHNIQUE:

North Arrow



GUAM REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form.

(Number all entries)



6 REPRESENTATIVE OF EXISTING SURVEYS

SENT TO: I

26 Title: Archaeology and History of Guam, National Park Service,
U.S. Dept. of the Interior

27 Author: Erik K. Reed

28 Date: 1952

29 Type: Federal

30 Survey Record Located At: U.S. Dept. of the Interior

9 MAJOR BIBLIOGRAPHICAL REFERENCES

49 References:

Osborne, Douglas

n.d. Chamorro Archaeology, an unpublished manuscript on Guam sites
University of Washington

Thompson, Laura

1932 Archaeology of the Marianas Islands, Bernice P. Bishop
Museum Bulletin 100, Honolulu, Hawaii 78 pp.

Identification No. 00-0

47 Legendary Materials Known: Yes No

(If Yes, state title of legend and attach copy if available)

48 Written Historical Materials: Yes No

49 List Any References: (Especially those mentioned in any portion of forms)

listed as abandoned village on map of 1852 A.D.

Coello, D. Francisco Atlas de Espana y Sus Posesiones de Ultramar,
1852 A.D. Madrid.

10 GEOGRAPHIC DATA

50 Approximate acreage: 13.5 acres

51 Latitude and Longitude Coordinates Defining a Rectangle Locating the
Property if More Than 10 Acres

Corner	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
NW	13°	37'	09" N	144°	50'	00" E
NE	13°	37'	09" N	144°	50'	06" E
SE	13°	35'	50" N	144°	50'	06" E
SW	13°	35'	50" N	144°	50'	00" E

52 Latitude and Longitude Coordinates Defining the Central Point of a
Property of Less Than 10 Acres

Latitude			Longitude		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

11 FORM PREPARED BY

53 Name and Title: Guam Inv ^{ent}ory Team

54 Organization: Bernice Pauahi Bishop Museum

55 Street/Number: 1355 Kili St. - P.O. Box 5037

City/Municipality: Honolulu

57 State: Hawaii 96818

58 GSA Code: 2300

12 GOVERNMENT OF GUAM REVIEW RECORD AND EVALUATION

Name of Reviewer: David F. Lutz
 Title: Planner
 Category: ☒ High Value ☐ Valuable ☐ Low Value ☐ Marginal
 Significance: ☐ National ☒ Local
 Recommended Disposition: ☒ Nominate National Register ☒ Guam Register
☐ Staff File
 Recommended Themes: Micronesia-Guam, Settlement Patterns, Habitation.
 Reviewer's Comments:

13 REVIEW BOARD EVALUATION RECORD

Date Reviewed: _____ Recorder _____
 Official Category: ☐ High Value ☐ Valuable ☐ Reserve
☐ Marginal
 Official Significance: ☐ National ☐ Local
 Official Disposition: ☐ Nominate National Register ☐ Guam Register
☐ Staff Files
 Review Board Comments:
 Voting Record (Yes, No, Abstention, or Absent)
☐ History (Carano) ☐ Architecture (Jones)
☐ Archaeology (Birkedal) ☐ Tourism (Unpingco)
☐ Planning (Gilliam)
 Date submitted to National Register:
 Date entered on National Register:

ARCHAEOLOGICAL SITE SURVEY RECORD

Map 1152 T 113, 114, 115, 116
 Site Mindon (Guam) Grid coordinates 156054
 Location Large sandy beach cove immediately south of Mindon Pt.
 Contour elevation 5-15 m.
 Previous site designation Large Beach, Guam
 Owner(s) Joe E. Artero
 Address Agaña, Guam
 Present tenant Owner Attitude toward excavation Probably favorable
 Site description Large sandy beach site with some of the latest latte in this area on it; one capped upright still exists here (photo).
 Area 100x50 m. Depth of deposit _____ Soil of site sand to sandy clay
 Vegetation coconut, pandanus
 Previous excavation Hombotel in the 1920's
 Surface features, roads, bldgs., etc. Latte stones; Artero's beach house and several trails through area and along beach.
 Artifacts Pottery, stone and shell tools, mortars
 Burials _____
 Remarks According to Artero, Hombotel excavated here in some of the latte (he remembers him). Site is still extensive & heavy deposits. Six sets of latte still present. Several rockshelters & some usage of flat areas on higher contours.
 Date of survey 9-65 Recorded by Edison Photos Yes
 Sketch or site map Site Map Publ. references Thompson 1922; Gibson n.d.; Reed 1952

INVENTORY DATA FORM

66 08 0011



1 NAME

Common: Uruno Beach

And/or Historic:

Type of Site: Habitation Settlement

2 LOCATION

Street/Number

Lot or Estate No.: lot no. 10080

Municipality: Dededo

Land Square and Section: square 2, section 2; square 3, section 4

GSA Code Number: 0300

Local Place Name: Uruno Beach

Site Identification Number: 66 - 08 - 0011

3 CLASSIFICATION

Category: District ☒ Site ☐ Building ☐ Structure ☐ Object ☐
(check one)Ownership: Government of Guam ☒ Private ☐ Federal ☐
(check one or more as appropriate)Status: Occupied ☒ Unoccupied ☐ Preservation Work In Progress ☐
(check one or more as appropriate)Accessible to Public: No ☒ Yes, Restricted ☐ Yes, Unrestricted ☐
(check one)

Present Use: (check one or more as appropriate)

☐ Agricultural	☐ Industrial	☐ Religious
☐ Commercial	☐ Military	☐ Scientific
☐ Conservation	☐ Museum	☐ Transportation
☐ Education	☐ Park	☒ Unused
☐ Entertainment	☐ Residence	☐ Other
☐ Government	☐ Ranch	

Additional Comments On Present Use:

C-40

4 OWNER OF PROPERTY

Owners Name(s): Jose C. Artero, Antonio C. Artero, and Consuelo A. Galvo

Street/Number:

Mailing Address: P.O. box 752

Municipality: Agana, Guam

Telephone Number:

Leasee's Name(s):

Leasee's Address:

Owner's Attitude: ☒ Unrestricted Research Allowed ☐ Restricted Research Allowed ☐ No Research Allowed

Additional Information on Locating Owner: (Contact person, etc.)

5 LOCATION OF LEGAL DESCRIPTION

Government Agency: Dept. of Land Management

Street/Number: Administration Building

Mailing Address: Agana, Guam 96910

6 REPRESENTATION IN EXISTING SURVEYS

Title of Survey: Notes on an Archaeological Survey of Guam, Marianas Islands

Author/Participant: Dr. Fred M. Reinsman

Date of Survey: 1965-66

Type of Survey: GovGuam ☒ Private ☐ Federal ☐

Survey Records Located At: Dept. of Commerce Agana, Guam

Artifacts Located At:

7 DESCRIPTION

Known Pressures On Site: Yes ☒ No ☐Destruction: ☒ No Known Future Danger ☐ Possible Future Danger
☐ Future Danger Certain ☐ Present Danger ☐ Presently Being DestCondition: Excellent ☒ Good ☐ Fair ☐ Deteriorated ☐ Ruins
(check one) ☐ UnexposedIntegrity: Altered/Original Location ☐ Altered/Moved ☐
(check one) ☒ Unaltered/Original Location ☐ Unaltered/Moved ☐

C-41

8 SIGNIFICANCE

- 36 Period: (check one or more as appropriate)
☒ Pre-Magellan ☐ 16th Century ☐ 17th Century ☐ 18th Century
☐ 19th Century ☐ 20th Century
- 3 Specific Dates: (If applicable and known)
- 3 Areas of Significance: (check one or as appropriate)
- | | |
|--|--|
| ☒ Aboriginal/Prehistoric | ☐ Literature |
| ☐ Aboriginal/Historic | ☐ Military |
| ☐ Agriculture | ☐ Music |
| ☐ Architecture | ☐ Political |
| ☐ Art | ☐ Religion/Philosophy |
| ☐ Commerce | ☐ Science |
| ☐ Communications | ☐ Sculpture |
| ☐ Conservation | ☐ Social/Humanitarian |
| ☐ Education | ☐ Theater |
| ☐ Engineering | ☐ Transportation |
| ☐ Industry | ☐ Urban Planning |
| ☐ Invention | ☐ Other (specify) |
| ☐ Landscape Architecture. | |
- Importance As Example of Type Site: ☒ Good ☐ Moderate ☐ Poor
(check one)
- 40 Susceptibility to Interpretation: ☒ Good ☐ Moderate ☐ Poor
(check one)
- Research Potential: ☒ Good ☐ Moderate ☐ Poor
(check one)
- Local Attitudes About Site: ☐ Valuable ☐ Moderate Value ☐ Low Value
☐ Ambivalent ☒ Unknown
(check one)
- Staff Evaluation: ☐ High Value ☒ Valuable ☐ Reserve ☐ Marginal
(check one)
- 44 Recommended Disposition: ☒ Nominate National Register ☒ Guam Register
(check one or more) ☐ Staff files
- Suggested Themes:
Micronesia - Guam Settlement pattern, Habitation.

Additional Comments:

Signature:

Evaluator:

Title: Project Director

C-42

9 BIBLIOGRAPHICAL REFERENCES

- 47 Legendary Materials Known: ☐ Yes ☒ No
(If Yes, state title of legend and attach copy if available)
- 48 Written Historical Materials: ☐ Yes ☒ No
- 49 List any References: (Especially those mentioned in any portion of forms
Osborne, Douglas
1947 Archaeology of Guam, American Anthropologist Vol. 49, no. 3
Menasha, Wisconsin pp. 518-524

10 GEOGRAPHIC DATA

- 50 Approximate acreage: 54.3 acres
- 51 Latitude and Longitude Coordinates Defining a Rectangle Locating the
Property if More Than 10 Acres
- | Corner | Latitude | | | Longitude | | |
|--------|----------|---------|---------|-----------|---------|---------|
| | Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |
| NW | 13° | 38' | 19" N | 144° | 50' | 41" E |
| NE | 13° | 38' | 17" N | 144° | 50' | 51" E |
| SE | 13° | 37' | 26" N | 144° | 50' | 09" E |
| SW | 13° | 37' | 25" N | 144° | 49' | 59" E |
- 52 Latitude and Longitude Coordinates Defining the Central Point of a
Property of Less Than 10 Acres

11 FORM PREPARED BY

- 53 Name and Title: Guam Inventory Team
- 54 Organization: Bernice Pauahi Bishop Museum
- 55 Street/Number: 1355 Kalihi Street - P.O. Box 6037
- 56 City/Municipality: Honolulu
- 57 State: Hawaii 96818
- 58 GSA Code: 2300

C-43

12 GOVERNMENT OF GUAY REVIEW RECORD AND EVALUATION

59 Name of Reviewer: *David F. Lotz*
60 Title: *Planner*
61 Category: ☐ High Value ☒ Valuable ☐ Low Value ☐ Marginal
62 Significance: ☐ National ☒ Local
63 Recommended Disposition: ☒ Nominate National Register ☒ Guam Register
64 ☐ Staff File
65 Recommended Themes: *Micronesian - Guam*
Reviewer's Comments:

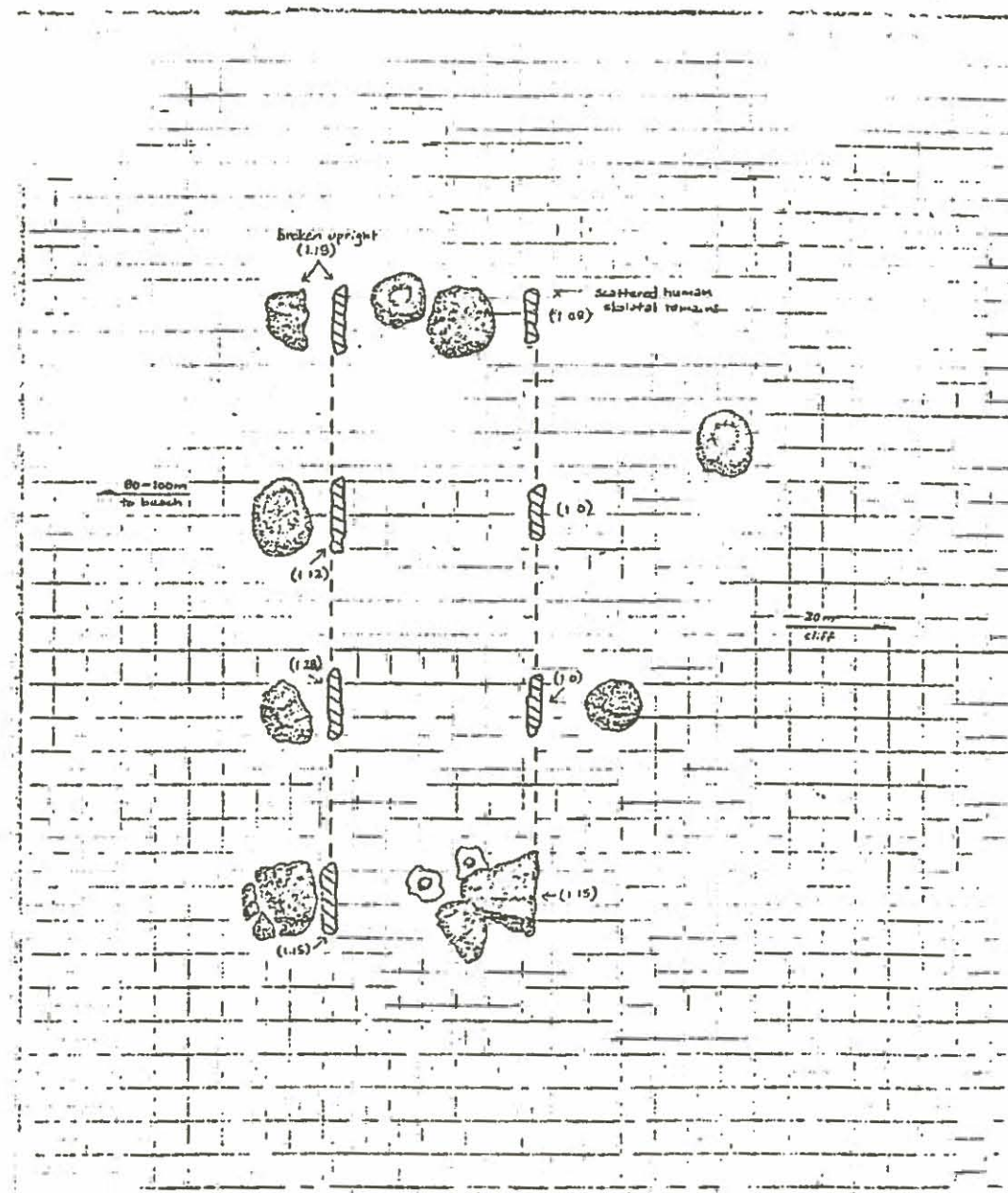
13 REVIEW BOARD EVALUATION RECORD

66 Date Reviewed: _____ Recorder _____
67 Official Category: _____ High Value _____ Valuable _____ Reserve
_____ Marginal
68 Official Significance: _____ National _____ Local
69 Official Disposition: _____ Nominate National Register _____ Guam Register
_____ Staff Files
70 Review Board Comments:

71 Voting Record (Yes, No, Abstention, or Absent)
_____ History (Carano) _____ Architecture (Jones)
_____ Archaeology (Birkedal) _____ Tourism (Unpingco)
_____ Planning (Gilliam)
72 Date submitted to National Register:
73 Date entered on National Register:

SUPPLEMENTARY FEATURE MAY FORM

0 1 2
ISLAND QUAD IDENTIFICATION NO. FEATURE NUMBER
SCALE IN m MAPPING TECHNIQUE: North A



FEATURE DESCRIPTION FORM

66 - 0 8 - 0 0 1 1 - 0 1

Guam Quad Identification Feature
Number Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; materials used; condition; surface artifacts or midden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

This latte is an 8 stone structure oriented 30° E of N and is located near the central part of the site some 80 m ^W of the beach and 20 m ^N of the cliffs. It is 9.8 m long and 2.65 m wide (interior dimension) with thin slab-like trapezoidal uprights from 1 to 1.28 m in height. Both uprights and capstones are made of limestone reef rock. Two single cavity basalt mortars lie between the southernmost pair of uprights, and a third lies 10 m to the NE. Scattered fragments of human bone (jaw, skull, longbones) lie near the eastern end, close to the last upright. A large well lies 10 m to the E.

The soil of the site is a brown sand containing limestone pebbles, shells, and other beach debris as well as scattered pottery sherds. A black sandy midden area lies 1 m E of the structure and runs to a large rock shelter in the cliffs 20 m away. Another small mound of black midden deposits is ca. 5 m to the NE. Two small upright fragments occur on the western edge of this area, 5 m N of the main latte structure.

Vegetation at the structure is *Cocos* sp., *Triphasia* sp., and *Mammea odorata*.

This latte group is the only set at this site remaining in restorable condition. Test excavations within the structure and the adjoining midden and rock shelter are recommended.

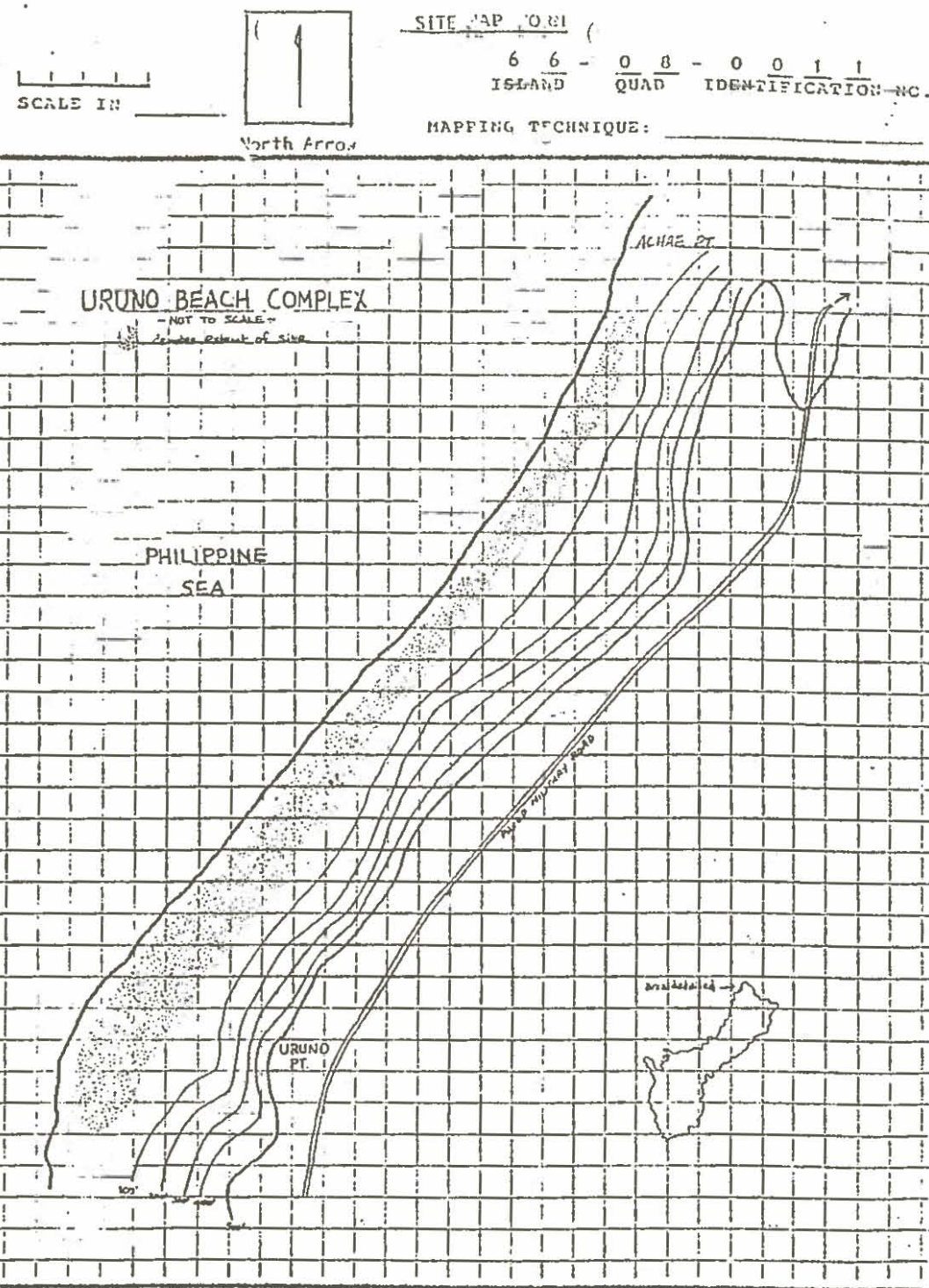
INDIVIDUAL FEATURE EVALUATION: ☒ RESTORABLE UNIT, ☐ RESEARCH UNIT, ☐ SALVAGE UNIT

Signed:

John L. Berman

C-46

Date: 5-21-74



C-47

GUAM REGISTER OF HISTORIC PLACES
CONTINUATION SHEET

Use this sheet as necessary to explain any item on any form.

(Number all entries)



6 REPRESENTATION IN EXISTING SURVEYS

- 26 Title: Archaeology and History of Guam, National Park Service U.S. Dept.
27 Author: Erik K. Reed of the Interior
28 Date: 1952
29 Type: Federal
30 Records Located: U.S. Dept. of the Interior

9 MAJOR BIBLIOGRAPHICAL REFERENCES

49 References:

- Thompson, Laura
1932 Archaeology of the Marianas, B.P. Bishop Museum Bulletin 100
Honolulu, Hawaii 78 pp.

Guam Quad Identification
Number

VERBAL DESCRIPTION MUST INCLUDE PERTINENT DATA ON: bearings and sources used to locate feature; terrain and vegetation; size; shape; construction technique; material used; condition; surface artifacts or midden visible.

SIGNIFICANCE STATEMENT MUST INCLUDE: unusual or important characteristics; accessibility; interpretive and research potential; evaluation of the site's importance as a representative of its class; recommendations for register category.

Description: The Urano Beach site is located at the base of the cliffs on the NW coast of the island from ca. 500 m S of Urano Point (HI 581) to Achae Point on the N. The southern part of the site is called Urano Beach on the USGS Ritidian Point Quadrangle map (1958). It is on the property of Jose C. Artero of Agaña. It may be reached by driving N on Highway 3 from Potts Junction, 3.2 miles to a paved, but badly deteriorated road .5 mile S of Urano Point which leads W to the cliffs. A steep trail leads down to L.R. Artero's ranch and the Urano site (66 08 0010). Walk N on the beach ca. 400-450 m to reach the southern end of the Urano Beach site.

The site is ca. 2200 m long and 100-150 m wide at the southern end, and covers the 20-40 foot contours. The heaviest concentrations of remains occurs in the southernmost 1200 to 1500 m of the site. At least 6 sets of latte occur here, most badly deteriorated and/or disturbed. A single set was recordable (66 08 0011 01). Several of the disturbed sets were small 4 stone sets, rather than the more usual larger latte. In addition, at least 3 large wells, ca. 10 m in diameter and still retaining remnants of the former stone facing on them, were noted. Scattered pottery, with heavier concentrations in low mounds occur all along the site area. Stone mortars, shells, broken shell and stone tool fragments, and other midden debris are also a part of the site remains. Rock shelters are found along the cliffs in the eastern part of the site.

The soil of the site is brown to black sand and sandy clay, containing scattered limestone pebbles and other beach debris.

Vegetation consists mostly of coconut (*Cocos* sp.) and *Pandanus* sp., but "Iron-China" (*Triphasia* sp.) and *Marras* sp. as well as other small shrubs and vines occur.

Significance: The Urano Beach site, like others along the NW coast appears to have been a heavily occupied area formerly. The large amounts of pottery and other living debris, and 3 large wells, indicate a site of some importance prehistorically. The single restorable structure, as well as the apparently fewer latte structures mean the site is less interesting from a restoration and developmental point of view than either Urano (66 08 0010) or Haputo (66 08 0007) also on this coast. Nevertheless, the archaeological research potential is very good and we recommend that a program of excavations be undertaken.

Recommended: Valuable site status

Signed:

X. J. L. Luman

Date: 5-21-74

APPENDIX D

DEPARTMENT OF THE AIR FORCE LETTER
24 JULY 1975, ELECTRONIC EMISSIONS

D-1

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 433 STRATEGIC WING (SAC)
APO SAN FRANCISCO 96334



REPLY TO
ATTN OF 43SW/LGPV

24 Jul 75

SUBJECT Contract F64133-75-C-0030, Candidate Environmental Statement

RECEIVED

JUL 2 1975

TO AUSTIN, SMITH & ASSOCIATES, INC.
P.O. Box BT
Agana, GU. 96910

AUSTIN, SMITH & ASSOCIATES, INC.
Honolulu, Hawaii 96813

Information currently available which was requested by your firm on
19 Mar 75 is as follows:

a. Air Force Satellite Control Facility inputs to questions 1,
6A, and 6B from 17 Mar 75 meeting and questions 2, 3, and 5 of 18
Mar 75 meeting are provided.

b. Question 3, 17 Mar 75 meeting - Northwest Field presently
serves as the site from the Air Force Satellite Control Facility.
There are future plans for the expansion of the conventional weapons
storage area into Northwest Field. The scope is shown on the attached
"Development Plan - Storage Area". In addition, the Global Position-
ing System is planning a station at Northwest Field.

c. Question 6.C, 17 Mar 75 meeting - The Air Force does not em-
ploy nor does it have information on routine maintenance schedules for
shielding and general radio interference protection equipment as
applied to installations in tropical locations.

d. Question 2, 18 Mar 75 meeting - Blast Clear Zone limits for
Ammunition Depot are as indicated on Attachment 1.

e. Coordinates of emission source is 13 degrees, 36 minutes,
Longitude.



Peace . . . is our Profession

D-2

f. With the exception of the 8-16 GHz band, all frequencies are in use 24 hours/day, 365 days/year. The 8-16 GHz band may be utilized anytime after FY 76 and would be used around the clock.

(1) Also note that the Global Positioning System is planning a station near OL AD which will receive frequencies from 1227 and 1575 MHz. Maximum permissible flux density will be -154 dba/m^2 , and operations will be full time. Requests for information on this program should be directed to SAMSO/YEP, P.O. Box 92960, Worldway Postal Center, Los Angeles, California, 90009.

g. Background noise is not expected to impact our operations regardless of the volume of traffic.

h. Present road is, at a minimum, 1400 ft. from the GTS TT&C 60 antenna. Maximum anticipated power density when radiating at 10kw exceeds the maximum recommended level of 10 MW/CM square. At a height of 8 feet above road surface, this level is 16 MW/CM square. The duration would probably not exceed 60 seconds and only on rare occasions when the antenna is at 0 deg. elevation and radiating at full power. This situation is not regarded as particularly hazardous to personnel traffic on the road.

i. A hazard may exist when the contractor is transporting explosive devices to the construction site. In this case it is recommended that coordination with the site be made prior to transporting.

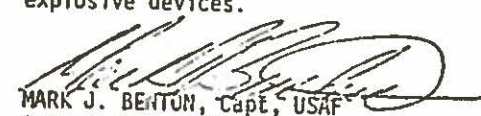
j. Based on a 1970 Hazard Survey by AFSC E&I (Gebia) the following radiation hazard distances when operating at 10kw:

POL	165 ft.
Personnel	2,609 ft.
3ED	31,300 ft.

k. No other reason other than obscura and radiation are known for establishing the one mile clear zone.

l. Based on the above, there is no restriction to use the road at a distance of one quarter mile except for coordination

when explosive devices are to be transported. However, in the interest of personnel safety, the contractor should consider recutting the road so that the closest point is in excess of one-half mile. This still would not alleviate the requirement concerning explosive devices.


MARK J. BENTON, Capt, USAF
Contracting Officer

1 Atch
1. Master Plan Drawing C-2

APPENDIX E

LIST OF PERSONS CONTACTED

~~LIST OF AGENCIES AND INDIVIDUALS CONTACTED~~

1. U.S. Air Force - Capt. Coleman; Lt. Vansaun, TSgt. Waterman; Mr. S. Lowrey
2. Seibu Leisure Guam - Mr. C.C. Cheng
3. Marine Laboratory, University of Guam - Dr. R. Tsuda, Mr. R.E. Dickinson
4. Land Management - Mr. J. Laguana
5. Department of Commerce, Parks and Recreation Resources - Mr. David Lotz
6. Department of Public Works, Solid Waste Disposal - Mr. J. Guerrero
7. Central Planning Agency, Territorial Planning Commission - Mr. Paul Souder
8. Department of Agriculture, Fish and Wildlife - Mr. Isaac Ikehara
9. Public Utility Agency of Guam - Mr. A. Halili, Mr. J. Carrera
10. Guam Power Authority - Mr. Cavote; Mr. S. Cabrera
11. Guam Telephone Authority - Mr. J. Nakamura
12. Department of Public Works, Highway Planning - Mr. J. Pastic
13. Guam Environmental Protection Agency - Mr. J. Wager; Mr. R. Carter
14. Department of Labor - Mr. L. Umagat
15. Guam Visitors Bureau - Mr. Frank S. Cheng
16. Singer-Layne Guam - Mr. Lester Lien
17. University of Guam - Dr. Oscar Levant

APPENDIX F

URUNO CODE - FROM SLG MASTER PLAN

13. PLAN FOR THE ENVIRONMENTAL PRESERVATION, PROTECTION AND MANAGEMENT:

13-1 Basic Plan for Environmental Preservation and Protection:

a) Natural Vegetation:

Palm forest must be protected and no permanent facilities will be built in this area. A basic clean up operation is necessary, however, to further enhance the beauty of this natural vegetation, and some temporary facilities may have to be built in the forest.

In the event the cutting of palm trees is required, it must be checked very carefully on a case by case basis. The survey of the location of unique vegetation must be made and the determination should be made to find out whether the particular plant must be left in the area or moved to the botanical garden planned in the Project Site.

The botanical garden should not limit the collection to the tropical vegetation on Guam or Micronesia but fruit bearing trees and vegetables must be cultivated for local consumption.

b) Animal Life:

A survey must be made on the kinds of animal life existing in the Project Site and they must be protected in the natural environment.

The plan will be made for the visitors to come in contact with such animal life in the botanical garden, camping area, and walking zone.

c) Land:

The plan is to utilize the natural contour of the existing land as much as possible and man-made creations must be kept to a minimum. A survey will be made to investigate the

location of caves or special land features and plans will be made to use them without destroying the naturally created land formation.

d) Reef:

It is important to take a great care in rehabilitating or changing the coral reef flats and a careful survey must be conducted.

When it is necessary to cut the reef flat and reef front to construct a marina, a survey must be conducted thoroughly to determine the location least affecting the destruction of coral and sea life. The structural stability must also be investigated.

In the event the coral reef flat is to be used for the construction of a pleasure canal, swimming hole, fish pond or an aquarium, the location, where the coral is dead and requires rehabilitation and where the fish life could be revived must be selected.

Refer to the Conference Memo No. 2, discussion on this subject with the marine biologist of the University of Guam.

e) Historical Remains:

It is possible to locate some historical remains or objects along the cliff or in the tropical forest within this Project Site. Upon discovery of such remains through an extensive survey the developer will try to leave or restore them at the location of discovery. Micronesian Museum will also be planned in the Project Site.

13-2 Authority on or with the Environmental Protection in Planning and Development:

- | | |
|---|---|
| a) Master Plan
Roadway
Sewage
Public Utilities | Environmental Protection Agency
of Guam |
| b) Development of Reef
and the Ocean
Sewage Discharge | Environmental Protection Agency,
U.S. Department of Interior |
| c) Roadway
Development of Reef
and the Ocean
Sewage Treatment
Electrical Supply | U.S. Military |
| d) Helicopter | Federal Aviation Agency (FAA) |

13-3 Uruno Code for Environmental Protection and Architectural Design Guide (Uruno Code):

The master plan of the entire Project will be made based on the environmental protective plan. However, in order not to destroy the total image of the Project, the design team must develop, guide and maintain the plan throughout the total phase of the Project. The Uruno Development Design Team (Leibu Leisure Guam and their staff designers) must seek the cooperation of the Government of Guam and the people on the island. The Uruno Design Committee can establish a Uruno Code taking into consideration all the pertinent laws and regulations but establish special guidelines to regulate the specific planning approach. The Committee should establish its own planning code to regulate and evaluate the Project voluntarily prior to receiving Government approval.

Architectural Code (Uruno Code) not only include all the available existing codes and regulations into consideration but also to establish the guidelines to protect the natural assets at the Uruno Project Site and how to utilize these assets by

sub-developers if they are to come in to participate on the Project. The Seibu Leisure Guam (SLG) will act as the overall project manager and coordinator of the design proposed by sub-developers when such a need arises. Although the developer (SLG) must respect the unique characteristics of the Project from sub-developers the guidelines to be established for the proposed Project must be carefully studied and must be furnished to the sub-developers in advance.

The following points must be taken into consideration in establishing such an agreement:

- a) Relationship with the Government of Guam.
- b) Duration and effectiveness of the agreement and modification procedures.
- c) Method for presenting appeal.
- d) Requirement for the sub-developers to present plans to the design committee.
- e) Designation of the number of types of facilities to be constructed on the land.
- f) Designation of the total floor area against land area (density designation).
- g) Regulation for earth moving.
- h) Regulation for destruction or moving of vegetation.
- i) Checking building heights and location of planned buildings with respect to view of the ocean. Obstruction of view must be avoided.
- j) Regulate building types in the environmental protective area for example: height, material, etc. Regulate building material used outside (example use of mirror glass or reflective element on the facade of buildings).

k) Regulation for the placement of sign board, advertisements, directional sign, etc.

l) Regulation on noise and light.

m) Regulation on disposal of trash.

n) Regulation on radio frequency interference.

o) Duties for the maintenance of the environment by the landowner and the developer and sub-developers.

p) Regulation on fire fighting equipment and fuel storage.

q) Regulation of various activities in the public area:

- 1) Speed limit for auto traffic
- 2) Protection of animal, vegetation, historical remains and natural landscape
- 3) Disposal method of trash
- 4) Regulation on explosive materials
- 5) Regulation of dangerous activities on the reef flat (Refer to Sea Ranch Architectural Agreement)

The following points will be taken into consideration in establishing a code for the maintenance of facilities at the Uruno Project Site:

a) Roadways and Utilities:

Community facilities (public facilities, kindergarten, meeting places) must be done by the Government of Guam.

b) Public Zone (Reef, Beach, Promenade Zone):

Museum, botanical garden, fish pond or hatchery, aquarium, mechanical transportation, information center, maintenance facilities will be taken care of by developer (SLG) and a portion by the Government of Guam.

- c) Subdivision area and accessory facilities will be taken care of by sub-developers and users.

15-1 Disposal of Waste Materials and Trash:

It is most important not to destroy the natural environment of the Lruno Project Site and the problems related with the disposal of trash and waste materials must be carefully considered. The disposal method must be tied in with the residents at the Project Site and the visitors to the site but must be carefully controlled, similar to the sewage treatment methods and regulations.

The amount of trash will vary with the nature of the facilities and can be divided into hotel and residential area where the density is fairly high and low density area such as the forest and outdoor area. Even though it may not be necessary to use an air duct system, it will be necessary to provide periodic waste collection vehicles to gather trash and transport it to the incineration plant for a densely populated area, but it will be difficult to accomplish this in the low density area and a new system may have to be developed. Provision of trash cans and periodic collection can solve this problem but the following items must be taken into consideration:

a) On Land:

- 1) Place to gather empty cans.
- 2) Automatic vending machine with the collection device for empty cans: It is expected that the enormous amount of empty cans will have to be disposed daily and must be disposed with the most practical and economical methods.
- 3) Small press to minimize volume and transport them out of the site.
- 4) Utilization of empty cans for some other use (imaginative ideas).

b) On the Reef!

- 1) Trash collection vessel.
- 2) Think of a game to collect trash by the visitors: Ask volunteer^s to collect trash in the reef area periodically. Awarding money to the best collectors of the trash.
- 3) Burn the trash at a camp fire event.
- 4) Monument to absorb all sorts of trash: Trash cans, incinerator and pressing equipment could be designed as a show piece or a monument. The process of disposal could be shown to visitors, or the residual heat could be utilized for some other useful purposes, converting it to sound or light.