

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

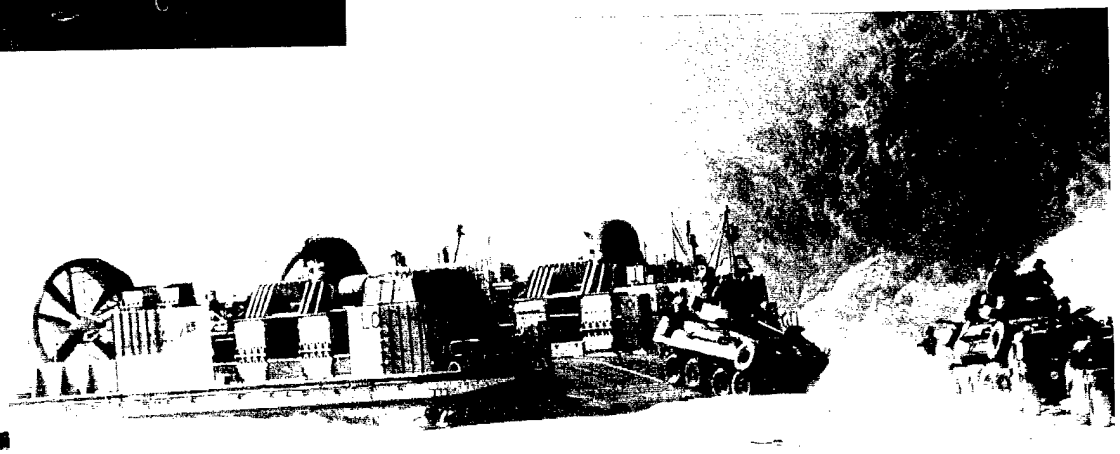
MILITARY TRAINING IN THE MARIANAS

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U.S. Pacific Command
June 1998

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DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

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DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
FOR
MILITARY TRAINING IN THE MARIANAS

Enclosure (1) is forwarded for your review and comment. The DEIS was prepared by Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) on behalf of the Commander in Chief, U.S. Pacific Command (USCINCPAC) in cooperation with all of the Pacific area military services, including the National Guard and Army Reserve. This DEIS supersedes the original DEIS of January 1997.

The revised DEIS incorporates both oral and written comments received on the original DEIS. The Notice of Announcement of Public Hearing and Availability of the original DEIS of January 1997 was published in the Federal Register on February 11, 1997 and Public Meetings were conducted during the period, March 3 through 6, 1997 on Rota, Tinian, Saipan and Guam.

Written comments should be postmarked not later than September 28, 1998 and be addressed to Commander, Attn: (Code 231FM), PACNAVFACENGCOM, Building 258 Makalapa, Pearl Harbor, HI 96860-7300.

Should you have any questions, please contact Mr. Fred Minato at (808) 471-9338, by facsimile transmission at (808) 474-5909 or email at fminato@efdpac.navfac.navy.mil.

Thank you in advance for participating in the EIS process.

Sincerely,

Stanley Y. Uehara

STANLEY Y. UEHARA
Director
Environmental Planning Division
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Encl:
(1) DEIS for Military Training in the Marianas of June 1998

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ABSTRACT

Draft Environmental Impact Statement (DEIS) for Military Training in the Marianas

[supersedes a previous DEIS for Military Training in the Marianas, dated January 1997]

Lead Agency : U.S. Pacific Command, Department of Defense
Coordinating Agency : Pacific Division, Naval Facilities Engineering Command
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ABSTRACT. The Commander, Naval Forces Marianas, acting for the Commander in Chief, U.S. Pacific Command, requires training areas for military forces in its area of responsibility. Approximately 4,600 personnel from the Air Force, Navy, Guam National Guard, Army Reserve, and Marine Corps as well as transiting carrier battle groups and amphibious ready groups depend on Guam and the Commonwealth of the Northern Mariana Islands for training. Training areas are required to develop war fighting skills and to maintain a state of combat readiness in troops stationed on Guam and in transiting forces headed for deployment in the Western Pacific and Indian Oceans.

The proposed action is to define certain DoD-controlled lands for military training necessary to ensure the readiness of U.S. forces assigned in the region or having assigned regional contingency missions. It is largely a continuing action. Proposed training locations are the Military Lease Area on Tinian, active military bases on Guam (Ordnance Annex, Waterfront Annex, Communications Annex, Andersen Air Force Base including the Main Base, Northwest Field, and Andersen South), the Navy-leased island of Farallon de Medinilla (FDM), and certain nonmilitary properties on Guam and Rota. The Preferred Alternative consists mostly of ongoing training land use, including logistics training, tactical exercises, combined arms training for large groups, joint-service exercises involving 1,000 or more personnel, parachute and aviation certification, weapons and demolitions certification, naval gunfire, and aerial bombardment. It proposes the following new land uses: amphibious landings at certain Tinian and Guam beaches, several new or modified live fire ranges on Tinian and Guam, new underwater demolition site, and a new rapid runway repair site. Alternatives include No Land Use, Reduced Land Use, No New Action (continuing training use presently occurring), and Not-preferred Action Alternatives (training uses desired by operators but not preferred due to significant impacts which cannot be mitigated to nonsignficance).

Tinian, Guam, FDM, and Rota are subtropical islands containing endangered species (birds, bats, reptiles, snails, and various plants); and migratory seabirds. The brown tree snake has decimated Guam bird populations, endangering or resulting in extirpation or extinction of some bird and bat species. Export of the brown tree snake to other islands from Guam would be ecologically disastrous. Cultural resources on Tinian and Guam include Chamorro sites and resources, and historic structures from World War II battles. Island residents are U.S. citizens. Apra Harbor on Guam and Northern Tinian are both popular tourist activity areas as well as being military-controlled sites used and proposed for military training use.

Eight potentially significant issues were identified and analyzed in detail: (1) Potential impacts on endangered species and other biota consist primarily of noise disturbance and habitat disturbance or destruction by fire, vegetation clearing, offroad vehicles, amphibious vehicles, and underwater demolition. Seabirds or endangered megapodes and fruit bats on FDM may be killed by ordnance. Proposed mitigation consists primarily of restricting or denying training activities at certain locations or during breeding seasons, and compensatory mitigation for impacts on Farallon de Medinilla. (2) Potential impacts on archaeological sites (Chamorro) and World War II historic resources would be mitigated by restricting or denying training activities at certain locations. (3) Analysis indicates that no significant impacts on existing Tinian wastewater disposal facilities would result from the proposed action and (4) no significant impacts on waste transportation or disposal facilities would result from continued backhauling of solid waste to Guam for disposal at a Navy landfill or transport of small amounts of hazardous waste from Tinian via Guam to the continental U.S. for disposal. (5) Analysis indicates that no impacts of aviation training or (6) live fire on designated ranges on public safety would occur which cannot be mitigated by observing existing military and FAA protocols. Potential impacts of a proposed sniper range on civilian hikers entering the Ordnance Annex will be mitigated by realigning firing positions so that the hiking trail is not in the surface danger zone. (7) Potential impacts on Tinian's economy from military training, and cumulative impacts with the new casino industry, will be mitigated by establishing a communications protocol with Tinian officials requiring 30 days' advance notice of any training activity. No disadvantaged or minority population will be disproportionately impacted by the proposed action. (8) Potential impacts on Apra Harbor commercial boating and diving operations from underwater demolitions training will be mitigated by using an alternative site as often as weather conditions permit.

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Latte stone on Tinian, 1944 (National Archives at College Park)

EXECUTIVE SUMMARY

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

EXECUTIVE SUMMARY

The purpose of this DEIS is to evaluate environmental impacts of using Department of Defense (DoD)-controlled lands in the Mariana Islands as training areas for some years into the future. This draft environmental impact statement (DEIS) supersedes a previous DEIS for Military Training in the Marianas, dated January 1997. This DEIS evaluates both ongoing and proposed new use of DoD lands for training. The basis for the proposed action is the Marianas Training Plan, prepared by the Pacific Division, Naval Facilities Engineering Command on behalf of the U.S. Pacific Command (USCINCPAC). All mitigation documented in the Record of Decision for the Final EIS will be included in future site-specific training orders, streamlining the process of planning training exercises and assuring that all necessary mitigation will be implemented.

The following sections are numbered to correspond with chapters of this DEIS.

1.0 PURPOSE OF AND NEED FOR MILITARY TRAINING IN THE MARIANAS

Summary. The proposed action is to use existing DoD-controlled lands in the Mariana Islands for military training necessary to ensure the readiness of U.S. forces assigned in the region or having assigned regional contingency missions. The proposed land use is largely a continuing action on the following U.S. government lands:

- **Tinian:** Military Lease Area
- **Guam:** COMNAVMARIANAS Waterfront Annex, Ordnance Annex, Communications Annexes; Andersen Air Force Base
- **Farallon de Medinilla:** [entire island]

Training needs in the Pacific theater. Military training in the Marianas is required to develop and maintain war fighting skills and a constant state of readiness in forces responsible for responding to crises in the "Pacific theater." The force structure of approximately 100,000 U.S. military personnel is projected to be in the Pacific area for the foreseeable future. These forces consist primarily of:

- Continental U.S. (CONUS)-based Carrier Battle Groups, Amphibious Ready Groups, and Marine Expeditionary Units, which deploy on a regular basis to the Western Pacific and Indian Ocean. These forces transit the Marianas and require training immediately prior to deployment.
- Forward-deployed forces permanently based in the Western Pacific, primarily on Guam and in Japan and Korea. Forces relying on the Marianas for training consist of approximately 4,600 personnel from the Air Force, Navy, Guam National Guard, and Army Reserve on Guam and the Marine Corps in Japan.
- Forward-based forces, not usually deployed to the Western Pacific but required to periodically train in joint exercises in the Marianas or Western Pacific.

Proposed training activities include basic military occupational skills training and weapons certification, logistics training, tactical exercises, combined arms training for large groups, and joint-service exercises involving 2,000 or more personnel on land. Transiting Amphibious Ready Groups, Marine Expeditionary Units, strategic bombing units, and aircraft carrier battle groups require amphibious assault training, aerial bombardment, and naval gunfire training. These activities have various training facility requirements, including relatively large areas of undeveloped and wooded terrain, urban areas, beaches with contiguous land maneuver areas, airfields, designated landing and paradrop zones, weapons ranges, seaports, and a bombing range.

A few training land uses are essential but have significant impacts which cannot be fully mitigated to nonsignificance or which remain controversial despite evaluation. These are:

- Amphibious assault vehicle (AAV) landings at one beach within Tinian's Exclusive Military Use Area (EMUA): a narrow corridor of low density coral would be damaged
- Aerial bombardment of Farallon de Medinilla (FDM) with live ordnance: bird mortality and habitat modification
- Underwater demolition of live 10- and 20-pound charges in Apra Harbor: concerns about safety of endangered sea turtles [no mortality or harm recorded from past use]

Alternative training locations are no longer available in the Philippines and are limited in size and scope in Japan. Forces based outside of Korea may not be permitted to train in Korea. Training areas in Hawaii are outside the Western Pacific theater of operations. Combined exercises are conducted in other countries, such as Australia and Thailand, but such training is expensive and infrequent.

Military land in the Marianas. The DoD leases a large portion of the island of Tinian (the Military Lease Area) for training and leases the uninhabited island of Farallon de Medinilla (FDM) for naval gunfire and aerial bombardment. Undeveloped areas owned by the DoD and suitable for training are available on Guam at Andersen Air Force Base (AAFB), COMNAVMARIANAS Waterfront Annex, Ordnance Annex, and Communications Annex sites at Finegayan and Barrigada. Training at AAFB facilities is administered by Commander 36th Air Base Wing. All other training lands in the Marianas are administered by COMNAVMARIANAS.

Decision needed. As a consequence of impacts analysis, the decisions to be made are:

- Whether or not to use or continue using certain lands for military training
- What training to perform on specific lands
- What mitigation to require for training impacts on specific training lands

The record of decision (ROD) will be signed by Commander, Naval Forces Marianas, acting in his capacity as Representative, US Commander-in-Chief, Pacific Forces (USCINCPAC).

Scoping. During the EIS scoping process, eight potentially significant impacts of the proposed action were identified for detailed analysis (see Section 4.0 below). Many potential impacts

(significant and nonsignificant) will be mitigated by compliance with existing federal, territorial, commonwealth, and military regulations and orders. These impacts include surface water quality, range and aviation safety, hazardous materials and hazardous waste management, and construction management practices.

Permits and approvals. Consultations have been initiated with government agencies to obtain their concurrence with the Preferred Alternative. Concurrence is required from the U.S. Fish and Wildlife Service and National Marine Fisheries Service for activities with the potential to impact threatened and endangered species and marine mammals. Concurrence is required from the Guam and CNMI Historic Preservation Officers for activities with the potential to impact sites determined to be significant under National Register of Historic Places criteria. Finally, the Guam Bureau of Planning and CNMI Office of Coastal Resources Management must concur that the proposed action is consistent with local Coastal Zone Management programs. The agencies may request modifications of the proposed action before providing their concurrence.

2.0 PROPOSED ACTION AND ALTERNATIVES

The proposed action is to use all suitable sites on DoD-controlled lands in the Marianas for military training—largely a continuing action. To meet the purpose and need, training sites are required which include large undeveloped and uninhabited areas, airfields, beaches, live fire ranges for various weapons, and underwater demolition sites. These features are collectively available on DoD-controlled lands on Tinian, Guam, and FDM. In addition, certain non-DoD areas on Guam and Rota are proposed as sites for selected training by small groups. Most proposed and alternative areas are currently used for at least 90 percent of the training activities described.

The alternatives addressed include:

- **No Land Use/Reduced Land Use:** Not using all or part of a land area for a given activity or category of activities
- **No New Action** (continuing action): Continuation of (i.e., no changes to) ongoing land use for training
- **Preferred Alternative:** Continuing land use, plus several new training land uses
- **Not-preferred Action Alternatives:** This collection of alternatives includes ongoing land use plus land use for training activities which were proposed by operators but are not included in the Preferred Alternative (usually because of significant impacts which cannot be mitigated to nonsignificance).

Alternative training locations outside the Marianas do not comprise reasonable alternatives to DoD lands in the Marianas.

Tinian land use. Tinian contains the 67 km^2 Military Lease Area, two airfields, a port, beaches which were used for amphibious landings in World War II (WWII), and a former live fire range (small arms and mortars). The Military Lease Area is essentially undeveloped and largely forested. Access is not restricted; it is currently used for military training and limited cattle

grazing. The northern section—the Exclusive Military Use Area—is also a tourist destination on Tinian, due to the presence of a WWII National Historic Landmark as well as beaches, a blowhole, and local shrines. Only about 70 percent of the 30 km^2 Exclusive Military Use Area may be used for unrestricted training, in compliance with existing agreements protecting endangered species, wetlands, and cultural resources. Several endangered bird species inhabit Tinian, and protected sea turtles nest on most of its beaches.

Most proposed training activities are continuing actions on Tinian, including large-scale field maneuvers, a variety of aviation training, and air-cushioned landing craft (LCAC) training. Proposed new land uses are constructing a small logistics support base camp, security gates, a small arms range, and a mortar range, and using two beaches for AAV landings. The Preferred Alternative excludes the security gates, mortar range, and one of the AAV landing beaches.

Waterfront Annex land use. The Waterfront Annex includes Orote Point and much of the shoreline of Inner and Outer Apra Harbors. Most of the annex is intensively developed, but Orote Point includes some mixed open and forested areas, in addition to an old airfield runway and a historic trail frequently open to civilians. Available training facilities include two small arms ranges, an airfield, a shooting house, adequate undeveloped land for small unit maneuvers, and beaches feasible for amphibious vehicle landings. Some areas around the harbor are in the process of being transferred to civilian authorities. The Outer Harbor contains submerged ships, some of which are historic resources and one of which contains depth charges which may be armed and unstable. Protected turtle species frequent the harbor, and migratory seabirds nest along the south cliffs of Orote Point.

Continuing training land uses are small unit bivouacs and tactics, base camp construction and operation, helicopter operations in Apra Harbor and at the airfield, LCAC landings, underwater demolitions, and use of the ranges and shooting house. The new training land uses proposed are to (1) modify former range to allow fire-and-maneuver capability, (2) modify another range to create a stress course, (3) conduct deepwater mine countermeasures (MCM) training at a site offshore of Dadi Beach, and (4) conduct LCAC, AAV, and LCU landings at various locations. The Preferred Alternative excludes some of the proposed LCAC and AAV landing areas.

Ordnance Annex land use. The Ordnance Annex is 36 km^2 of mostly undeveloped land, with a network of roads serving ordnance magazines. Permanent structures and training activities are prohibited within certain portions of the explosive safety quantity distances generated by the stored ordnance. Resources in the Ordnance Annex include Fena Reservoir (one of two major surface water bodies on Guam), substantial numbers of archaeological resources, various endangered or rare animal species (birds, bats, butterflies, snails, and geckos), and wild carabao, which attract poachers. A commonly used civilian hiking trail passes through the southwest portion of the annex.

Continuing training land use consists of small unit patrols and land navigation, water purification, bivouacs, and helicopter operations. The only new land uses proposed are construction of a sniper firing range and breaching house in the southern portion of the annex and use of an existing helicopter landing zone as a parachute drop zone. The Ordnance Annex is not proposed for amphibious landings, underwater demolitions, or bombing. The Preferred

Alternative includes all proposed new land use, but modifies the sniper range orientation and design.

Andersen Air Force Base and Communications Annex land use. AAFB and the two Communications Annex sites make up 92 km^2 of largely undeveloped open and forested land. The coastline consists of high cliffs with a few beaches. AAFB Main Base is a large working airfield, Northwest Field is an airfield used for operations and training, and the Munitions Storage Area is a secured magazine. Communications Annex Finegayan is a receiver site, and Communications Annex Barrigada has a transmitter relay. The few remaining endangered Mariana crows live at AAFB, primarily in the Munitions Storage Area; endangered bats live in the Pati Point cliffs adjacent to Main Base. A National Wildlife Refuge overlay extends through much of Northwest Field and the Munitions Storage Area, and an Ecological Reserve Area is established at Communications Annex Finegayan.

The only new training land use proposed is rapid runway repair at Northwest Field. Continuing training consists of aviation training (field carrier landing practice, night vision goggle training, specialized helicopter landings, paradrops), small unit maneuvers and bivouacs, TRUE training, over-the-beach training, and use of two small arms ranges. The Preferred Alternative includes all ongoing and proposed new land uses.

Farallon de Medinilla land use. FDM is an uninhabited island which has been used for aerial bombardment and naval gunfire since 1971. It is home to several migratory seabird colonies, and four endangered Micronesian megapodes were sighted in a November 1996 survey. The two small beaches are not potential green sea turtle nesting areas. The island contains an abundance of UXO.

The new training land use proposed is ground-based mortar, artillery, and anti-tank fire. This cannot be implemented, as personnel are no longer allowed to land or move about on the island due to the presence of highly sensitive, unexploded cluster bombs observed in 1996. The Preferred Alternative excludes ground-based weapons fire and modifies existing aerial bombardment impact areas.

Non-DoD land use. Continuing use of a parachute drop zone in Dandan is proposed for Guam, and new use of the Talafofo and Ylig Rivers is proposed for riverine training. For Rota, continued forward staging base/bivouacs in Songsong Harbor is proposed, as well as new night vision goggle training at the civilian airport. The Preferred Alternative excludes night vision goggle training on Rota and riverine training on the Talofofo and Ylig Rivers on Guam.

Comparison of alternatives. The Preferred Alternative maximizes training use of sites with appropriate geographic features and facilities. It eliminates, where practical, use of lands for training that would result in significant impacts which cannot be mitigated. Protected species and cultural resources are the resources most likely to sustain impacts from the proposed training. These resources exist on all DoD lands in the Marianas, partly due to protection from commercial development pressures. The primary mitigation for these impacts is avoidance according to the following constraints, illustrated in Figures ES-1 through ES-5:

- **No cultural resources disturbance**: No vehicular travel off road, no pyrotechnics, no demolition, and no digging without prior written approval from COMNAVMARIANAS
- **No wildlife disturbance**: No vehicular travel off-road, no pyrotechnics or open fires, no firing blanks, no live ammunition or training demolition, no digging, no mechanical vegetation clearing, no flights below 305 m AGL, no helicopter landing zones
- **No training:** No training allowed, except troop and vehicle movement along established roads

On Tinian, the Preferred Alternative is essentially the No New Action alternative with the addition of AAV landings which would harm a limited amount of sparsely distributed coral at one beach. No significant impacts of ongoing training cannot be mitigated, so there is no compelling reason to reduce ongoing land use for training. Maximum land use would result in permanent UXO contamination and would allow AAV landings at multiple beaches, harming more coral.

At the Waterfront Annex, the Preferred Alternative would reduce the need to close Apra Harbor to commercial traffic once a month and would not have any significant impacts which cannot be mitigated. Land use has been slightly reduced by mitigation measures. Maximum land use has the potential to harm wetlands and coral reef.

At the Ordnance Annex, the Preferred Alternative would not have any significant impacts which cannot be mitigated. Land use has been constrained by No Training and No Cultural Resources Disturbance areas. Maximum land use would have significant public safety impacts.

At AAFB, the Preferred Alternative is very similar to No New Action. It would not have any significant impacts which cannot be mitigated. Land use has been constrained to protect endangered species.

The Preferred Alternative for the two Communications Annex sites is No New Action, which has no significant impacts.

For FDM, the Preferred Alternative will have impacts on seabirds and on endangered Micronesian megapodes which cannot be mitigated to nonsignificance. Reduced Land Use and No Land Use would eliminate such impacts but would totally fail to meet the need for aerial bombardment training. No other bombardment sites are available to the forces serving the Western Pacific theater.

On non-DoD-controlled lands, the Preferred Alternative is No New Action, which has no significant impacts. Maximum land use has the potential to disturb endangered species on Rota and to disturb undiscovered cultural resources on Guam.

Summary. The Preferred Alternative (summarized in Table ES-1 at the end of this summary) accomplishes most training required to meet the purpose and need, while mitigating most potentially significant impacts to nonsignificance. It fails to meet a variety of live fire training needs, which must be met on the U.S. mainland, in Hawaii, or in combined exercises on foreign

soil. The Preferred Alternative will have one significant impact which can only be mitigated by compensatory mitigation: bombardment of FDM, which is likely to harm, harass, or kill individual endangered or migratory birds.

3.0 EXISTING ENVIRONMENT

Physical environment. The Mariana Islands are an 800-kilometer chain of 15 volcanic islands in the Western Pacific. Guam, Rota, and Tinian are three of the four southernmost and most populated islands in the chain. FDM has never been inhabitated. The primary natural hazards are typhoons and earthquakes.

The islands are composed of volcanic rock capped by coralline limestone of varying thicknesses. Soils developed on volcanic rocks are poorly drained clays, while soils developed over limestone are shallow and highly porous. Surface water only exists in areas where clay prevents water from draining through to the porous rock below; there is no fresh surface water on FDM. Aquifers on the larger islands are believed to occur primarily in limestone; it is not known whether a freshwater aquifer has accumulated on FDM. Groundwater and surface water quality are good in most cases. Marine water quality around the islands is generally good, except in proximity to sewage outfalls. Air quality is good, due to the lack of emissions sources and the nearly constant tradewinds.

The islands' visual characteristics are defined by the ocean and local topographic features, primarily dramatic ocean cliffs and white sand beaches. Built environment is relatively sparse on Rota and Tinian and absent on FDM. On Guam, urban and suburban areas dominate the central portion of the island.

Biological resources. Native limestone forests on Guam and Tinian were reduced by the impacts of WWII, as well as by development and long-scale agriculture (on Tinian). Much of the limestone forest remains on Rota; Guam and Tinian now are dominated by secondary growth forest and grasslands, with some wetlands and strand vegetation. Marine habitat includes coral reefs and benthic communities.

A relatively high number of native Mariana wildlife species are listed as endangered or threatened by the federal and local governments, either as a loss of habitat or predation by humans and snakes. The greatest threat to terrestrial endangered species on Guam is from the introduced brown tree snake. The snake has so far not become established on other islands of the Marianas, although isolated snake sightings have occurred on Saipan and Tinian.

Tinian is home to the endangered Mariana moorhen, endangered Micronesian megapode, and threatened Tinian monarch. The monarch is ubiquitous throughout the island in large numbers, but it does not exist anywhere else. Green sea turtles nest on Tinian's beaches, and coconut crabs inhabit the woods. Mariana fruit bats visit Tinian, although no permanent colonies have been observed.

On Guam, protected species include 3 plant species, 3 bat species, 2 sea turtle species, 2 land reptiles, 8 skinks and geckos, 2 tree snails, and 18 bird species (some of which are extinct on Guam). A small number of species has managed to survive predation by the brown tree snake.

The few remaining Mariana crows on Guam inhabit areas of AAFB, together with Mariana fruit bats. Green sea turtles nest on AAFB beaches. Mariana common moorhens and sea turtles inhabit or visit the Waterfront Annex; and moorhens, fruit bats, and island swiftlets are found at the Ordnance Annex.

Rota's forests provide habitat for the Mariana crow and the fruit bat. Several wildlife sanctuaries and conservation areas have been established on Rota to protect endangered species.

FDM is a breeding location for migratory seabirds, notably three booby species and great frigatebirds. Several Micronesian megapodes were observed on FDM in 1996; it is not known whether they nest on the island.

History and cultural resources. The Mariana Islands are part of Micronesia and have been controlled by many different nations since their "discovery" by Magellan in 1521. The oldest dated archaeological remains indicate that humans first settled the Marianas as early as 1500 B.C. At the time of first European contact, the native Chamorro people exhibited a typical Oceanic economy, depending on farming and marine resources. The most notable artifacts of the ancient Chamorro culture are sets of latte stones, upright pyramidal stone pillars topped by capstones and occurring in two parallel rows of 6 to 12 stones. Chamorro sites have been identified and investigated on all DoD-controlled lands except FDM.

After European contact, the Spanish claimed the Mariana Islands, and depopulated the northern islands by resettling the Chamorros on Guam. After the Spanish-American war, Guam became a possession of the U.S. and was developed as a naval base. The northern Mariana Islands passed from Spain to Germany, which leased much of Rota and Tinian to the Japanese in the early 1900s. The Japanese South Seas Development Company established sugar cane plantations on Tinian and Rota, bulldozing much of the indigenous forests and other native vegetation. Structures dating from this period still exist on Tinian and have been included in interpretive trails developed by the Navy.

As WWII approached, the Japanese military government took control of Tinian, building Ushi Airfield and other facilities using Korean slave labor. Japan occupied Guam soon after. In a series of battles in 1944, Saipan, Tinian, and Guam were liberated from the Japanese by U.S. forces. Extensive rebuilding by the Seabees converted Tinian to a major airfield, from which B-29s flew bombing runs to Japan. In 1945, the ENOLA GAY and BOCK'S CAR flew from Tinian's North Field to drop atomic bombs on Hiroshima and Nagasaki, respectively. North Field is now a National Historic Landmark.

Infrastructure. Guam, Tinian, and Rota each have a harbor, a civilian airport, a municipal solid waste landfill, and suppliers of potable water and electricity. Wastewater disposal on Tinian and Rota consists of individual disposal systems (septic tanks and cesspools), while Guam has wastewater treatment facilities. Civilian landfills on Guam and Tinian are not in compliance with federal solid waste regulations; the Guam landfill, under court order to close in 1997 remains open. Military bases on Guam provide their own infrastructure and also provide potable water to civilians via the Public Utility Agency of Guam. Both AAFB and the Waterfront Annex maintain solid waste landfills and hazardous waste storage facilities, which are in compliance with federal regulations. FDM is not developed.

Socioeconomic environment. Residents born on Guam and in the CNMI are U.S. citizens. Citizens residing in proximity to military lands are not economically disadvantaged relative to the rest of the Marianas and Western Pacific population.

Guam has experienced steady growth of its tourist industry and business community since the end of WWII; it is now a hub of Western Pacific transportation, in addition to being the home of the only U.S. military installations on U.S. soil in the region. Military land use on Guam is being reduced, in accordance with the Guam Land Use Plan (GLUP) Update and the Base Realignment and Closure (BRAC) program.

Tinian and Rota continue to develop, but at a much slower pace than Guam. Tinian residents are striving to develop a casino industry, to bring more tourists onto the island from Saipan for longer stays. Rota is experiencing some resort development.

4.0 ENVIRONMENTAL CONSEQUENCES

Potentially significant issues were evaluated in detail and are summarized below. Nonsignificant potential impacts were evaluated in less detail. The two types of resource most likely to be adversely impacted are cultural resources and biological resources. Table ES-2 (at the end of this Executive Summary) summarizes potential impacts and proposed mitigation measures.

4.1 Brown Tree Snake

The most significant impact which could result from the proposed action is export of BTS from Guam to Tinian, Rota, FDM, other Pacific islands, or the U.S. mainland. BTS interdiction is prevented through the efforts of USDA Wildlife Services (WS), which directs BTS control measures for all military exercises on Guam in accordance with the Brown Tree Snake Control/Interdiction Plan for Military Training Exercises. WS has a detailed protocol and existing infrastructure and arrangements to isolate and inspect military cargo and vehicles staged at AAFB and Apra Harbor prior to shipping to Tinian, FDM, Rota, or other locations at risk from BTS. WS also manages secondary inspections at the receiving locations. All training units arriving on Guam receive a BTS information packet and briefing.

4.2 Impacts on Tinian

Protected species and habitat. Off-road vehicle travel and excavation could damage sensitive habitat and take ground-nesting endangered species. Use of pyrotechnics and open fires could burn habitat and take endangered species. Noise from weapons fire, helicopter hovering and landing, and close air support could disturb endangered species. Logistics shipping could result in BTS import in cargo. AAVs and LCACs may crush or break coral on reefs or compress sand over turtle nests. Clearing vegetation for small arms and mortar ranges may reduce endangered species habitat.

Most of these impacts will be mitigated by observing No Wildlife Disturbance and No Training constraints illustrated in Figure ES-1. BTS hazards will be mitigated as defined above. AAVs will be required to operate single file within a narrow lane approach over Unai Babui's coral reef.

LCACs will be required to remain fully up on cushion while crossing any shallow reef. All landing beaches and one control beach will be surveyed by a biologist for percent coral cover, turbidity, fish assemblage, sedimentation rates, and topography before and after every landing exercise or at least twice a year. If Tinian monarchs are a listed endangered species at the time clearing is required for the proposed fire-and-maneuver range, up to 4 hectares of tangantangan will be planted elsewhere on the island. Tracer rounds will not be permitted on the fire-ad-maneuver range, and the mortar range will not be constructed.

Cultural resources. Programmatic impacts to resources consist of ground disturbance (by vehicles, bivouac activities, or excavation) or defacement or removal of artifacts. Site-specific impacts include possible disturbance of resources by AAVs or LCACs at Unai Babui and Unai Chulu and projectile impacts from TRUE training at the former Japanese Naval Air Command Post.

Mitigation of most impacts, including at Unai Babui and Unai Chulu, is compliance with No Cultural Resources Disturbance areas, which sets many areas off limits to vehicles and other sources of ground disturbance. Potential impacts of TRUE training will be mitigated by photodocumentation of the building condition before and after exercises. A Navy archaeologist will review the photographs and will either allow or disallow TRUE training to continue at this location.

Wastewater disposal. Wastewater generated during medium and large exercises has been disposed in Tinian's only municipal septic systems. Analysis indicated that impacts of continued disposal would not be significant. Construction of a small military septic system at the proposed logistics support base camp would mitigate any impacts on the municipal system.

Solid and hazardous waste disposal. Solid waste generated by exercises on Tinian is transported to Guam for disposal at the Navy's landfill at the Waterfront Annex. This will not adversely impact the Navy landfill capacity (less than 1% addition to volume). The civilian landfill situation will not be affected by this action. Waste must be fumigated upon arrival on Guam. No hazardous waste has been generated in past exercises. If generated, hazardous waste would be transported to Guam in accordance with DOT regulations, for transport and disposal at a licensed facility on the U.S. mainland.

Range safety. Potential hazards of the proposed fire-and-maneuver range and shooting house will be managed in accordance with strict range protocols. The EMUA will be temporarily closed to civilian access, as necessary. The proposed mortar range is not included in the Preferred Alternative, so no mitigation of potential UXO hazards is proposed.

Aviation safety. Potential hazards include conflicts with civilian air traffic on Saipan and Tinian, civilian vehicles driving on North Field, and the potential for mortar rounds to intersect civilian aircraft flight paths. Air traffic conflicts will be prevented by positive communication with the FAA on Saipan and by published notices. The EMUA or portions thereof will be temporarily closed to civilian access, as necessary, to prevent accidents. The proposed mortar range is not included in the Preferred Alternative, so no mitigation is proposed.

Socioeconomic impacts. Temporary closures of the EMUA impact tourist operators on Tinian and Saipan. In addition, military use of the harbor and airport may conflict with civilian traffic, particularly if the nascent casino business greatly increases the number of tourists on Tinian. Impacts will be mitigated by coordination with Tinian authorities at least 30 days in advance of any EMUA closure and any large scale use of the harbor or airport.

4.3 Impacts on the Waterfront Annex

Protected species and habitat. Underwater demolition could injure or kill fish or endangered marine species (turtles) or could fracture coral within a certain radius of the detonation. Amphibious vehicles may damage coral on shallow reefs or compress sand over turtle nests.

Impacts of underwater demolition on endangered species are mitigated by an existing survey protocol; no coral is near the demolition sites. LCACs will not land at Dadi Beach if the beach slope is too steep to permit the LCAC clearing the reef and being fully on the beach when coming off-cushion.

Cultural resources. Underwater demolition could impact sunken ships. It is not known whether it would trigger 50-year-old depth charges on the TOKAI MARU which may be armed. Analysis indicates that the sunken ships are unlikely to be affected by the proposed charges at the proposed site. Mitigation includes preferred use of proposed site offshore of Dadi Beach rather than the existing Apra Harbor site, weather permitting.

Range safety. Small arms ranges have theoretical surface danger zones (SDZs) extending over an ocean area used for recreation. The ranges have a 60-foot-high backstop which is expected to stop all stray projectiles. Mitigation is observation of all range control measures, including public notification and observers.

Underwater demolitions could harm divers within the safety exclusion zone in Apra Harbor or offshore of Dadi Beach. EOD personnel patrol the area and close it to civilians prior to any detonations.

Socioeconomic impacts. Apra Harbor closures for underwater demolitions require commercial boat and dive operations to close or relocate their dives for 4 hours once a month. Mitigation is primarily to use the proposed Dadi Beach underwater demolition site instead of the Apra Harbor site, weather permitting. When using the Apra Harbor site, EOD will provide 30 days' notice to commercial operators.

4.4 Impacts on the Ordnance Annex

Protected species and habitat. No significant impacts are expected to protected species in the Ordnance Annex. Training in much of the Ordnance Annex has been constrained by establishing no wildlife disturbance areas as mitigation. If tree snails are listed and are found in proposed training areas, mitigation will be negotiated with USFWS.

Cultural resources. The proposed sniper range will be configured so that significant cultural resources are protected from projectiles by intervening topographic features.

Range safety. The proposed sniper range will be configured so that the SDZ does not intersect a civilian hiking trail which passes through the southern portion of the annex.

4.5 Impacts on AAFB and Communications Annexes

Protected species and habitat. Aviation noise and visual disturbance may disturb endangered Mariana crows and fruit bats at AAFB. Mitigation is strict regulation of flight tracks and altitudes, particularly during crow breeding season. Hiking on an established trail through Communications Annex Finegayan will not disturb tree snails which may soon be listed by USFWS as endangered species.

Cultural resources. Rapid runway repair will not harm a potentially historic runway at Northwest Field, as it will be confined to an adjacent parking apron.

4.6 Impacts on FDM

Protected species and seabirds. Seabirds and endangered Micronesian megapodes (if any) on FDM may be killed by bombing or harmed by alteration of habitat and food source as a result of bomb-induced fires. BTS could be imported in targets from Guam. No impacts are expected to endangered sea turtles, as the FDM beaches are unsuitable for sea turtle nests (wave-washed and rocky).

Bird mortality will be managed by placing targets away from the most sensitive nesting and roosting areas, by concentrating targets inland, and by avoiding the isthmus and eastern cliff face. USFWS guidelines will be followed for permitted takings of bird species. Other mitigation is compensatory and includes broadcasting rodenticide pellets to limit the FDM rat population and enhancing megapode habitat on another island in the Marianas. Targets shipped from Guam will be inspected, steam-cleaned, and staged in snake-free areas.

Public safety. UXO will accumulate on land and to a lesser extent in water. No impacts to fishing boats will occur, as the exclusion area will be surveyed prior to bombing, and routine notifications will warn civilians to avoid the area. No aviation interference will occur, due to airspace restrictions and routine notifications.

4.7 Non-DoD Lands

Impacts to public safety from parachute operations in Dandan are unlikely, but will be avoided by routine scheduling and notifications. No impacts to endangered species on Rota are expected, as proposed NVG training at Rota Airport is not included in the Preferred Alternative.

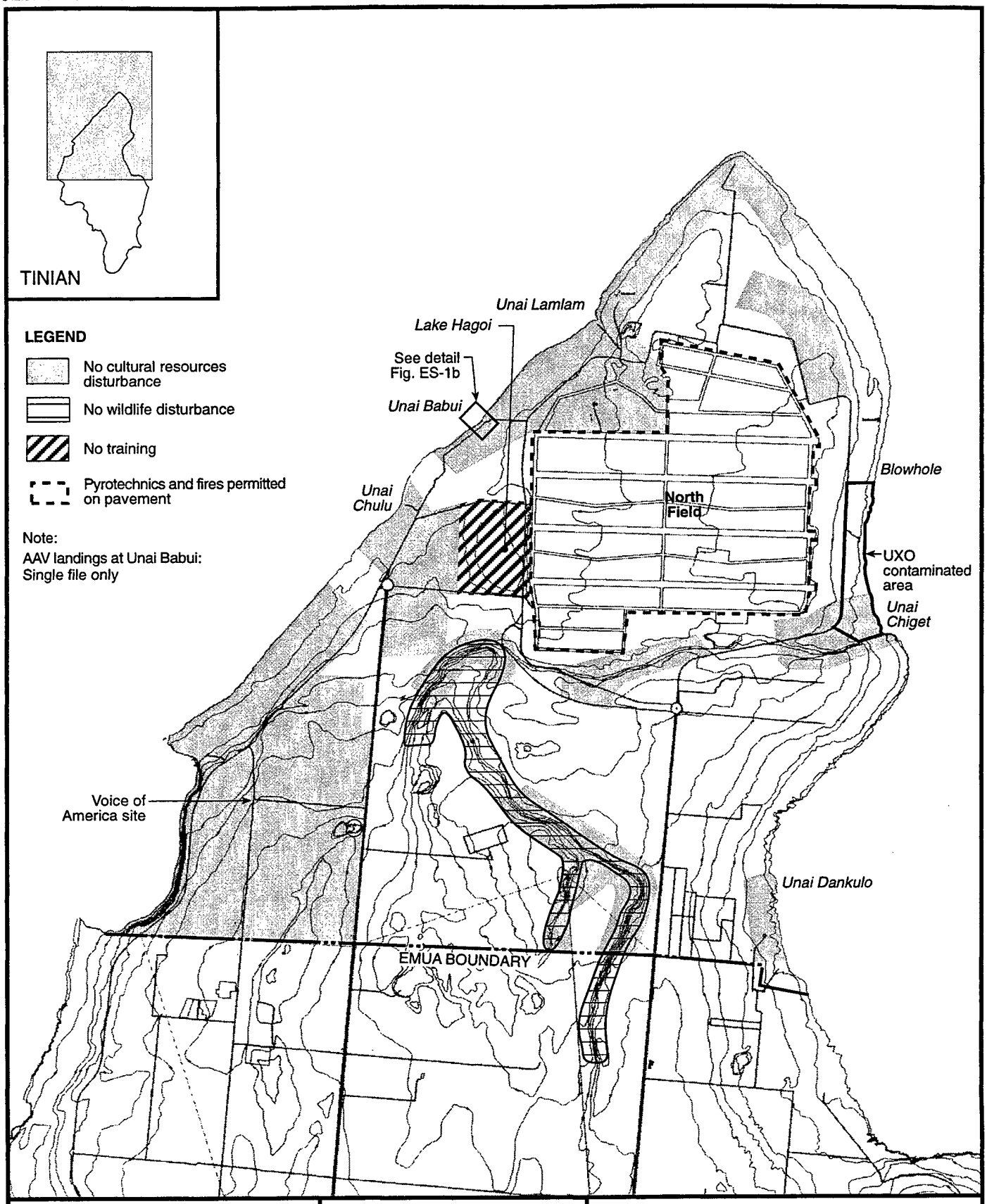
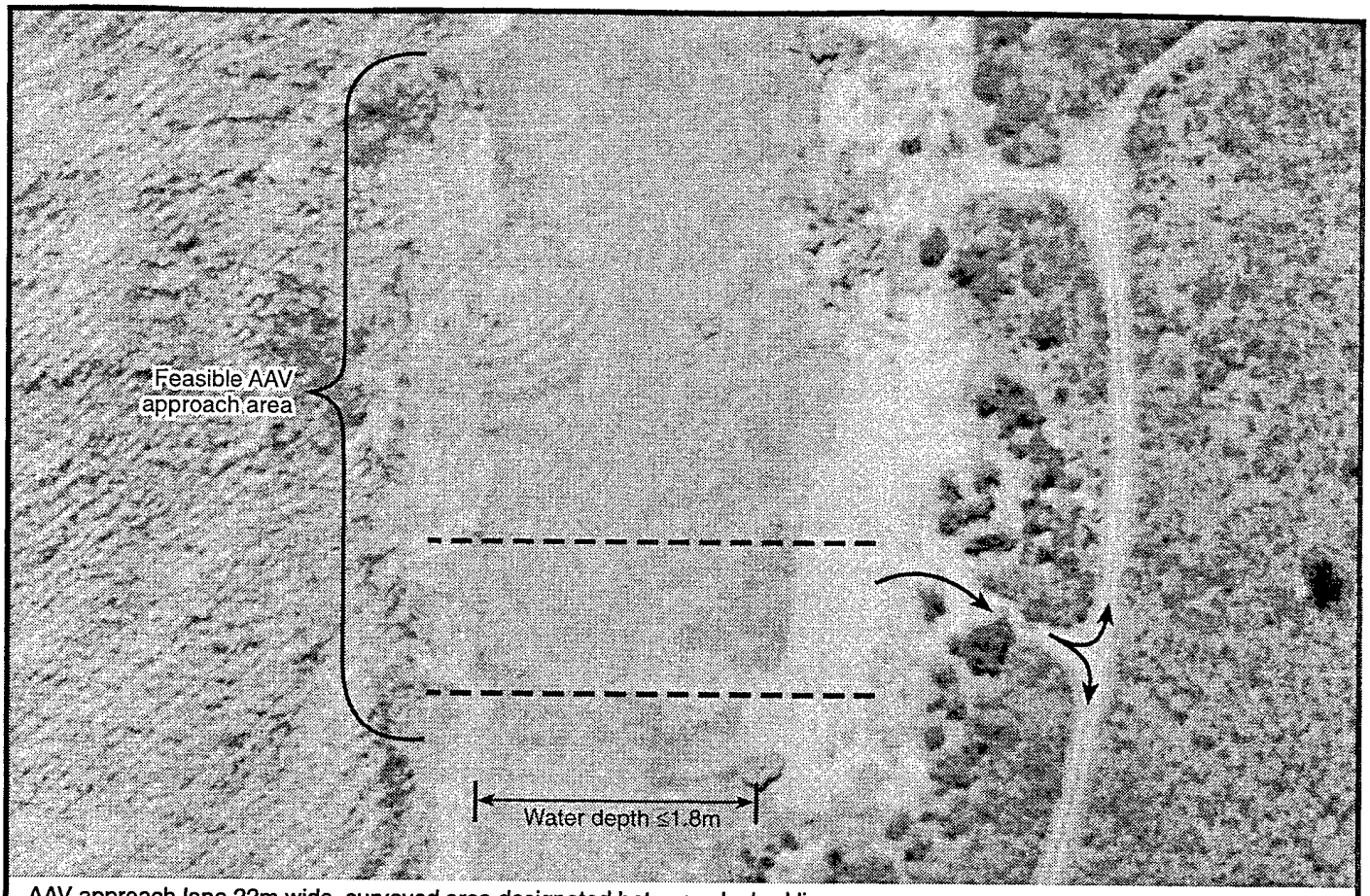


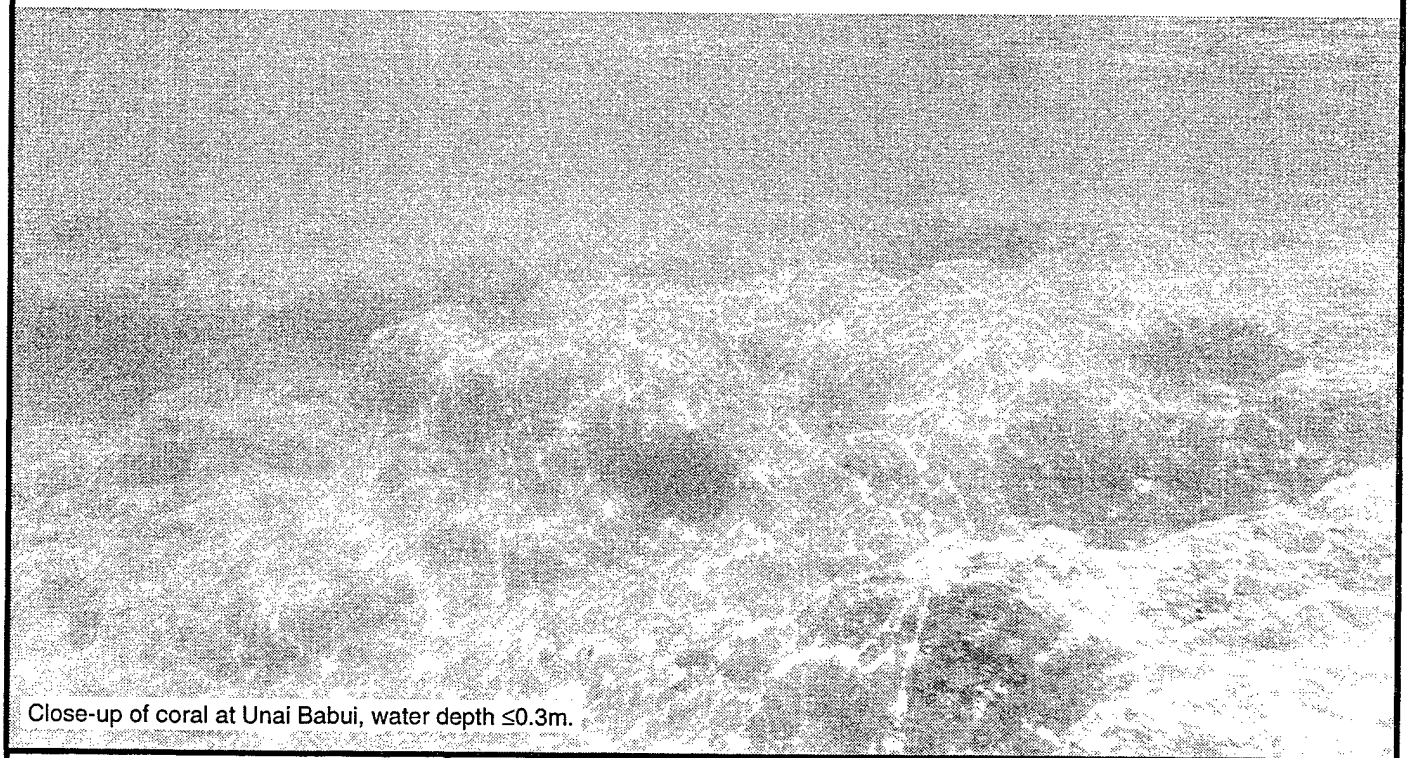
Figure ES-1a
TINIAN CONSTRAINED AREAS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

342.0414/003-26 r12.11.97



AAV approach lane 22m wide, surveyed area designated between dashed lines.



Close-up of coral at Unai Babui, water depth ≤0.3m.

NORTH

0 10 20 (Meters)

0 40 80 (Feet)

LEGEND

Recommended AAV approach lane

Direction of AAV travel

Figure ES-1b
APPROXIMATE AAV LANDING AREA, UNAI BABUI
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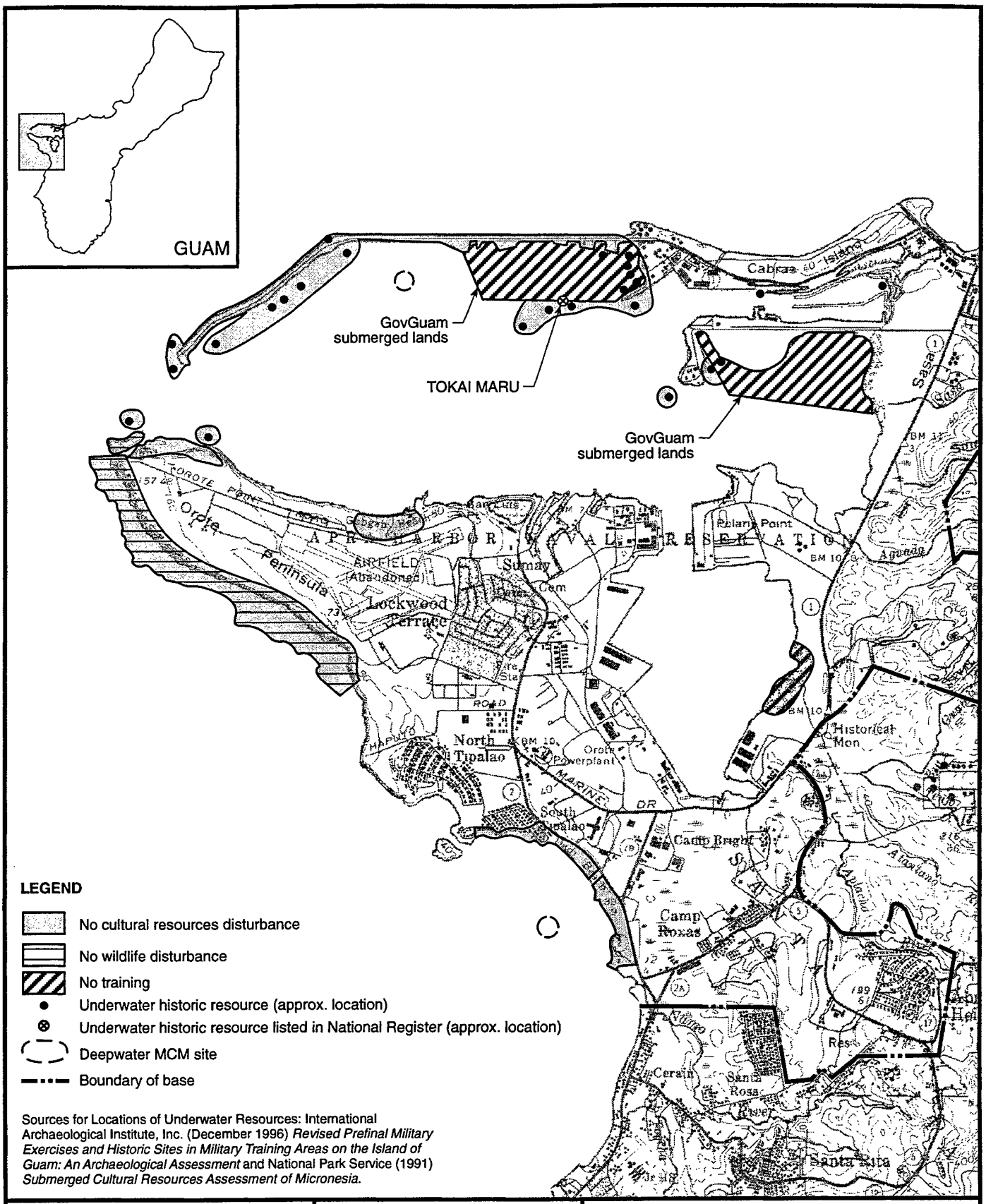
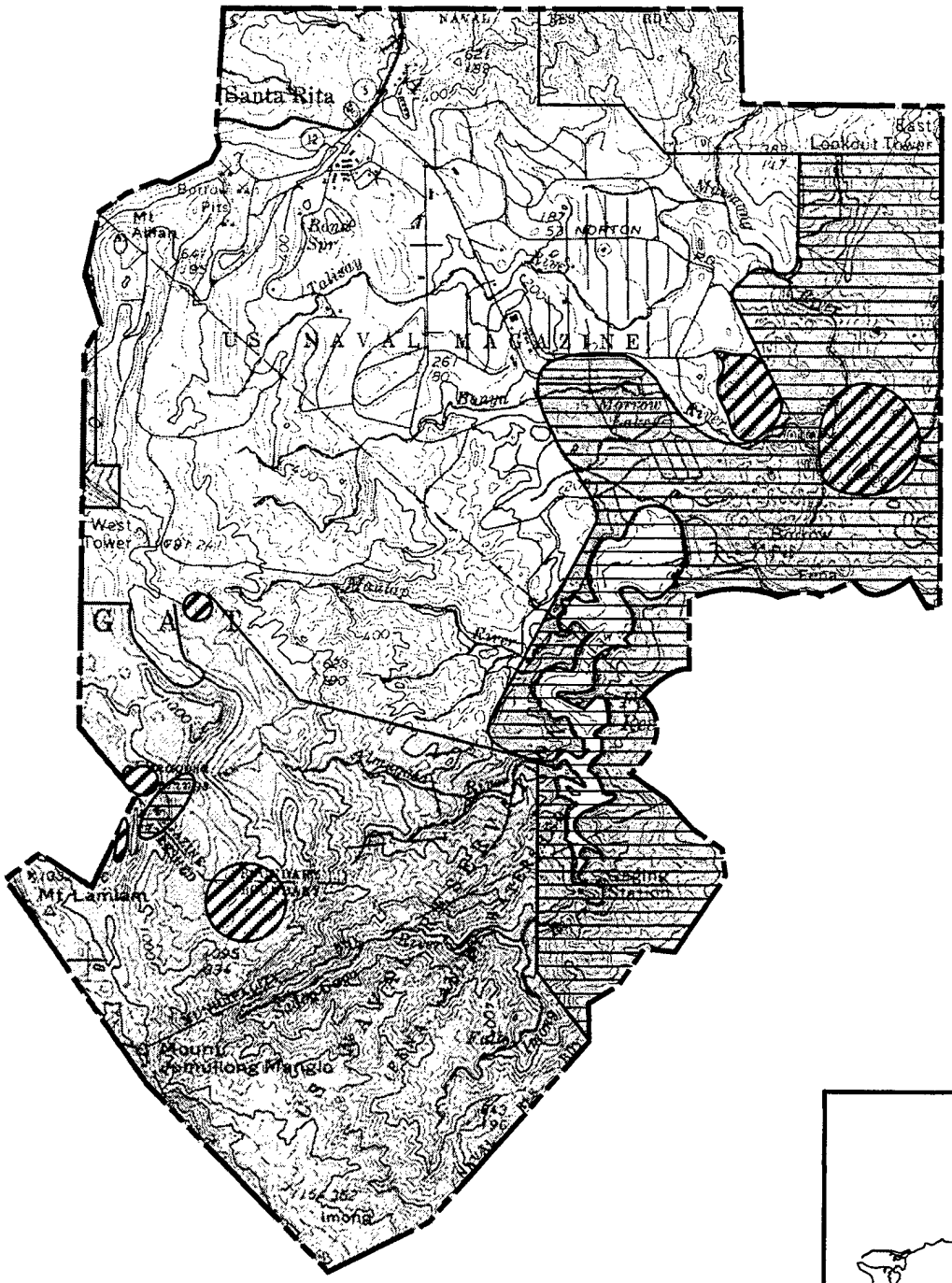


Figure ES-2
WATERFRONT ANNEX CONSTRAINED AREAS
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No new bivouac sites to be used without approval of COMNAVMARIANAS Cultural Resources Manager.

Details found in Section 2.8

NORTH

0 500 1000 (Meters)

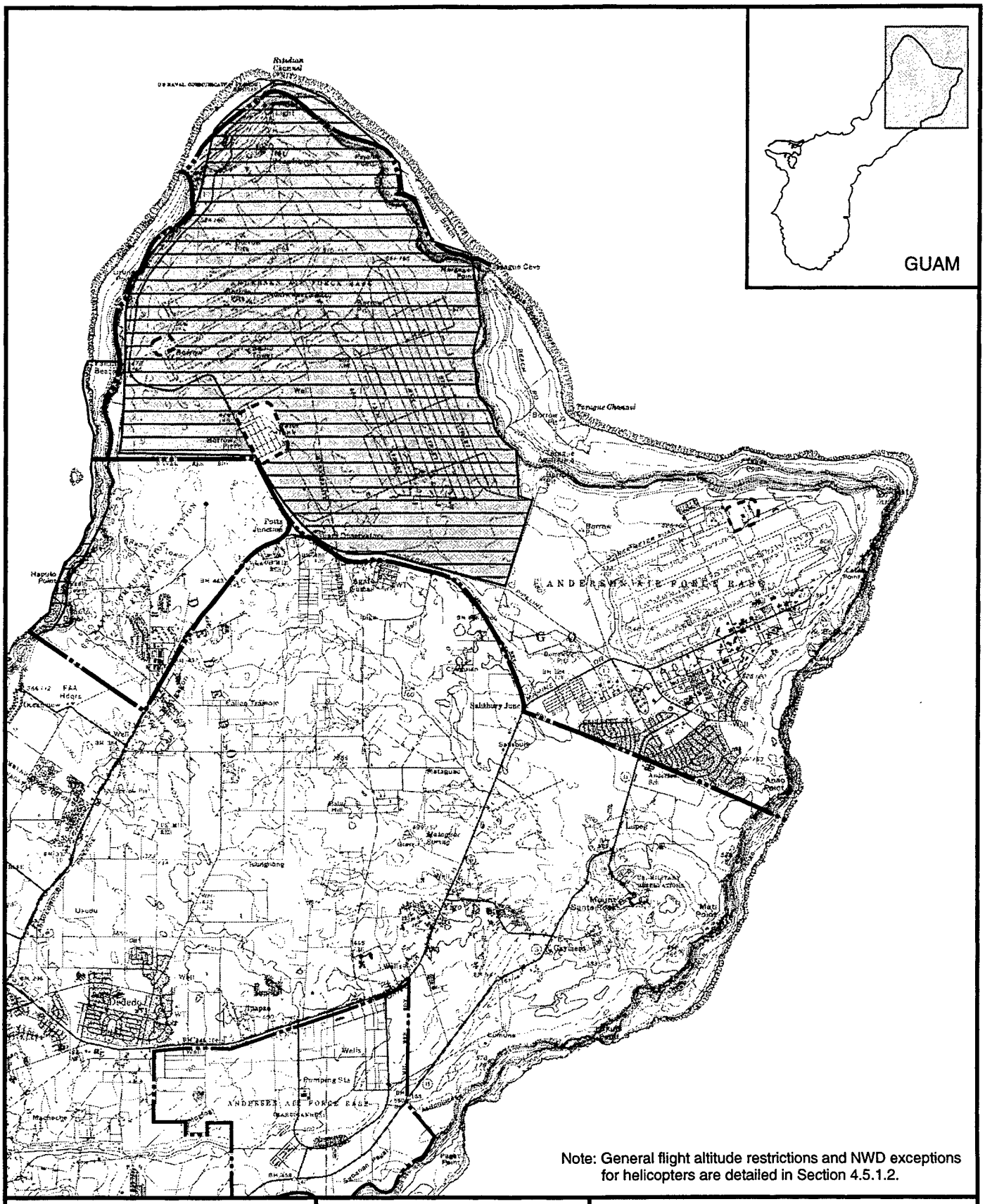
0 2000 4000 (Feet)

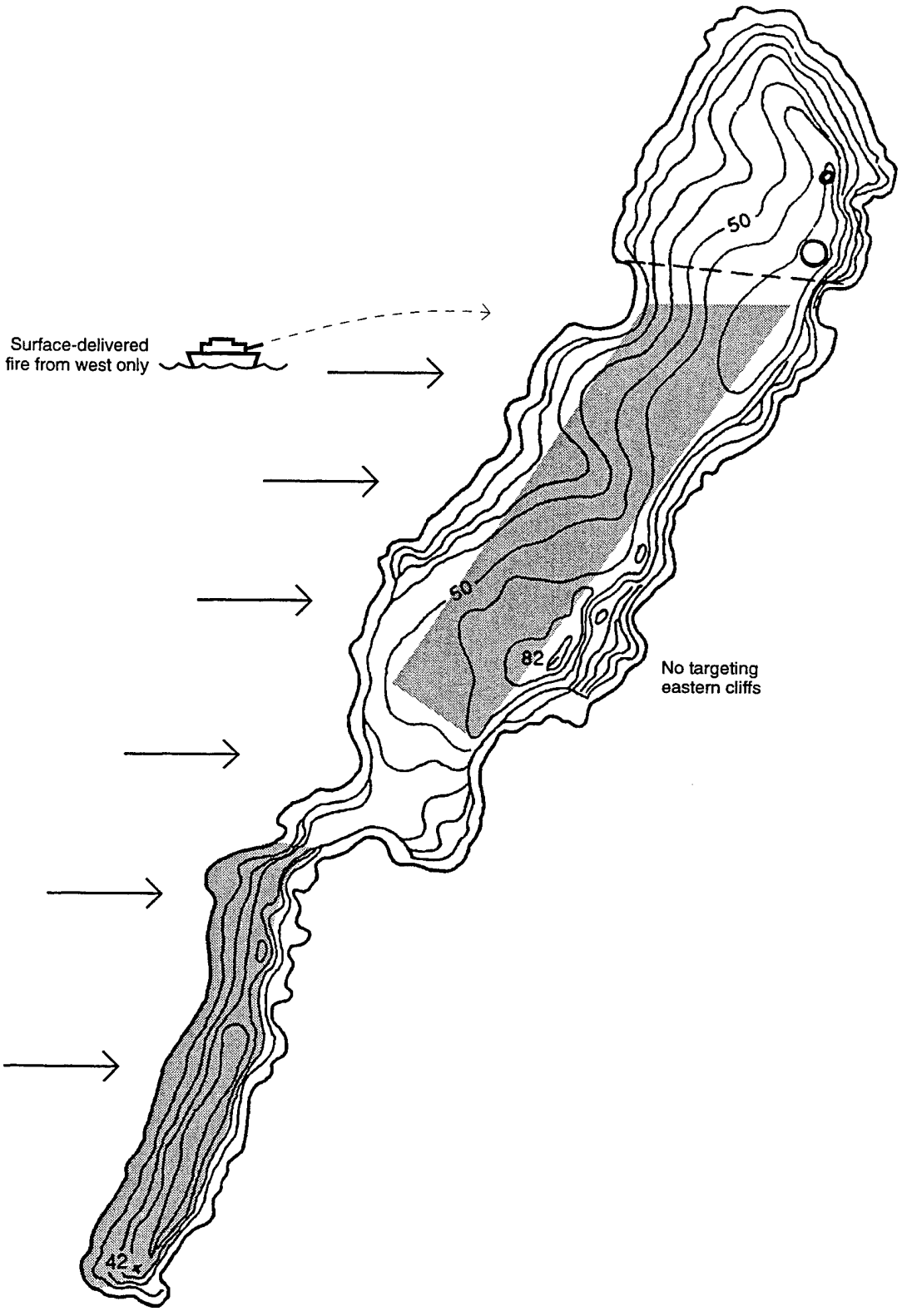
LEGEND

- No cultural resources disturbance
- No wildlife disturbance
- No training

Figure ES-3
ORDNANCE ANNEX CONSTRAINED AREAS
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342.0414/017-11 r4.23.98


GUAM
ANDERSEN AIR FORCE BASE
ANDERSEN AFB
Tarague Cove
Tarague Channel
Potts Junction
Salisbury Junction
Andersen Point
Santa Rosa
Mati Point
Haputo Point
Dadedo
Wells
Pumping Sta
Borrow Pits
Barrow Pit
Quarry
Well
Cliff
Beach
Reef
Lupog
Mataguac
Salisbury
Tarague
Tumon
Ritidian (Ocean)
Ritidian Point
Ritidian (Lagoon)
Ritidian Point
Ritidian Channel
Ritidian Reef
Ritidian Beach
Ritidian Cliff
Ritidian Quarry
Ritidian Well
Ritidian Borrow Pits
Ritidian Barrow Pit
Ritidian Pumping Sta
Ritidian Wells
Ritidian Dadedo
Ritidian Tapas
Ritidian Salisbury Junction
Ritidian Potts Junction
Ritidian Haputo Point
Ritidian Andersen Point
Ritidian Santa Rosa
Ritidian Mati Point
Ritidian Lupog
Ritidian Mataguac
Ritidian Salisbury
Ritidian Tarague
Ritidian Tumon
Ritidian Tarague Cove
Ritidian Tarague Channel
Ritidian Tarague Reef
Ritidian Tarague Beach
Ritidian Tarague Cliff
Ritidian Tarague Quarry
Ritidian Tarague Well
Ritidian Tarague Borrow Pits
Ritidian Tarague Barrow Pit
Ritidian Tarague Pumping Sta
Ritidian Tarague Wells
Ritidian Tarague Dadedo
Ritidian Tarague Tapas
Ritidian Tarague Salisbury Junction
Ritidian Tarague Potts Junction
Ritidian Tarague Haputo Point
Ritidian Tarague Andersen Point
Ritidian Tarague Santa Rosa
Ritidian Tarague Mati Point
Ritidian Tarague Lupog
Ritidian Tarague Mataguac
Ritidian Tarague Salisbury
Ritidian Tarague



NORTH

0 100 200 300 (Meters)

0 500 1000 (Feet)

LEGEND

Aerial bombardment target areas

Figure ES-5
FDM FIRING DIRECTION AND TARGET PLACEMENT
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Belt Collins Hawaii, 1998

Table ES-1 Preferred Alternative Training Land Use[1]

	TINIAN			COMNAVMAR TRAINING AREAS					AAFB			NON-DOD LAND		FDM
MAJOR TRAINING ACTIVITIES	**EMUA**	**MLA**	**Non-DoD Land**	**Apra Inner Harbor**	**Apra Outer Harbor**	**Orote Peninsula /Camp Covington**	**Ordnance Annex**	**NCTAMS Finegayan/ Barrigada**	**Andersen Main**	**Andersen NW Field**	**Andersen South**	**Guam**	**Rota**	
1. Field Maneuvers and Logistics Support			harbor					both						
2. Aviation Training														
Helicopter												Dandan		
Fixed-wing														
Paradrops												Dandan		
3. Amphibious Landings Using:														
Assault amphibian vehicles (AAV)	Babui		Kammer	Toyland	note 2	Tipalao								
Inflatable assault craft (CRRC/RHIB)								Finegayan					Songsong	
Air Cushion Landing Craft (LCAC)	Chulu, Dankulo		achogna	Toyland	note 2	Tipalao								
Displacement Hull Landing Craft (LCU)			Kammer	Toyland										
4. Live Fire Training														
Pistol and submachine gun(9mm)							Jungle trail	Finegayan						
Rifle and SAW (5.56mm)							Jungle trail	Finegayan						
Light machine gun (7.62mm)								Finegayan						
Sniper rifle (7.62 mm)														
Sniper rifle (.50 cal)														Note 3
Heavy machine gun (.50 cal)														Note 3

Table ES-1 *(continued):*

	TINIAN			COMNAVMAR TRAINING AREAS					AAFB			NON DOD LAND		FDM
MAJOR TRAINING ACTIVITIES	**EMUA**	**MLA**	**Non-DoD Land**	**Apra Inner Harbor**	**Apra Outer Harbor**	**Orote Peninsula /Camp Covington**	**Ordnance Annex**	**Comm. Annex Finegayan/ Barrigada**	**Andersen Main**	**Andersen NW Field**	**Andersen South**	**Guam**	**Rota**	
40mm grenade														note 3
40mm rifle grenade launcher (training projectiles only)														
TRUE: Shooting/breaching house														
Artillery crew live fire														
60mm mortar (M766 training projectile only)														
60mm, 81mm mortar crew live fire														
Anti-tank missile fire														AT-4 from offshore Note 3
5. Underwater Demolitions														
Deepwater MCM (EODMU-5)				<= 5lb		Dadi								
Shallow water MCM (SEALs)						Tipalao								
6. Naval gun fire														
7. Aerial bombardment														

Notes:

1. See Figures 2-1 through 2-6 for detailed locations.
2. Outer Harbor Landings — AAV at Drydock Island, Polaris Point, Sumay Cove Marina; LCAC: Drydock Island, Polaris Point; LCU at Drydock Island, Polaris Point, WW II fuel pier, Sumay Cove Marina
3. SEALs embarked in RHIBs may fire from offshore to the same impact areas designated for naval gunfire on the west flank of FDM.

Table ES-2 Potential Impacts and Proposed Mitigation

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources				
Vegetation	Fire damage	Y, if it destroys habitat for endangerd species	Restrict use of open fires and aerial pyrotechnics to paved or low-fire hazard areas only.	Y
			Curtail use of fire-causing objects during periods when fire hazard is high.	
			Brief troops on potential for fire and contingency reactions.	
			Have appropriate firefighting equipment readily available for response at tent camps, firing ranges, landing zones, airfields, and vehicle maintenance and refueling areas.	
			Plan camp layouts with fire lanes; provide fire extinguishers in accordance with regulations.	
			Incorporate firefighting response drills into area security plan.	
			Prohibit use of tracer rounds at proposed Tinian and Ordnance Annex ranges.	
			Maintain crash-fire-rescue equipment near flight lines for large exercises.	
	Deplete vegetation by clearing for tactical exercises and bivouacs	Y, if it destroys habitat for endangered species	Restrict seasons of major clearing events in designated areas, to avoid physical disturbance of nests	Y
			Select already cleared areas for administrative camp sites.	
			Use and maintain established, surveyed DZs and LZs only.	
			Cut no vegetation larger than wrist size.	
			Minimize degree of vegetation clearing when preparing fighting positions and firing lanes.	
	Tinian: Deplete vegetation by clearing for new small arms and mortar ranges	Y (Tinian monarch habitat)	Replant 21 ha of tangantangan elsewhere in EMUA to mitigate for small arms range clearing, if monarch is still protected at the time of range construction.	Y
			MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE	
	Introduce alien weedy plant species	N	Comply with standard practice of checking clothing and boots for seeds, cleaning equipment before loading up for exercises, and inspecting impacted construction materials for the presence of noxious weeds.	N/A
	Salt spray from amphibious vehicles may harm terrestrial species	N	Impact is less common and of shorter duration than salt spray generated by typhoons, to which ecosystems are adapted.	N/A

Table ES-2 (*continued*):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources *(continued)*:				
Vegetation *(continued)*:	Amphibious vehicles or offloaded vehicles may disturb strand vegetation	N	Select beach ingress and egress routes to minimize vegetation impacts.	N/A
Wetlands	Loss of wetland function	Y	Restrict training access within wetlands.	Y
			Designate certain wetlands NT (No Training) or NWD (No Wildlife Disturbance), as necessary.	
	Guam: Harm mangrove roots by hiking during riverine training	N	Designate mangrove swamp at mouth of Atantano River NT.	N/A
Protected birds, bats, and terrestrial species	Introduce brown tree snake (BTS) or other invasive animal species to Tinian, Rota, FDM, Hawaii, or continental U.S. from Guam	Y	COMNAVMARIANAS or AAFB notify USDA of any exercise including transport from Guam to the CNMI, Hawaii, or CONUS. USDA erect temporary barriers, set snake traps, establish snake-sterile zones, steam clean all vehicles to dislodge BTS, inspect all cargo and MIL VANS with dogs, prohibit transport of material without "inspected" sticker, perform secondary inspection upon arrival at destination. Inspect all shipments leaving Guam for Hawaii or CONUS upon completion of exercise.	Y
			Update Navy and AAFB BTS control protocols as new control measures are adopted.	
	Disturb protected bird and bat species by noise or physical interference from aircraft, off road vehicles (including vegetation clearing), and blasting RRR sites	Y	Restrict training seasons and times of day in designated areas to avoid loud noises or physical disturbance of nests by vehicles, aircraft, or personnel during breeding seasons.	Y
			Guam: Observe altitude restrictions at AAFB and Ordnance Annex.	
			Designate primary habitat and nesting sites NT or NWD, as necessary.	
			Direct personnel to avoid collecting or disturbing wildlife for any reason.	
	Guam: Disturb endangered Mariana moorhens with blank firing in Atantano marshlands	Y, if birds are present in brackish waters	Avoid disturbing any birds or nests observed. (Moorhens are not expected to be in area used for training.)	Y
	Guam: Disturb tree snails at Haputo adjacent to hiking trail	N	Personnel will remain on established trail.	N/A
	Rota: Disturb endangered Mariana crows with noise from NVG helicopter flight training	Y, if birds nest near runways	NVG HELO TRAINING ON ROTA IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	Y

Table ES-2 (*continued*):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources (*continued*):				
Protected birds, bats, and terrestrial species *(continued)*:	**FDM:** Harm or kill migratory seabirds or endangered Micronesian megapodes with naval gunfire or aerial bombardment	Y	Limit naval gunfire to western cliffs, minimizing impacts to eastern cliff.	N
			Limit aerial bombardment target areas to central portions of island, avoiding eastern cliffs and central isthmus.	N
			Enhance megapode habitat on Sarigan Island (compensatory mitigation).	N
	Guam: Injury to moorhens at Fena Reservoir from sniper rifles	N	Moorhens are protected from bullets by intervening terrain.	N/A
Terrestrial wildlife	**Guam:** Injury to carabao in Ordnance Annex from sniper rifles	N	Snipers are trained to notice movement and will be directed to avoid shooting carabao.	N/A
Protected marine species	Mortality of sea turtles from landing vehicles crushing nests or hatchlings on beaches, or inability of hatchlings to scale tire or track ruts in beach sand	Y	Survey landing beaches $\leq$ 6 hrs before landings, and flag areas free of nests. Landing vehicles and offloaded vehicles will remain in flagged nest-free areas. Biologist must be present during night landings, to watch for turtles.	Y
			Smooth out beach after amphibious vehicle landings.	
	Guam: Harm or kill sea turtles, marine mammals, or fish due to shock wave from deepwater MCM	Y (sea turtles only)	Survey blast area to 1000 m radius prior to exercise to identify marine animals. If protected species are encountered, halt training until the animals have left the area.	Y
			Use Dadi Beach site instead of Apra Harbor site, when weather permits.	
			Use only 10-lb charges at Apra Harbor site, as long as Dadi Beach site is available for 20-lb charges.	
			Conduct post-blast surveys to identify number of fish kills and any sea turtles killed or injured; reevaluate protocol after 2 years.	
	FDM: Harm or kill sea turtles or whales in nearshore waters during naval gunfire or aerial bombardment	Y	Sea turtles have not commonly been observed near FDM. Areas will be surveyed for sea turtles and whales prior to exercises; if animals are observed, the exercise will be postponed until such have left the impact area.	Y

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? Y/N	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? Y/N
Natural Resources *(continued)*:				
	Guam: Harm or kill sea turtles or whales in nearshore waters during floating mine neutralization	N	Survey area for protected marine animals prior to exercise.	N/A
Coral reef and sand beach	AAVs crush coral in water <1.8 m deep	Y	AAV LANDINGS AT UNAI CHULU AND UNAI DANKULO ARE NOT INCLUDED IN PREFERRED ALTERNATIVE.	N
			Tinian: Restrict AAV landings in EMUA to Unai Babui. Limit approach to single permanently marked lane 22 m wide. Do not conduct landings at low tide.	
			Tinian: Monitor effects by surveying Unai Babui before and after AAV landings (or at least twice per year) for % coral cover, topography, turbidity, sedimentation rates, fish assemblage. Unai Lamlam will also be surveyed, as a control site.	
			Guam: Restrict AAV landings to areas with no live coral reef.	Y
	Bow wave generated by LCACs at low speeds may break coral on shallow reef flats	Y	**Unai Chulu, Unai Dankulo, Dadi Beach:** Only cross reef flat fully on-cushion, slowing down or turning only over land.	Y
			Avoid turning LCAC in shallow waters over reef flats.	
			Survey landing beaches <1 week prior to exercise ; avoid landings on beaches with >6° slope (which would cause LCAC to slide out over shallow water at low speed).	
			Tinian: Monitor effects by surveying Unai Chulu before and after LCAC landings (or at least twice per year) for % coral cover, topography, turbidity, sedimentation rates, fish assemblage. Unai Lamlam will also be surveyed, as a control site.	
	Guam: Damage to coral structure from shock waves generated by deepwater MCM	Y	Avoid underwater demolition within 100 m of reef.	Y
	Guam: Damage to reef flats from shallow water MCM	Y	Restrict use of live charges to offshore areas with no live coral in waters 3 to 8 m deep, i.e., Breakwater, Tipalao, and Spanish Steps beaches.	Y
			SHALLOW WATER MCM AT GABGAB BEACH IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	Y
	FDM: Damage to coral from UXO or from bomb explosions at water surface	N	(No evidence of such impacts was observed in recent marine surveys.)	N/A

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? Y/N	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? Y/N
Natural Resources *(continued)*:				
Coral reef and sand beach *(continued)*:	Landing vehicles and offloaded vehicles disturb beach vegetation and sand	N	Select beach ingress and egress routes to minimize vegetation impacts.	N/A
			Use beach matting, where necessary, to reduce erosion and rutting caused by disembarking vehicles traversing soft sand.	
			Restore beach topography upon completion of exercise.	
			Avoid engineered modifications of beaches (e.g., regrading other than for restoration of original topography).	
Insects and diseases	Introduce new/noxious insects or diseases	N	Adhere to existing quarantine procedures for cargo and equipment inspections.	Y
			Transport all solid waste (SW) from Tinian in containers designed for steam sterilizing, and sterilize according to standard procedures upon arrival on Guam.	Y
Cultural Resources				
Historically significant archaeological resources, historic structures, National Historic Landmarks	Programmatic: Damage or data loss from ground disturbance by offroad vehicles, construction, rapid runway repair, or excavation of fighting positions or latrines	Y	Designate areas NT or NCRD (no cultural resources disturbance), as appropriate.	Y
			Physically mark NT boundaries so they can be identified both day and night in areas lacking naturally recognizable boundaries.	
			Publish information and maps identifying known historic and cultural areas for exercise planning.	
			No digging within 1 meter of historic structures with concrete walls or in any cave.	
			Monitor training activities for adherence to restrictions, as needed.	
			If cultural resources are encountered, cease any disturbance and notify COMNAVMARIANAS Enviromental Division.	

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Cultural Resources *(continued)*:				
Historically significant archaeological resources or historic structures, National Historic Landmarks *(continued)*:	Programmatic: Damage or data loss from ground disturbance by offroad vehicles, construction, rapid runway repair, or excavation of fighting positions or latrines *(continued)*:		**Tinian:** Install signs or flagging, as needed, to remind trainees of NCRD areas. **Tinian:** Complete data recovery to enable more offroad vehicle travel.	
	Damage or data loss from vandalism	Y	Brief troops on history and significance of resources. Provide educational handouts for exercise participants to understand and protect resources prior to training.	Y
	Tinian: Projectile impacts on walls of former Japanese Command Post from TRUE training	Y	Photo-document condition before and after use of proposed temporary bullet traps; cease live fire training if damage to walls occurs.	Y
	Tinian: Disturbance of Unai Chulu prehistoric complex by offroad vehicles, especially in high grass	Y	Designate entire archaeological site NCRD.	Y
	Tinian: Disturbance of Unai Babui burials and prehistoric deposits by AAVs	Y	Designate vicinity NCRD.	Y
	Guam: Disturbance of Dadi Beach cave sites by vehicles disembarking LCACs	Y	Designate LCAC landing zone that avoids vicinity of cave sites.	Y
	Guam: Defacement of latte villages in Ordnance Annex by sniper rifle projectile impacts	Y	Site targets so that lattes are protected by topographic features (hills). Do not use range and jungle trail until COMNAVMARIANAS Cultural Resources Manager has approved target locations.	Y
	Guam: Damage to historic runways at Northwest Field from RRR cratering	Y	RRR is proposed for a former taxiway, not a historic runway. Minimize damage by creating 3 permanent craters for repetitive use.	Y
	Guam: Damage to submerged historic resources in Apra Harbor from shock waves generated by deepwater MCM	Y	No damage is likely. Reduce use of this site in favor of Dadi Beach site, weather permitting.	Y
Visual resources	Damage to scenic resources (tourist sites) from demolition or weapons fire	N	Avoid demolition and weapons training in proximity to scenic areas.	N/A

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Environmental Quality				
Air quality	Increased amounts of smoke and dust generated by training	N	Do not use smoke or tear gas in areas with civilians present or downwind.	N/A
			Use sanitary waste burn cans in locations downwind of camps and visitor locations.	
Climate	Increased potential for fire within training areas during droughts (cumulative with other sources of sparks)	Y	Curtail training as necessary during droughts, particularly in areas with rudimentary or nonexistent firefighting capabilities.	Y
Geologic features	**Tinian:** Cratering in impact area	N	MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	N/A
Groundwater and soil	Contamination from improper field sanitation or improper disposal of portable toilet waste	N	Comply with field sanitation SOP; remove and dispose of solid wastes, gray and black water.	N/A
			Ensure contractors dispose of portable toilet wastes appropriately.	N/A
	Contamination from accidental release of fuel during vehicle/aircraft refueling, maintenance, or repair activities or at temporary hazardous materials/hazardous waste storage area(s)	N	Comply with existing regulations and SOPs regarding fuel and haz mat/haz waste handling, transportation, and spill control.	N/A
			Avoid performing scheduled maintenance during field exercises.	
			Refuel only on paved surfaces and using standard spill containment measures.	
			Avoid overfilling vehicle fuel tanks to allow for fuel expansion.	
	Soil erosion and rutting from ground excavation, construction activities, gray water disposal to ground, amphibious vehicles traversing beaches, or projectile impacts at firing ranges	N	Restore training areas to original grade and revegetate, as necessary, upon completion of training activities.	N/A
	ROWPU effluent disposal could affect groundwater	N	ROWPU effluent will be discharged only to an infiltration trench or septic system.	
Surface water quality (marine and fresh)	Increased siltation and/or turbidity due to erosion from amphibious landings, beachside offloading of vehicles and cargo, riverine training	N	Do not land vehicles on silty (vs. sandy) shorelines, or use matting to minimize vehicle effects on soil.	N/A
	FDM: Increased erosion due to cliffside bomb impacts	N	(There is no evidence that bombing has greatly augmented the naturally dramatic erosion process on FDM.) Avoid targeting eastern cliffs.	N/A

Table ES-2 (continued):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Environmental Quality *(continued)*:				
Surface water quality (marine and fresh)	Contamination from accidental release of fuel during vehicle/aircraft refuehighling, maintenance, or repair activities	N	Avoid performing scheduled maintenance during field exercises.	N/A
			Refuel only on paved surfaces and using standard spill containment measures.	N/A
			Avoid overfilling vehicle fuel tanks, to allow for fuel expansion.	N/A
	Degradation from runoff of gray water or ROWPU effluent	N	Direct gray water or ROWPU effluent away from surface water bodies, in accordance with SOPs.	N/A
	Potential heavy metal contamination from lead bullets in over-water SDZs	N	Construct/maintain dirt berms/bullet stops behind targets.	N/A
Flooding	None		None required.	N/A
Noise	**Rota:** Disturb nearby populated areas and avifaunal from rotary-wing landings and takeoff at night	N	NVG FLIGHT CREW TRAINING ON ROTA IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	N/A
	Guam: Disturbances to Tipalao residents from LCAC landings at Dadi and Tipalao Beaches	N	Perform landings during daylight hours only.	N/A
Man-made Hazards and Constraints				
Commercial aviation facilities and traffic	**Tinian:** Interference with Tinian-Saipan commuter flights and international flights in/out of Saipan International Airport	Y	Coordinate with FAA during planning and have direct communication with air traffic control officials during military flights, in accordance with SOPs and FAA regulations.	Y
			Issue NOTAM for use of North Field.	
	Tinian: Interference of airborne and airmobile operations at West Tinian Airport with flight operations	Y	Coordinate with civilian authorities at least one week prior to military landings at West Tinian Airport.	Y
			Move military aircraft out of active runway areas as quickly as possible.	
			Maintain lateral safety clearances from active runways and landing zones; avoid conflicts between training activities and accident potential zones at ends of runways.	
			Restrict training dates/times to avoid major holidays, when heavier tourist traffic is expected.	

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued)*				
Commercial aviation facilities and traffic *(continued)*:	**Tinian:** Interference of airborne and airmobile operations at West Tinian Airport with flight operations *(continued)*:		Publish NOTAM for parachute drops east of West Tinian Airport.	
			Restrict flight tracks/hours, as needed.	
			Have crash, fire, rescue equipment readily available.	
	Tinian: (Mortar rounds trajectory intersecting civilian flight tracks)	Y	MORTAR RANGE IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	Y
	FDM: Interference of bomber aircraft with civilian air traffic.	Y	Publish NOTAMS and notify FAA, warning civilian aircraft out of 4.3-km-radius restricted airspace.	Y
Civilian and military fuel storage facilities	**Tinian:** EMR hazards to fuel (HERF) and personnel (HERP)	N	Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, and fueling operations.	N/A
			Publish VOA frequencies and EMR zones in training instructions for Tinian (COMNAVMARIANAS INSTR 5440.1C).	
Public health & safety	Safety hazards to civilians on historic trails adjacent to small arms ranges (EMUA and Waterfront Annex)	N	Publish specific range regulations and distribute to all units planning training activities.	
			Adhere to all safety requirements prior to and during live-fire and demolition activities, particularly required range area sweeps and surveillance to ensure no danger to others. Curtail firing if anyone enters range area.	
			Guam: Close portions of historic trail to visitors during range use.	
			Tinian: Erect temporary security gates, closing EMUA during range use.	
	Safety hazards to boaters and divers in small arms range over-water SDZs	N	Publish NOTAMs and NOTMARs.	N/A
			Maintain observation of water SDZ during range use.	
			Mount and use warning signs, flags, or strobe lights on shore during range use.	
			Mark SDZs on local navigation charts.	
			Cease firing if boat enters SDZ.	

Table ES-2 (continued):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued)*				
Public health & safety *(continued)*:	**Guam:** Safety hazards from sniper rifles to hikers on trail passing through Ordnance Annex	Y	Range will be designed so that SDZ does not intersect hiking trail.	Y
	Guam: Safety hazards to boaters and divers near deepwater MCM site.	Y	EOD personnel clear site and exclusion zone prior to exercise.	Y
	Guam: Safety hazards to civilian divers from potential sympathetic detonation of depth charges on TOKAI MARU	N	[Sympathetic detonation is unlikely to result from explosion of 10- and 20-lb charges over 1 km from TOKAI MARU. No mitigation proposed.]	N/A
	Tinian: Safety hazards to tourists encroaching UXO impact area for proposed mortar range.	N	MORTAR RANGE IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	N/A
	Tinian: Electromagnetic radiation (EMR) hazards to personnel (HERP) from communications equipment used in training	N	Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, fueling, and ordnance operations. Provide EMR hazard overlays to training units as necessary.	N/A
Airports	**Tinian:** Military aircraft may interfere with civilian air traffic at West Tinian Airport	Y	Communicate/coordinate with FAA and civil authorities 30 days in advance of any exercise.	Y
			Issue NOTAMs and NOTMARs 72 hours prior to any exercise.	
			Plan military helicopter activity avoid commercial flight tracks and Saipan approach and departure altitudes, whenever possible.	
			Avoid parking ramp tie ups by military aircraft.	
	Increased demands on local customs and immigration services	N	Notify local authorities 30 days before large exercises. Identify time frames and locations for customs and immigration support in advance of the exercise.	N/A
Harbors	Interference with civilian ports of entry	N	Schedule shipments in advance. Coordinate with civilian authorities 30 days in advance of any exercise using harbor.	N/A
			Minimize time necessary to be alongside in port.	
	Increased demands on customs and immigration services	N	Notify local authorities 30 days before large exercises.	N/A

Table ES-2 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued):*				
Roadways and traffic	Road damage by tracked vehicles	N	Inspect tracked vehicles for serviceable track pads.	N/A
			Allow only rubber-padded track-laying vehicles on roads.	
			Avoid neutral steer/pivot turns on paved roads.	
			Use equipment haulers for tracked vehicles with all-steel tracks.	
	Interference with civilian traffic	N	Establish military traffic control and security within training areas accessible to others.	N/A
			Notify local authorities 7 days in advance of troop transport on public roads.	
Public services	**Tinian:** Increased demands on public safety authorities	N	Coordinate with the local fire and police departments; augment civilian forces as appropriate.	N/A
Infrastructure				
Potable water supply	**Tinian:** Depletion of local water supply during large exercises	N	Conduct advance planning with municipality to identify requirement, times, and places for issue.	N/A
Wastewater disposal systems	Chronically overload Tinian's municipal septic system capacity	Y	Delay emptying portable toilet waste, if large functions are occurring at Field House.	N
			Direct waste to proposed base camp septic system, once it has been built.	
	Increased cumulative demand for public wastewater treatment system if tourism greatly increases	N	Secure agreement from municipality to allow portable toilet waste disposal to public treatment system (if one is built).	N/A
			Direct waste to proposed base camp septic system, once it has been built.	
Solid and hazardous waste collection and disposal facilities	**Tinian:** Absence of RCRA-approved SW disposal facility for exercise-generated waste	Y	Backhaul SW to DoD facility on Guam for proper disposal.	Y
	Guam: Depletion of GovGuam or private landfill capacity	N	Do not use GovGuam or private landfill. Dispose SW in DoD landfill at Apra Harbor.	N/A
	Interference with civilian need for shipping capacity due to transport of SW from Tinian to Guam	N	Coordinate with local shipping companies and ensure adequate shipping capacity prior to large exercises. Delay shipping SW, if necessary, until adequate ships are available.	N/A

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Infrastructure *(continued)*				
Solid and hazardous waste collection and disposal facilities (continued)	Disposal of ships' waste nearshore	N	Comply with COMNAVMARIANAS/C7F directives and federal regulations not to dispose of SW within 25 nautical miles of shore.	N/A
	Tinian: Absence of RCRA-approved hazardous waste (HW) disposal facility in CNMI or Guam	Y	Ship HW to DoD facility or continental U.S. for proper disposal.	Y
Floodwater storage	None	N/A	None required.	N/A
Electricity and communication	**Tinian:** Temporary increased demand for electricity	N	Communicate and coordinate with appropriate local agencies prior to exercise.	N/A
			Supplement commercial power with field generators.	
Social Environment				
Land use	Interference with/encroachment on neighboring land use/property	N	Monitor activity within training area to identify and avoid potential encroachments.	N/A
	Safety risks to neighboring areas and inhabitants from use of firing ranges and established EOD sites	Y	Establish buffer zones, traffic control, and area monitors/umpires, as necessary, to eliminate civillian encroachment into range areas.	Y
	Conflicts with civilian activities	N	Schedule/coordinate potentially conflicting activities with appropriate local agencies 30 days prior to exercise. Publish NOTAMs and NOTMARs.	N/A
	Noise disturbance by aircraft near residential areas	N	Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAMs and NOTMARs.	N/A
	Danger to civilians from training on non-DoD lands (paradrops only)	N	Obtain permission from property owner prior to exercise.	N/A
	Disfigurement of publicly accessible land areas by littering or effects of bivouacs and logistics support activities	N	Clean and inspect all training areas. Do not bury paper trash or other training residue. ("Pack It In; Pack It Out")	N/A
	Tinian: Longterm UXO contamination of proposed mortar range impact area	Y	MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE	Y
	Guam: Aggravation of ongoing dispute over control of Apra Harbor	N	Continue efforts to resolve dispute.	N/A

Table ES-2 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Social Environment *(continued)*				
Commercial enterprises	Increased demand on various commodities	N	Give notice to local officials and merchants so they can prepare for increase in demand and avoid shortages.	N/A
			Contract locally for required services.	
	Tinian: Closure of EMUA to tour companies and tourists due to small arms range use	Y	Give 30 days' advance notice before curtailing access to tourist sites within EMUA.	Y
	Tinian: Closure of EMUA to subsistence fishers due to small arms range use	N	Establish an access corridor to accommodate civilian visitors, when possible.	
	Guam: Closure of portions of Apra Harbor to commercial boat and diving operations for 4 hours once per month	Y	Reduce use of this site in favor of Dadi Beach site, weather permitting.	Y
Tinian government and agencies	Inconvenience regarding joint use of civilian facilities (West Tinian Airport, field house)		Notify Mayor's office at least 30 days prior to exercises.	N/A
Environmental justice	Disappropriate hardship on local minority or economically disadvantaged population	N	Design training activities to eliminate conflict, promote mutual understanding, and enhance local economy.	N/A



(National Archives at College Park)

CHAPTER ONE

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

1. PURPOSE OF AND NEED FOR MILITARY TRAINING IN THE MARIANAS

The purpose of this DEIS is to evaluate environmental impacts of continuing use of Department of Defense (DoD)-controlled lands for military training conducted in the Mariana Islands in the foreseeable future. This draft environmental impact statement (DEIS) supersedes a previous DEIS for Military Training in the Marianas, dated January 1997.

Military training is a continuing action, i.e., it is not commenced and concluded in a specific period of time like a construction project, but is an ongoing activity over an unspecified period. Its duration may be open-ended. NEPA documentation for a continuing action continues to meet NEPA requirements unless:

- It is discovered that the environmental effects of ongoing activities are significantly and qualitatively different or more severe than predicted in any original NEPA documentation.
- There is a substantial change in the ongoing activities, with the potential for generating significant environmental impacts. Such impacts might result from substantial changes in operational tempo, areas of use, or training methodology and equipment.

As described in this chapter, the **purpose and need** is to maintain a high level of capability in units stationed or operating in the Western Pacific Ocean, in support of the national defense strategy for the Pacific theater.

1.1 SUMMARY

The proposed action is to use existing DoD-controlled lands in the Mariana Islands for military training necessary to ensure the readiness of U.S. forces assigned in the region or with assigned regional contingency missions. The proposed land use is largely a continuing action conducted on lands owned, leased, or otherwise controlled by the U.S. Government, as well as adjacent waters and air space. The lands proposed for continued training are:

- Tinian Military Lease Area (CNMI)
- COMNAVMARIANAS Waterfront Annex (Guam)
- COMNAVMARIANAS Ordnance Annex (Guam)
- Andersen Air Force Base (Guam)
- COMNAVMARIANAS Communication Annexes Finegayan and Barrigada (Guam)

- Entire island of Farallon de Medinilla (CNMI)

The following sections provide an overview of the notional purpose for which training in the region is necessary, the commands and organizations which currently train in the Marianas, and alternative training locations in the Western Pacific.

1.2 PURPOSE AND NEED: TRAINING REQUIREMENTS IN THE PACIFIC THEATER

The Commander-in-Chief, United States Pacific Command (USCINCPAC) is responsible for an area comprising 105 million square miles and 44 countries, including two of the world's most populous countries and seven of the world's largest armed forces. The United States has mutual defense treaties with five nations in this Pacific area of responsibility, which extends from California to Diego Garcia (in the Indian Ocean).

The United States has a national security strategy of cooperative, flexible and selective engagement. This strategy requires a continued American involvement in the Pacific area to promote an environment of trust, cooperation, and stability. As part of this strategy, U.S. military presence is required in the region to deter armed conflict, guarantee lines of communication, and to help ensure the continued independence of the region's numerous nations. To this end, a force structure of approximately 100,000 U.S. military personnel is projected to be in the Pacific area for the foreseeable future.

The military element of the U.S. defense strategy is achieved not only by the presence of forces in the region, but also by strong alliances and by the ability of military forces to respond quickly and effectively in a crisis. This demonstrated capability deters potential aggressors in times of crisis and provides the ability to attain a favorable outcome in military engagements, should deterrence fail.

The use of training areas in the Mariana Islands is crucial to Pacific Command forces for maintaining essential military capabilities, demonstrating combat readiness, and assuring responsiveness to crises in the region.

The following subsections describe the general organization and homebasing posture of Pacific Command forces, the types of forces and their roles and missions that require training in the region, and the specific training requirements to be met.

1.2.1 Pacific Force Structure

Execution of the Pacific Theater Engagement Plan requires the Pacific Command to employ forces based in a variety of deployment postures. Essentially, this means that forces assigned to Pacific Command for the defense of the Mariana Islands and other areas in the Western Pacific are not all based in the region, and may need to deploy from distant bases to the region in response to world events. Because of their distant home

basing, training for employment in the region is very important for these units. The various deployment postures of forces with regional responsibilities include:

- **Forces based in the continental U.S.** I Marine Expeditionary Force (I MEF), U.S. Third Fleet, and the Army I Corps provide military forces that transit through the Western Pacific every six months to and from their home bases in the continental U.S. (CONUS). Forces from these commands deploy on a regular basis to the Western Pacific and Indian Ocean, where they provide a military response capability in support of Pacific Command's regional responsibilities. Of particular interest for Marianas training, I MEF and Third Fleet provide Amphibious Ready Groups (ARGs) with embarked Marine Expeditionary Units (MEUs) for service in the Western Pacific and Indian Ocean. These forces provide an immediate amphibious landing capability in the area of operations and are replaced every six months.

  Aircraft carrier battle groups (CVBG) also deploy from CONUS through the Western Pacific to the Indian Ocean on a six-month rotation. Both of these early response forces must remain in the highest state of mission readiness. At any one time, a CONUS-based ARG/MEU and a CONUS-based CVBG are stationed near or west of the Mariana Islands. Transit time from their home bases to the western Pacific is approximately two to three weeks.

- Forward-based forces, including **military forces stationed in Hawaii and Alaska**. These forces do not regularly deploy to the Western Pacific region and therefore do not have a requirement to train in the Marianas region on a regularly scheduled basis. However, forward-based forces are required to train in the Marianas or Western Pacific region on a periodic basis to maintain and demonstrate the capability to respond to crises in the region. Such training is normally performed as part of a named joint exercise, such as Tandem Thrust. These forward-based forces include the Army's First Brigade, Sixth Light Infantry Division and 11th Air Force in Alaska, and the 25th Light Infantry Division (minus), 45th Corps Support Group, and Third Marine Regiment (Reinforced) in Hawaii.

- Forward-deployed forces include those **permanently based in the Western Pacific, primarily in Japan, Korea, and Guam**. The Fifth and Seventh Air Forces are located in Japan and Korea respectively, with 13th Air Force at Andersen Air Force Base on Guam. The Eighth U.S. Army is stationed in Korea; III Marine Expeditionary Force (III MEF) is stationed in Okinawa; and U.S. Seventh Fleet operates out of homeports in Japan. Seventh Fleet and III MEF deploy an ARG/MEU (USS BELLEAU WOOD, the command ship), and Seventh Fleet deploys a Carrier Battle Group (USS INDEPENDENCE) and a variety of task forces for regional contingencies, exercises and training. Maritime Prepositioning Squadrons (MPS) provide equipment and supplies for Marine and Army forces based outside of the region; these vessels are located in Diego Garcia, British Indian Ocean Territories, and in the Mariana

Islands. In times of crisis, or in training for such events, assigned forces fly into the region unburdened by heavy equipment and supplies, making use of the prepositioned material in the vessels to carry out their missions. Unloading equipment and supplies from these vessels and issuing them to the units which have flown into the region are major components of MPS exercises.

1.2.2 Forces to be Maintained

The forces that must train in the Marianas represent an entire array of combat, combat support and combat service support, special operations, and logistic missions that may be needed to respond to operational commitments with little notice. USCINCPAC is the operational commander for the forces assigned in the region. Individual service commands, such as the Navy's Pacific Fleet Command (CINCPACFLT), provide forces to the operational commander for employment. That employment may range from simply force presence to a spectrum of response contingencies including disaster relief, limited regional conflict, and major regional conflict. Each service component and the operational command staff have specific roles to fulfill in the potential employment spectrum. These must continuously be sustained and tested in training to maintain the required operational capabilities in the Western Pacific. Training activities and exercises must be conducted by readiness forces in or near their areas of responsibilities so that the exercising forces may rapidly respond to actual contingencies should they occur.

The missions and capabilities of the commands and organizations that train in the Marianas include:

Non-Guam-based commands and organizations:

- The **headquarters element** of a transient force is normally comprised of a task force commander and supporting staff responsible to plan operations, communicate with all assigned forces, expeditiously displace to designated locations, assume command of assigned forces, and carry out operations as planned or as ordered by higher headquarters. This headquarters must be able to maneuver its forces, employ them to achieve assigned missions, and take protective measures against hostile action.
- The **Aircraft Carrier Battle Groups** originate in CONUS for deployment in Southwest Asia or the Western Pacific and Indian Ocean. One Carrier Battle Group is homeported in Japan. These forces operate in and transit through the Marianas region in response to operational deployment requirements. These forces consist of aircraft carriers and associated surface combatant ships. The aircraft carriers have embarked composite air groups composed of fighter, attack, and electronic countermeasures aircraft, among others. Capabilities to be maintained include the entire spectrum of naval aviation warfare, including air-to-ground delivery of ordnance, air-to-air interception and combat, surveillance of airspace, surface-to-air combat, and surface gunfire by carrier escort vessels.

- **Amphibious or expeditionary forces** consist of ARGs, MEUs, and Maritime Prepositioned Forces (MPF). They originate from CONUS, Hawaii, and Japan, with prepositioned forces also in Diego Garcia. These forces consist of amphibious or prepositioned shipping, with associated command and control, and surface combatant vessels. Amphibious forces include amphibious assault ships which operate as small aircraft carriers with well-decks capable of supporting helicopter and vertical short take-off and landing (VSTOL) attack aircraft, and amphibious landing craft and vehicles. These forces, often employed with CVBG's, have the capability for forcible entry to a hostile shore. They employ air-to-surface and surface-to-surface ordnance delivery, perform amphibious landings using assault amphibious vehicles (AAV) or air-cushion landing craft (LCAC), and perform infantry, mechanized, artillery, engineering, and logistic operations ashore. These multipurpose, immediate response forces also provide a range of humanitarian and evacuation operations, and operations other than warfare. The nucleus of a MEU is normally an infantry battalion, reinforced with supporting arms and air-ground mobility assets.
- **Maritime Prepositioned Forces** do not provide a forcible entry capability, but require a benign port and airfield from which the vessels can be unloaded by forces flown into the region by strategic lift aircraft. Each MPF is capable of supporting a Marine Expeditionary Force (MEF) Forward, a brigade-sized expeditionary, composite force of ground, aviation, and logistic elements, with two to three times the size and capability of a MEU.
- Elements of the **U.S. Army Special Forces** battalion stationed on Okinawa deploy with USAF tactical airlift from Japan to the Marianas for training in small unit patrolling, reconnaissance, and airborne/airmobile operations.
- Navy **Maritime Patrol Aircraft** conduct unilateral and bi/multilateral undersea warfare, surface warfare, maritime interception operations, sea surveillance and control, search and rescue (SAR) training, and actual SAR missions with detachments supported by Andersen Air Force Base (AAFB).
- The **Air Combat Command** (ACC) has strategic bombing elements stationed in CONUS, but assigned to USCINCPAC for employment under certain contingencies. These forces include B-52, B-1, and B-2 bombers, which fly from bases in CONUS directly to target areas in the region, or deploy from CONUS bases to regional bases such as AAFB for arming and further deployment to the area of operation. These aircraft deliver ordnance to ground targets from either high level or low level, and employ both area and precision-guided munitions.

Guam-based commands and organizations:

- The **13th Air Force**, stationed at AAFB, is responsible to Commander, Pacific Air Forces (PACAF) to plan, execute, and control aerospace operations throughout the Southwest Pacific and Indian Ocean area of

responsibility. The 13th AF provides USCINCPAC a combat-ready, deployable staff to direct joint/coalition contingency operations. The 13th AF ensures assigned combat forces are effectively employed and logistically supported, and maintains military relationships with regional partners.

- The **36th Air Base Wing** hosts wing support to more than 7,000 military, civilian, and dependent personnel at AAFB. Support is provided to 13th AF, various Air Force supporting squadrons, and one U.S. Navy helicopter squadron (HC-5). The 36th ABW maintains the manpower, facilities, and equipment infrastructure needed to support tactical/strategic peacetime/wartime operations. It provides personnel and equipment for generation, mobilization, deployment, and employment in support of USCINCPAC operation plans. AAFB is a major transportation complex responsible to support most training organizations transiting the Marianas.
- **Commander Naval Forces Marianas** (COMNAVMARIANAS) is an area commander responsible for operations and training at all Navy-controlled training areas and for services available in the Marianas. As the USCINCPAC representative, COMNAVMARIANAS coordinates joint service use of training areas and facilities. These include a shore bombardment, strafing and aerial bombing range at Farallon de Medinilla, a military lease area on Tinian, and Orote Point, Inner and Outer Apra Harbor, the Waterfront Annex, the Ordnance Annex, and Communications Annex properties on Guam. COMNAVMARIANAS also coordinates Navy and Marine Corps use of training areas managed by 36th ABW at AAFB.
- Stationed at and supported by AAFB, the Navy's **Helicopter Combat Support Squadron FIVE** (HC-5) has multiple missions in the Pacific and Indian Ocean areas of responsibility. The squadron provides aircraft detachments for vertical replenishment, vertical on-board delivery, amphibious search and rescue (SAR), and utility services in support of Seventh Fleet and Commander U.S. Navy Central Command, and administrative and logistics support, airborne firefighting support and 24-hour SAR services for Guam and the CNMI. The squadron is the primary maneuver training support squadron to ground forces in the Marianas conducting airborne and airmobile operations.
- **Explosive Ordnance Demolition Mobile Unit FIVE (EODMU-5)**, stationed at the Waterfront Annex, is responsible for detecting, disarming or otherwise neutralizing/rendering safe, and disposing of explosive ordnance. They perform their mission under both tactical and administrative circumstances, both on land and in the water. EODMU-5 performs counter-mine warfare, and detects and neutralizes naval mines under water through detonation with charges up to 20 pounds of explosives. Stationed in an area still affected by the presence of World War II unexploded ordnance (UXO), EODMU-5 shares clearing responsibilities with USAF EOD personnel throughout the Marianas.

- **Naval Special Warfare Unit ONE (NSWU-1)**, stationed at the Waterfront Annex, consists of permanently assigned staff as well as SEAL platoons and a Special Boat Detachment on six-month deployment rotation. These forces provide a forward-deployed Special Operations capability to COMSEVENTHFLT and COMSOCPAC. NSWU-1 is responsible for maintaining the battle readiness of each platoon for immediate deployment as required. Training requirements include skills needed for numerous air and sea mobility options and special reconnaissance, unconventional warfare, close quarter battle, foreign internal defense, direct action, and other special operations.

- The Navy operates long-range receiving and transmitter communications stations at **Naval Computer and Telecommunications Master Stations** in Finegayan and Barrigada. Training primarily remains technically oriented and on-station for NCTAMS personnel. Finegayan also supports other U.S. Navy units with its known-distance small arms firing range. Both stations have areas that are available to ground units for conducting small unit tactics, scouting and patrolling, and land navigation.

- Camp Covington is the home of **Naval Mobile Construction Battalion** (NMCB), better known as Seabees. In addition to permanent detachments, a Seabee battalion rotates to Camp Covington from CONUS every seven months to conduct training in terrain, climate and environment similar to those expected when responding to contingencies or disasters in the Pacific. The training stresses construction skills as well as tactical proficiency, command/control and communications, defensive tactics, convoy security and patrolling, and small arms qualification. (As an example of maintaining readiness in preparation for contingencies anywhere on the globe, two Seabee battalions that deployed to Bosnia received their tactical training during Guam deployments.) Training requirements are fulfilled on U.S. Navy and USAF bases on Guam, reducing costs to transport personnel and equipment to more distant training locales.

- Both Guam **Army National Guard and U.S. Army Reserve** Marianas forces are assigned to Guam (with one reserve platoon on Saipan), conducting tactical training one weekend per month, during two-week annual training duty (ATD), and during joint exercises on Guam every two years. Although ATD may provide an opportunity to train away from the Marianas, the units are responsible to accomplish all individual and unit training requirements at home stations. Since home armories and reserve training centers have limited space, the units use Navy and Air Force facilities to conduct field maneuvers and firing range training. There are five Guam National Guard units and three Army Reserve Marianas units based on Guam. (Three of the Reserve units are "round-out" units to U.S. Army units, meaning that their training readiness must support a call-to-active duty and deployment within 30 days. Two were activated and deployed to Desert Storm.)

Training requirements for these units, together with unit size and frequency, are summarized in Table 1-1.

1.2.3 Purpose of and Need for Specific Training Activities

This DEIS proposes a broad spectrum of training land uses, the majority of which have been on-going for many years and are evaluated herein as continuing actions. Some proposed training land uses are new and have been proposed to meet specific training land needs. Certain training land uses have significant impacts which cannot be fully mitigated to nonsignificance or which remain controversial despite evaluation that indicates there will be no significant impacts which cannot be mitigated. In many cases, proposed training that would have significant impacts is not included within the Preferred Alternative of this EIS. However, some training with such anticipated effects remains in the Preferred Alternative because there are no suitable alternative sites, because the need is important to maintaining an assigned military mission capability, and because the impacts, although significant, can be managed and would have a limited effect. These training land uses include:

Amphibious assault vehicle landings at a beach within Tinian's Exclusive Military Use Area. The AAV is the one of the principal ship-to-shore transportation means available for amphibious operations, and its safe and effective use requires training in launching and recovery, navigation to shore, crossing the shoreline, and operations ashore. Training includes both crew technical operations and tactical operations with other types of combat units. AAVs are a basic maneuver element of the MEU and, as such, require integration in MEU training. Tinian is the only training area in the region suitable for maneuver training of a MEU.

The potentially significant environmental impact is caused by the effects of AAVs as they cross reefs and reef flats, as the tracks touch bottom (in about 2 meters [m] of water) then propel the vehicle to shore. Because over time AAVs crossing the reef and reef flat will disrupt the substrate along the travel route for the width of the AAV tracks, their proposed use for landing on Tinian will be restricted to one beach and only a single lane on that beach crossing the reef. The beach and lane have been selected in an area of poor coral growth and where growth potential is limited because of natural effects, so the impacts of this training use will be localized and minimized. The proportion of coral affected in the immediate area is a very small proportion of the total coral coverage in adjacent areas.

Aerial bombardment of Farallon de Medinilla with live ordnance. FDM is the only range area in the region useable for training with live ordnance from ships and aircraft. There are several reasons for using live ordnance in training.

- Ordnance training includes the entire process of selection, transport, and preparation of a particular munitions for use. These tasks include properly identifying the required type of ordnance for the target, providing those items

to the point of delivery, properly fusing the item, and then delivering on the target. Accurate delivery often requires observing the strike of the item by its explosive signature and adjusting subsequent rounds. Use of inert ordnance does not train the entire system of people and organizations aboard ship or in aircraft units who are involved in the process described above. Because there is a heightened risk involved in using live ammunition, people involved in its handling or use must be trained in the correct procedures and conditioned to the elevated stress and need for alertness under the controlled conditions of training exercises, so they will be more likely to respond properly during combat conditions.

- Fleet units, both surface and aviation, which use FDM are on operational assignments far from their homeports. Because they are combat ready units, they do not embark with training or dummy ordnance, as their storage space is limited and all space is required for basic loads of combat munitions. Since FDM is the only location in the western Pacific available to U.S. forces for this type of training, and because the naval elements using FDM have only live ordnance aboard for operational reasons, there are no viable alternatives to the continued use of FDM for live ordnance delivery.
- While strategic bombers from ACC are not permanently on station with live ordnance loads, their prepositioned ordnance in the region is similarly configured for operations. ACC units have the same requirements outlined above for live ordnance training that involves the entire ordnance selection, handling, preparation, and delivery system.

The potentially significant impact is mortality to birds as a result of ordnance delivery. While bird populations on FDM appear to be stable in the context of long term use of the island for bombing and naval gunfire practice, and while fishery resources appear not to be affected by such use, it is also apparent that long term changes in vegetation have been caused by fire, and that killing of individual birds does occur as a result of the training.

Underwater detonation of live 10- and 20-pound charges. Underwater demolition and mine countermeasure training is employed by EOD teams stationed on Guam. These personnel are responsible for safely recognizing various ordnance items and knowing how to neutralize them using correct explosives. The training resulting in underwater explosives includes recognition, properly configuring the correct charge, fusing, and returning the team to a safe location prior to the explosion. These skills, which involve a high level of personal stress and care, must be practiced in the controlled circumstances of training, so that proper performance under the greater stress of operational conditions is more likely to be achieved. These explosive ordnance disposal skills are routinely employed for the safety of the civilian community in the Marianas from WWII ordnance, as well as during military operations such as Desert Storm.

While 20 pounds of explosive is the upper explosive weight limit employed for mine countermeasures training on Guam, most charges are of a lesser amount, depending on

the item being neutralized. Sheltered water is required, so that training can be planned and carried out dependably under most weather conditions. Sites are selected to minimize damage to the surrounding benthic environment, and procedures are in use, as approved by Guam EPA, for surveillance and protection of endangered marine turtles. There are no alternatives for conducting this training, for which environmental effects are predictable and limited in extent. The sites selected minimize environmental damage and disruption to other water users, consistent with meeting training requirements.

1.2.4 Alternative Training Locations

1.2.4.1 TRAINING LOCATION CRITERIA

The availability of reasonable alternative locations for military training is dependent on numerous parameters associated with training activities. Primary among these are the required levels of training, training frequencies, proximity to areas of potential employment for operations, and cost.

- The **levels** of training to be conducted range from the skills required of an individual, through small unit training, to force level exercises. Skills training for the individual includes such tasks as marksmanship, ability to operate assigned equipment under field conditions, and the ability to survive in a combat environment. Tactical training focuses on unit performance, from ship and aircraft crews to gun crews and infantry maneuver elements. Training for these elements focuses on teamwork and coordinated interactions, communications, sensing the tactical environment, and responding appropriately. Force level training occurs when all elements of an assigned force are brought together to carry out a particular mission. These exercises focus on logistics, communications, and command and control, as well as a demonstration of all the foregoing levels of training.
- In terms of **frequency**, individual and tactical training is routinely conducted to maintain proficiency, and must be conducted in a manner that permits the training units to meet their assigned responsibility for regional contingencies. Since the members of these units change every one or two years, new personnel must continuously be integrated into unit operational procedures. Task force exercises are performed on a scheduled basis, the frequency of which depends on the particular purpose and composition of the exercising element. For example, ARG/MEUs need to exercise several times during a deployment cycle to sustain their capacity for mission response, whereas larger exercise forces assembled from the entire Pacific theater may only exercise every other year, such as in exercise Tandem Thrust.
- **Proximity** to areas where the training organization or command may be employed in a rapid response to world events is necessary for deployed units with contingency response missions or those assigned to USCINCPAC for regional missions. One of the purposes for training in the Marianas is so that

regional response forces can be available for operational employment, should they be called, even during training events. Training in the region is also necessary for the commands from more distant home bases, because of the requirement to train in the necessary movement and logistic skills to rapidly deploy to the region. Demonstration of this capability during exercises makes these forces credible in the deterrence of potential aggression.

- **Costs** of training include both direct dollar expense of transportation and supplies, as well as administrative overhead to arrange for the training events. The administrative effort required to arrange for training is an important but hidden cost to smaller units, because they have limited resources to arrange for training at distant or difficult to reach locations. The logistic expense of transporting the training element to and from the training area is a direct dollar cost of individual training events and is generally only warranted over long distances for exercises which have specific contingency mission response objectives. The cost of acquiring and maintaining the training areas that are suitable for the types of training to be conducted are independent of the individual training events. The more frequent the training needs, such as for individual and small unit training, the more efficient and readily available training areas must be to remain cost effective.

Considering these parameters, suitable training area alternatives need to have the following characteristics to be reasonable alternatives for meeting the training need:

- Routinely available on a schedule that meets training frequency needs of units assigned to regional missions
- Available at an efficient cost
- Suitable in size, terrain, and location to allow the variety of training necessary to meet training proficiency requirements for assigned forces and missions
- Primarily on military-controlled (owned or leased) lands, or lands on which the appropriate military headquarters has land use rights for training
- On U.S.-controlled lands, or lands on which the United States has rights to conduct training without recourse to negotiations at the diplomatic level, or on lands in which training would not cause diplomatic destabilization
- Located in the theater of operations such that training and exercises accomplish the multiple objectives of USCINCPAC's security strategy, including presence, continued crisis response posture, and deterrence through demonstrated response capability in the region

1.2.4.2 ALTERNATIVE TRAINING LOCATIONS OUTSIDE THE REGION

Outside the Marianas, possible training areas that have potential to meet some or all of the foregoing training criteria are evaluated below. In general, these potential training

areas do not provide reasonable alternatives for training in the Marianas for the reasons stated.

Republic of the Philippines. Prior to 1993, the United States military conducted training operations in the Philippines on ranges and maneuver areas associated with Clark Air Base and Naval Station, Subic Bay. With the closure of these bases and the lack of a Status of Forces Agreement with the Philippines government, potential training areas in the Philippines no longer meet any of the criteria outlined above.

Japan. A limited number of training areas in Japan, including Okinawa, are available for use by U.S. forces assigned in Japan. These training areas include some maneuver areas, limited amphibious landing areas, and some live-fire ranges for individual and crew-served weapons. Some areas are managed by U.S. military commands and others are managed by, and shared, with the Japanese Self Defense Force. As a rule, these areas are small and constrained, with their training value impaired by encroachment over the years. For Okinawa-based forces, training areas are sufficient for most individual and some tactical level training. However, MEU-sized landing areas are not available, and weapons ranges do not accommodate surface naval gunfire or air-to-surface ordnance delivery by USN/USMC and USAF tactical and strategic squadrons. For other than individual skills training, and particularly for ARG/MEU and CVBG training, Japan does not meet the criteria for training areas outlined above.

Republic of Korea. The Republic of Korea has permanently stationed American forces, primarily for defense of the Republic of Korea. These forces are not normally deployed outside of Korea for training, and adequate training areas exist in Korea for the maintenance of mission response capability. However, for diplomatic reasons and concerns that training not be a destabilizing influence, transient military forces no longer routinely train or are severely limited in the number participating or the frequency of training events. For this reason, Korea does not provide alternative training areas that meet the criteria outlined above.

Hawaii. Training areas in Hawaii are located on Kauai, Oahu, and the Big Island of Hawaii, and are designed to meet specific service training requirements. None is suitable for the full integration of multiservice training. The islands are not located in the Western Pacific theater of operations which increases reaction times for training forces to meet the USCINCPAC security strategies of forward presence, and rapid crisis response posture and deterrence. Movement of forward-deployed forces back to Hawaii for training is estimated to double fuel costs for U.S. Seventh Fleet organizations.

More distant locations: Some of the transient forces that train in the Marianas do so while en route to deployments in the Persian Gulf and Southwest Asia. These are primarily the CONUS-based CVBGs and ARG/MEUs. The Marianas represent the farthest west U.S. military training area available for sustainment training, since there are no U.S. military training areas for these forces in the Persian Gulf area. Farallon de Medinilla represents the last available surface and aerial bombardment range routinely

available for U.S. Forces operating in the Western Pacific or Indian Ocean/Persian Gulf. There are no others meeting the criteria above. While exercises are conducted by U.S. forces in conjunction with other nations in these regions—Australia and Thailand, for example—such combined exercises are infrequent and expensive, and do not meet the routine readiness training needs of forces assigned in the Western Pacific.

1.3 TRAINING LANDS IN THE MARIANAS

The U.S. military owns or controls land on Guam, Tinian, and FDM. The U.S. presence in the Marianas dates back to the Spanish-American War and was consolidated during and after World War II.

1.3.1 History of the U.S. Military in the Mariana Islands

As a result of the Spanish-American War, Guam became a U.S. possession under U.S. Navy jurisdiction. Guam served as a location for refueling and radio communication, with a contingent of Marines assigned in the late 1930s. One of the Navy's missions was intercepting Japanese radio transmissions from Micronesian islands. The German colonies in Micronesia north of the equator became a mandate of Japan as a consequence of Japan's declaration of war against Germany in 1914. Toward the end of the 1930s, the Japanese developed airfields, seaplane bases, and defensive positions on Saipan, Tinian, and Rota. World War II arrived in Guam on December 8, 1941, with Japanese aerial bombardment of Guam villages from Saipan-based aircraft. Japanese amphibious assault landings at Tumon and Aporguan led to the defeat of the insular Force Guard and the beginning of two-and-one-half years of Japanese occupation.

In August 1942, the Allies initiated an island-hopping campaign to drive the Japanese from occupied Pacific islands. American aircraft carrier-based forces first invaded the Marianas in February 1944. Saipan was invaded by U.S. forces on June 15, 1944, and secured by the Second and Fourth Marine Divisions on July 9. The invasion of Guam began on July 21, 1944, with the Third Marine Division landing at Asan and the First Provisional Marine Brigade and the Army's 77th Infantry Division landing at Agat. On July 24, the Fourth Marine Division landed on Tinian (see photos on covers of Chapters Two and Three). Tinian was declared secure on August 1, 1944; Guam was declared secured ten days later (cover of this chapter). Rota, Aguijan, and islands north of Saipan were not invaded. Instead, their Japanese defenders were shelled, bombed, and bypassed. Massive construction on Guam, Tinian, and Saipan transformed the islands into the sites of major U.S. military airfields and ports needed to continue the war effort. Guam's Northwest Field, Tinian's North and West Fields (cover of Chapter Four), and Saipan's Isley Field were constructed in minimum time to support bombing missions in preparation for the invasion of mainland Japan.

[1] Commander, Seventh Fleet message 031034Z July 97

At the end of World War II, all of the Marianas came under the control of U.S. military forces. In 1946, the Military Government of Guam was reestablished as the Naval Government of Guam, and the Navy was allowed to acquire private lands. In August 1950, the Organic Act of Guam gave Guamanians American citizenship. Postwar control of the Northern Marianas passed to the U.N. Trust Territory of the Pacific Islands (TTPI) on July 18, 1947, under U.S. administration. The Department of the Interior took jurisdiction from the U.S. Navy in July 1951. Within one year, control was passed back to the U.S. Navy for the Northern Marianas (less Rota), as the Central Intelligence Agency commenced training Chinese Nationalists at camps established on Saipan and Tinian.

The Northern Mariana Islands were returned to the jurisdiction of the Department of the Interior in May 1962. The TTPI had been divided into six districts; the Mariana Islands (less Guam) were one such district. By 1964, negotiations began regarding the future political status of the Northern Marianas. In February 1975, the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America was signed. The Northern Marianas delegation achieved their main objectives of U.S. citizenship, economic development, control over their internal affairs, and a smooth transition. American military needs were met; FDM was designated as a target range, and the military acquired use of a portion of Tanapag Harbor, joint use of Isley Field, and establishment of a military area on Tinian. The northern two-thirds of Tinian was planned to support an Air Force and Naval base, and the southern one-third was returned to civilian use.

1.3.2 DoD Land in the Marianas

The DoD owns or otherwise controls lands on three islands in the Marianas: Tinian, Guam, and FDM. The affected land areas are shown in Figures 1-1 and 1-2 and are summarized on Table 1-2.

Tinian. Training land on Tinian is leased by the U.S. from the CNMI, pursuant to the 1975 Covenant which made the Mariana Islands District of the Trust Territory of the Pacific Islands a Commonwealth of the United States. Related documents signed between 1975 and 1994 established the current land use configuration (see Figure 1-2). The Military Lease Area (MLA) consists of a 30.68 km^2 Exclusive Military Use Area (EMUA) in the north and a 31.65 km^2 Leaseback Area (LBA) in the south. The EMUA is controlled by the military, with civilian and tourist access permitted except during certain training activities. The LBA, which includes West Tinian Airport, may be used by the CNMI and its sublessees for agriculture, grazing, and other purposes expressly permitted by the U.S. (provided such uses are compatible with Federal Aviation Administration [FAA] safety zone requirements for the airport area). The U.S. may train in the LBA, subject to written notification of CNMI, and has agreed to minimize interference with civilian activity at West Tinian Airport. The U.S. has also retained the following rights in the village of San Jose and the harbor area:

- The right to moor vessels, handle cargo, stage equipment and materiel, and conduct other port-related activities at Tinian Harbor
- The right to temporarily secure and use portions of the area on a not-to-interfere basis to conduct military training exercises or to perform activities in support of military training exercises
- The right to install, operate, and maintain fuel and utility lines from Tinian Harbor over CNMI lands to serve areas in the MLA

A 3.2 km^2 portion of the EMUA has been allotted to the Voice of America (VOA) for installation and operation of a transmitting station (see Figure 1-2). Training cannot occur on the VOA parcel, due to hazards of electromagnetic radiation.

Guam. The Guam Land Use Plan, 1994 (GLUP 94) indicates that the DoD owned approximately one-third of all land on Guam as of 1994. Of this land, approximately 25 percent has been proposed for release and/or has been released under the Base Realignment and Closure (BRAC) program. Both Air Force and Navy properties have been considered for release, but the BRAC 95 decision ratified by the U.S. President and the Congress in September 1995 includes only 2,800 acres of Navy land. The BRAC release affects but does not eliminate training conducted at the Waterfront Annex and Ordnance Annex[2] and the Communications Annex at Barrigada.

Table 1-2 Military-Controlled Lands Used for Training

LOCALE	LAND AREA (km^2)	PRIMARY FUNCTION
Leaseback Area (Tinian)	36.92	Military training
EMUA (Tinian)	30.66	Military training
Ordnance Annex	35.78	Ordnance storage, operations, administration, training, and support
Waterfront Annex	18.13	Houses various activities and entities which fulfill the support role for Naval operations on Guam
AAFB Main Base	44.72	Aviation support for military operations in the Western Pacific
AAFB Northwest Field	17.72	Ground and aviation training
Andersen South	9.79	Contingency dormitories and training area
Communications Annex Finegayan	11.95	Receiver facility and communication center
Communications Annex Barrigada	7.48	Transmitter facility
Farallon de Medinilla	0.9	Aerial bombardment and naval gunfire training

Other training areas on Guam unaffected by BRAC decisions include Communications Annex Finegayan and AAFB, including Andersen South. All of the training areas have active facilities and assigned personnel responsible for nontraining activities. Proposed

[2] These names are now obsolete but are used in this document due to the familiarity of their use.

training will occur on areas of land that are compatible with adjacent, nontraining activities.

FDM. The Covenant with the CNMI and related documentation also provided for use of the uninhabited island of FDM as a target for aerial gunnery and naval bombardment. The DoD controls access to and airspace around the island.

Certain natural and man-made constraints exist at each of the training areas considered in this DEIS. Such constraints affect the training options available to exercise planners and unit commanders operating in the Marianas. These limitations affect the types of training that can be conducted within a given area, the size of exercise forces, types of equipment that may be used, and the exercise schedule.

1.3.3 Training Lands Administration

COMNAVMARIANAS is the controlling and scheduling authority for Navy-managed training areas and Navy support services available in the Marianas. It coordinates Navy/Marine Corps unit requests to use Air Force training lands, as necessary. COMNAVMARIANAS, as the representative of USCINCPAC in Guam and the Commonwealth of the Northern Mariana Islands/Federated States of Micronesia/Republic of Palau, also coordinates joint-service uses of training areas and facilities. This responsibility includes maintaining a shore bombardment range at FDM and submarine and antisubmarine warfare operating areas on the open sea, as well as the military land maneuver training areas on Guam and Tinian that are the focus of this DEIS. COMNAVMARIANAS is also responsible for managing the use of non-DoD lands that may be made available to Navy and Marine Corps units for military training. A description of Fleet operating areas and training facilities has been published as direction for units requesting training in COMNAVMARIANAS' area of responsibility.

36 ABW is the controlling and scheduling authority for Air Force-managed training areas and services available on Guam. 36 ABW is responsible for providing training support at AAFB for units in transit for off-island training. Formalized exercise request procedures are published and are followed by all military services requesting use of Air Force training areas.

Other senior commands are responsible for identifying and coordinating training requirements within COMNAVMARIANAS/36 ABW areas of responsibilities. U.S. Army training needs are coordinated by Commander, U.S. Army Pacific (USARPAC), Fort Shafter, Honolulu, Hawaii. Coordination of U.S. Army reserve training is conducted by Headquarters IX Corps Command, Fort Shafter, Honolulu, Hawaii. Headquarters Regional Support, Guam Territorial Area Command, at Fort Juan Muña, Tamuning, Guam, is responsible for coordinating training requirements for the Guam National Guard. U.S. Marine Corps training requirements are coordinated by either Headquarters, III MEF in Okinawa, Japan, or Headquarters, I MEF at Camp Pendleton,

California. Headquarters, PACAF coordinates training requirements submitted by USAF organizations in the Pacific and CONUS.

1.4 DECISION NEEDED

The proposed action for which this EIS is being prepared is to use certain military and civilian lands for purposes of conducting military training as described herein. Military training use of the principal lands under evaluation is a continuing action, much of which predates the effective date of NEPA, January 1, 1970. Certain of the lands in question have been the subject of prior NEPA documents for particular training uses, notably the use of FDM as a bombardment range and use of much of Tinian for military exercises.

The intent of this EIS is to evaluate currently ongoing environmental effects that have not previously been evaluated, and to determine whether substantial environmental degradation is occurring or likely to occur as a result of ongoing or proposed new activities. Ongoing activities that may have changed in tempo, scale, use of new equipment, or in different locations are evaluated, as well as newly proposed activities. Ongoing activities covered in previous NEPA documents are evaluated where potential exists that ongoing environmental effects may be different qualitatively or more severe than predicted.

As a consequence of this analysis, the decision(s) to be made with regard to military training in the Marianas include:

- Whether or not to use or continue using certain lands for military training
- What training to perform on specific lands
- What mitigation to require for training impacts on specific training lands

The record of decision (ROD) on these questions will be signed by Commander, Naval Forces Marianas, acting in his capacity as Representative, USCINCPAC. The decision(s) implicit in this ROD will be implemented in directives prepared for use of the live fire ranges and training areas managed by COMNAVMARIANAS and 36 ABW. The ROD will also reflect policy as it pertains to the requirement to continue using, or to cease using, certain locations with strategic importance for training regional response forces to carry out missions as part of the nation's security strategy.

1.5 SCOPING SUMMARY

This DEIS has been prepared in accordance with the National Environmental Policy Act of 1969, which requires an EIS for "major federal actions with the potential to significantly affect the environment." Council on Environmental Quality (CEQ) regulations implementing NEPA require that there be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process is termed "scoping."

1.5.1 Scope of Issues Addressed

The scoping process began with a review of existing documentation and interviews with military organizations regarding military activities and the existing environment in the Marianas. It included opportunities for the public to comment on the proposed action. The scoping process concluded with a review of issues to determine which were potentially significant and which were nonsignificant and/or otherwise outside the scope of this DEIS.

1.5.1.1 Public Involvement Process

In November 1995, a Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* (Appendix A-1); individual copies were mailed to Guam, CNMI, and federal agency officials, as well as to potentially concerned private parties (Appendix A-2). The public was invited to communicate concerns, issues, and alternatives at public scoping meetings conducted in December 1995; the meetings were announced in the *Pacific Daily News* (Appendix A-3). Sign-in sheets and an informal record of all public comments are included in Appendices A-4 and A-5, respectively. Written responses to the NOI are included in Appendix A-6. A list of agencies, organizations, and persons to whom copies of the DEIS have been sent is included in Appendix A-7. Agency comment letters to the DEIS are included in Appendix A-8, together with the Navy's responses to comments.

1.5.1.2 Issues Raised During Scoping

The primary issues raised by citizens and public agencies were impacts on endangered species—particularly the impact on endangered species caused by the accidental export of brown tree snakes from Guam—and safety issues related to live fire, demolition, and aviation training. On all islands, questions were raised concerning the timeframe and range of training covered by the EIS. There was some concern that any training not included in the EIS would be "covered up" and not properly assessed for impacts. Better protocols for communicating with civilian authorities prior to exercises were requested, particularly in regard to air traffic and natural resource impacts.

On Guam, there were also comments on possible future civilian or Government of Guam (GovGuam) reuse of military-owned lands, and questions regarding the need to train in the Marianas at all or on Guam and Rota in particular. Issues raised on Rota included the need to train on Rota, impacts on endangered wildlife species, and requests for civic works projects by visiting military units. Comments on Tinian also included requests for civic works projects, as well as questions regarding use of public beaches, a request for a new landfill, access to historic sites in the EMUA, maintenance of cultural resources in the EMUA, and more economic benefits to Tinian from exercises.

1.5.1.3 Screening Process and Issues Discarded From Detailed Consideration

Issues raised during scoping were evaluated for relevance to the proposed action and, if deemed relevant, for significance.

Several issues raised during scoping were not directly related to the proposed action and were therefore eliminated from detailed consideration in this DEIS. Specific reasons are as follows:

Issue: Need for mitigation measures to accommodate future civilian reuse of military lands on Guam.

Reason eliminated: The issue of civilian reuse is addressed in documentation relating to GLUP 94 and BRAC 95 and is not within the scope of this DEIS for training. However, it is in the best interests of the DoD to avoid adversely impacting training lands, and this document identifies numerous mitigation measures intended to prevent or limit such irreversible effects or any other significant permanent damage to military lands.

Issue: Socioeconomic impact of BRAC 95.

Reason eliminated: The release of lands on Guam under the auspices of BRAC 95 is not part of the proposed action; therefore, the impact of such releases (e.g., job loss) is not within the scope of this document. With the exception of the positive impact of increased work for shipping companies in association with transporting materiel to and from Tinian, the proposed action is not expected to have any socioeconomic impacts on Guam. The proposed action identifies training internal to the military and occurring on lands already controlled by the military. It will not create or decrease jobs, reduce land available for civilian activities, affect housing availability, or generate fiscal impacts on the Government of Guam.

Issue: Cleanup of training areas.

Reason eliminated: Both the Air Force and the Navy have site investigation and cleanup programs in place to address and implement cleanup of military facilities. All military lands proposed for training are currently under investigation for potential contamination and/or undergoing site remediation. Other than mitigation proposed to avoid future adverse impact, the issue of military land cleanup is not within the scope of this DEIS.

Issue: Examine graving dock in Apra Harbor as alternative area for demolition training.

Reason eliminated: The graving dock is located in an active industrial area incompatible with live demolition training. As the dock is now closed off from the harbor, it does not provide the underwater access required by training personnel. In addition, the space is too small for safe training with the 20-pound charges now used by EOD in Apra Harbor.

Issue: Risk assessment for brown tree snake introduction to Rota as a result of proposed SEAL activities.

Reason eliminated: This DEIS assumes there is high risk of brown tree snake (BTS) import during any transport of equipment from Guam to another island. Therefore, units leaving Guam for Rota (including the SEALs) undergo BTS inspections in compliance with the October 1996 *Brown Tree Snake Control/Interdiction Plan for Military Training Exercises* discussed in Chapters Three and Four of this DEIS. No preliminary risk assessment will be necessary.

Issue: Need to have more civic works projects, restore the veterans memorial park on Rota, build a road around Rota, and provide MEDEVAC service on Tinian.

Reason eliminated: Many individual units will arrange for civic works projects in association with training on Rota and Tinian. However, such projects will be performed at the discretion of the units and are not required for training. Therefore, such projects are not part of the proposed action and do not fall within the scope of this document.

Issue: Develop RCRA-approved landfill on Tinian, preferably in the EMUA.

Reason eliminated: Construction and operation of a RCRA-approved landfill is a substantial and costly undertaking, involving significant potential liability on the part of the landfill owner/operator. The military has no need for a landfill on Tinian, and construction would require a separate EIS document under NEPA. However, solid waste management in general is an issue examined in this DEIS.

Issue: Clean up Tinian's port facilities.

Reason eliminated: Tinian's port facility was turned over to civilians as part of the Lease Agreement signed in 1994. Training vessels using the port operate in compliance with federal regulations prohibiting release of contaminants into the waters of the U.S. The existing condition of the port is outside the scope of this DEIS.

Issue: Involve Tinian businesses in federal bidding activities.

Reason eliminated: Tinian businesses are welcome to compete for federal jobs advertised for bids. It is the responsibility of the businesses to obtain newspapers or other publications providing notice of such jobs. Government entities are strictly prohibited from giving preferential treatment to particular enterprises in the procurement process without specific Congressional authorization.

Remaining issues were evaluated for significance, to determine the depth of analysis required for this DEIS.

1.5.2 Identification of Significant Issues

CEQ regulations provide that the following should be considered in determining whether an issue is significant under NEPA:

- Affects public health and safety
- Affects unique characteristics of a geographic area (historic/cultural resources, wetlands, ecologically critical areas, wild/scenic rivers, parks)
- Is highly controversial
- Involves highly uncertain, unique, or unknown risks
- Establishes a precedent
- Generates cumulatively significant effects
- Involves sites listed or with the potential to be listed on the National Register of Historic Places
- Affects plants or animals listed as threatened or endangered under the Endangered Species Act
- May violate laws or requirements imposed for protection of the environment

Table 1-3 summarizes the screening analysis and identifies the reasoning by which issues were determined to be significant or nonsignificant. Issues determined to be significant were studied in detail. They are identified below and their potential effects are discussed in detail in Chapter Four. Those issues and potential impacts identified as nonsignificant and readily mitigated have been considered and are itemized, but detailed analysis was deemed not necessary.

Eight potentially significant issues were identified during the scoping process. Some of these issues are common to all islands considered in this DEIS; other issues are particular to the island of Tinian, which has no permanently staffed military facilities. The significant issues and proposed mitigation measures are briefly identified in this section and are discussed in detail in Chapter Four.

Issue 1: Impacts on biological resources. Guam, Tinian, and Rota are home to a variety of threatened and endangered species, particularly native birds, migratory sea birds, and sea turtles. On Guam, accidental BTS importation has resulted in eradication of most native bird species. Prevention of BTS import from Guam to other islands of the CNMI or Hawaii during personnel or equipment transport is probably the most significant issue addressed in this DEIS. In addition, certain proposed training activities might result in an "accidental take" (including noise impacts) of an endangered or threatened bird, bat, or other listed animal. Finally, proposed amphibious vehicle landings have the potential to damage coral, which would be contacted by the vehicle's tracks in water less than 1.8 meters deep.

Issue 2: Preservation of cultural resources. Training sites on Guam and Tinian contain ancient Chamorro archaeological sites valuable for data collection and, in some cases, recommended for preservation. In addition, it is important to preserve the remains of World War II structures as part of local and world history. Proposed training activities include ground disturbance by vehicles and other activities which have the potential to result in loss of data and defacement or destruction of resources.

Issue 3: Wastewater disposal on Tinian. Tinian currently has no large-scale civilian or military wastewater treatment facility. Wastewater disposal is a major logistical component of large training exercises involving several hundred or more ground troops. Potential concerns are impacts of periodic wastewater disposal on existing municipal septic systems in San Jose, in addition to impacts on groundwater resources, air quality, and public health if wastewater is improperly disposed.

Issue 4: Solid and hazardous waste disposal on Tinian. Tinian has no EPA-approved solid waste landfill and no hazardous waste treatment capability. Training activities routinely generate varying amounts of solid waste (primarily cardboard and paper) and may generate very small amounts of hazardous waste and used oil. Waste will be backhauled to Guam for disposal at the Navy landfill at NAVACTS Waterfront Annex. Potential impacts include shortening the useful life of the Navy landfill, as well as impacts on groundwater resources, air quality, and public health if waste is not properly disposed.

Issue 5: Aviation safety. Ongoing and proposed new training activities include aviation operations with the potential to affect public safety. Fixed- and rotary-wing aircraft move in and out of military airfields and landing zones, as well as certain civilian airfields. Some military airfields are accessible to the public; others have approach or departure avenues with the potential to interfere with commercial aircraft. Finally, paradrops at an existing parachute drop zone relatively near to the civilian airfield on Tinian could interfere with civilian aircraft approach or departure.

Issue 6: Firing range safety. The proposed action includes installation or modification of several ranges to accommodate additional weaponry. Some of these ranges have the potential to introduce new impacts to public safety. The two ranges proposed for modification on Orote Point are accessible to the public, as would be the proposed range locations on Tinian. The safety fan for a proposed range at the Ordnance Annex includes part of a hiking trail, used by civilians for a traditional Easter celebration. The proposed mortar range on Tinian would generate an unexploded ordnance (UXO) hazard in an area potentially accessible by the public.

Issue 7: Socioeconomic impacts on Tinian. Tinian's relatively small population is isolated from economic opportunities available to Saipan residents. Training activities have the opportunity to provide economic benefit by generating purchase of local goods and services. Training activities also occasionally impact the cost and logistics of certain public services and facilities, such as firefighting capability, use of the airport and harbor,

and potable water supply. Exclusion of tours from sites in the EMUA would have a negative effect. One casino and hotel has opened and another is planned, and cumulative socioeconomic impacts may result from the combination of military training and large-scale tourism.

Issue 8: Socioeconomic impacts of Apra Harbor closures. Underwater demolition by EODMU-5 in Outer Apra Harbor requires certain areas of the harbor (including a number of popular dive sites) to be closed to civilian activities once a month for approximately four hours. This has the potential to cause loss of income to commercial boat and dive operators.

1.5.3 Impacts Mitigated to Nonsignificance by Existing Management Requirements

Military organizations are required to comply with existing federal environmental regulations and Executive Orders, as well as with military orders which specify detailed means to implement environmental management and protection measures. Compliance with military orders and with federal environmental regulations enables training units to routinely avoid many otherwise potentially adverse impacts. Therefore, because CEQ regulations direct that environmental analysis in an EIS focus on significant issues, such impacts are itemized but not analyzed in detail in this document.

The sections below review certain potential impacts which will be routinely mitigated (i.e., avoided) by adherence to existing orders and regulations. Chapter Two provides a detailed table of all potential impacts resulting from the proposed action, together with mitigation (including the routine management cited below). All mitigation specified in this DEIS will be written into standing orders regulating training on Guam and Tinian. Therefore, all proposed mitigation will be automatically implemented by units following training orders.

In addition to site-specific orders, all training units have organic orders and SOPs which regulate their activities and mitigate potential environmental impacts. These orders provide information and guidance for certain training activities and for training at specific locations, including notifications, pollution prevention, supply and logistics constraints, waste management procedures, and spill prevention for petroleum products and hazardous substances. Specific impacts to be mitigated by compliance with existing orders and regulations are discussed in the following sections.

1.5.3.1 Surface Water Quality

Training units and facility training orders specify measures to prevent contamination of surface waters and groundwater by discharges produced by training personnel. The

measures apply to mess and medical facilities, field sanitation, and vehicle fueling, maintenance, and repair. The following preventive measures are specified:

- Containment berms, pans, or liners will be used during all activities involving POL transfer or replacement.
- Mess facilities will direct all wastewater through a grease trap prior to discharge to the soil or will use tray-packs, which do not generate any cooking waste.
- Medical waste will be contained and disposed of at an appropriate, licensed facility.
- Ships engaged in training activities will not discharge solid waste within 25 nautical miles (nm) of any island and will use all available means to cause unprocessed garbage to sink as rapidly as possible.
- All construction performed by the Seabees will include erosion controls to prevent sediment runoff into surface waters.

1.5.3.2 Range Safety

Site-specific impacts may be significant and are addressed in Chapter Four. Obvious hazards associated with live-fire ranges will be managed in accordance with established range practices. Each range has an associated surface danger zone (SDZ) in which activities are stringently restricted. In cases in which SDZs extend into areas accessible by the public (including fishing vessels and aircraft), public notices are published (notices to airmen [NOTAMS] and notices to mariners [NOTMARS]). In addition, SDZs are guarded and access is prohibited; each SDZ is surveyed and cleared of personnel and endangered marine animals (where relevant) prior to use.

Approval. In addition to a training range being environmentally sound, it must be safe. Range design and siting must be approved by the Navy, and all protective, mitigation measures must be in place prior to obtaining permission to activate the range from the Chief of Naval Operations (CNO) and the Commander, Naval Facilities Engineering Command (NAVFAC). A primary operating requirement is absolute control by the Range Safety Officer of the area comprising the SDZ both over land and water. Visual markers, safety observers, and communications measures are integrated to allow the Range Safety Officer to immediately curtail training if an unsafe condition exists.

Regulations. Potential impacts caused by weapons and demolition training are managed by SOPs and area-specific constraints. Safety criteria and related operational/training procedures are published by the responsible government agencies. These criteria and military SOPs mitigate most potential impacts of live-fire activities. Site-specific range regulations define range boundaries, firing lines and SDZs, permissible live fire training activities, required supervision and observation on the range and within the surrounding area, and necessary logistic support such as medical and firefighting response.

Range regulations are published and distributed to all units requesting the use of training areas and live-fire ranges in the Marianas. Prior to live fire training, the designated officers-in-charge and range safety officers are required to demonstrate knowledge of range regulations and restrictions.

Notifications. FAA and USCG regulations define required NOTAM and NOTMAR publication and notice procedures, to warn the public to avoid certain areas at published times. NOTMARs are broadcast on marine bands by the USCG (and CNMI Emergency Management Office for FDM) in advance of any training activity. COMNAVMARIANAS and AAFB are responsible for public announcements for newspaper, radio, and television dissemination as needed.

Warning signs and observation. To ensure tourist and resident safety within training areas that are accessible to the public, military traffic control and range safety observation posts (including oversight of SDZs) are established, with positive communication to officers-in-charge of training and range safety personnel. Warning signs are posted to warn those approaching an SDZ and training range area on foot, in vehicles, and in water craft. When necessary, roadblocks and sentries are used to ensure traffic is delayed as necessary. Gates, range flags and sentry posts are established as necessary to provide security at ranges and SDZs.

Weapons activity with the potential to interfere with civilian aviation is required to occur within a defined Controlled Firing Area and to meet other requirements of FAA Order 7400.2D.

1.5.3.3 Electromagnetic Radiation

Zones of electromagnetic radiation (EMR) are generally found around transmitting antennas where high density electromagnetic fields may pose a hazard to personnel, ordnance, or fuel operations (HERP, HERO, and HERF, respectively), or where such fields may interfere with aviation electronics equipment. Each piece of equipment has a known hazard radius, and all portable transmitters will be sited to avoid such hazards. All field military communications equipment have been tested for HERP, HERF, and HERO and are operated only in modes that do not present a hazard. Standard communications equipment is operated in an authorized manner in frequency bands assigned for use in accordance with Federal Communication Commission (FCC) and military policy. During transmission periods, personnel manning the vehicles monitor the equipment and the surrounding area to ensure that no one comes within hazardous range. These transmissions are not known to be of sufficient strength to pose a hazard to wildlife.

1.5.3.4 Aviation Safety

The FAA requires that it be notified of military aircraft and weapons fire with the potential to interfere with civilian air traffic. All military aircraft approaching, departing, or operating at Tinian notify the FAA in Guam and Saipan 72 hours prior to any exercise.

Aircraft using established runways and LZs on Guam follow site-specific notification procedures and respond to all control tower orders.

1.5.3.5 Hazardous Materials/Hazardous Waste Management

All military units follow unit- and site-specific SOPs regarding hazardous materials and hazardous waste (HM/HW) management. These SOPs directly comply with federal regulations, including the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), the Superfund Amendment and Reauthorization Act (SARA), the Toxic Substances Control Act (TSCA), the Clean Air Act (CAA), Department of Transportation (DOT) regulations covering transport of HM/HW, and territorial and commonwealth regulations on HM/HW management.

1.5.3.6 Construction Management Practices

No proposed construction is approved and initiated without complying with standard site management practices to prevent sediment runoff, fugitive dust, and erosion.

1.6 GOVERNMENT PERMITS AND APPROVALS

As part of the EIS process, consultations have been initiated with various government agencies to obtain their concurrence with the preferred alternative. The agencies may request modifications to the proposed action or proposed mitigation before providing their concurrence. The following approvals are required:

Section 106 consultation. The National Historic Preservation Act requires consultation with the Guam and CNMI Historic Preservation Officers (HPOs) because the proposed action involves sites listed or eligible to be listed on the National Register of Historic Places. Consultation will be formally initiated upon publication of this revised DEIS. The final EIS (FEIS) will include the HPOs' concurrence that the proposed action will not adversely affect sites determined to be eligible for listing under National Register criteria.

Section 7 consultation. The Endangered Species Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) because the proposed action will occur at locations inhabited by endangered plant and animal species. Consultation will be formally initiated upon publication of this revised DEIS. The FEIS will include USFWS and NMFS concurrence that the proposed action will not adversely impact plants or animals listed as threatened or endangered under the Act.

CZM consistency determinations. The Coastal Zone Management (CZM) Act requires a determination that the proposed action is consistent with local CZM programs, which regulate nonpoint source pollution and protect coastal resources. On Guam, CZM is administered by the Bureau of Planning; in the CNMI, CZM is administered by the

Office of Coastal Resources Management. A consistency determination will be formally initiated upon publication of this revised DEIS. The FEIS will include concurrence by these agencies that the proposed action is consistent with their programs.

Land use and policies. The majority of lands to be affected by the proposed action are owned or leased by the DoD for the purpose of military training and associated activities. Therefore, the proposed training activities on military-controlled lands are not inconsistent with federal or local land-use planning and policy. Real estate agreements are generally required to authorize training when one DoD component uses the land and/or facilities of another DoD component, federal agency, local government agency, or a private owner. Such agreements are currently in place for all locations proposed for training.

Other permits and approvals are identified in the appropriate sections in Chapter Four and in related tables and appendices.

1.7 DOCUMENT ORGANIZATION

This document is necessarily streamlined, as it covers information and analysis of the effects of a large number of training activities on nine military land parcels and several non-military-controlled areas on four islands in two political jurisdictions.

Chapter One explains why the proposed action is needed. It documents the scoping process, including issues raised during scoping and those issues eliminated from detailed consideration. This chapter uses criteria defined in CEQ regulations to identify significant issues for detailed evaluation as part of the EIS process. It also identifies those potential impacts which will be routinely avoided by compliance with existing regulations and standing operating procedures (SOPs).

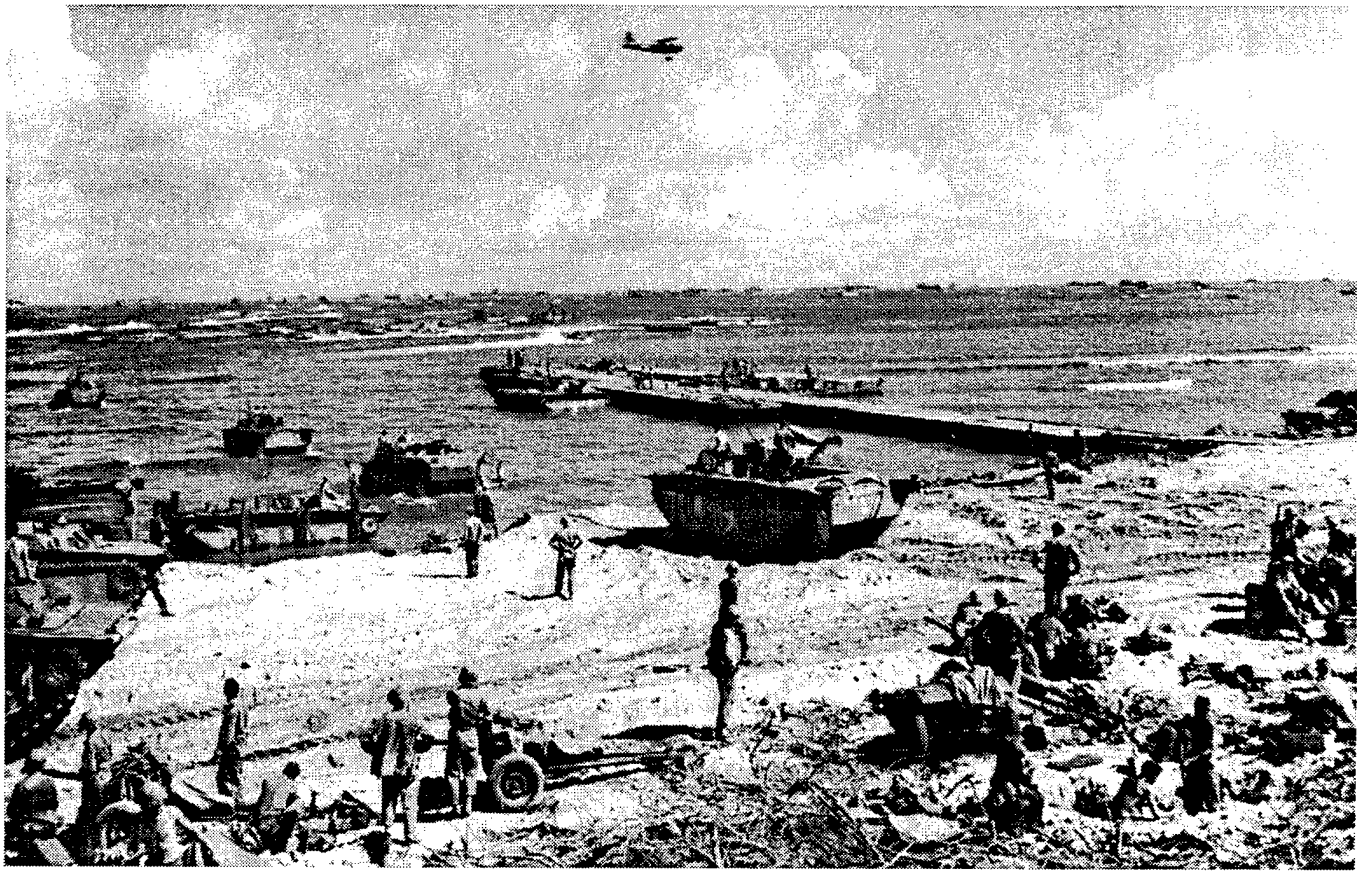
Chapter Two details the proposed land areas and training activities and defines the proposed action and alternatives. It compares the alternatives in terms of (1) the extent to which they meet the purpose and need for the proposed action, and (2) their overall potential to adversely impact the environment. The Preferred Alternative is identified. Chapter Two concludes with a table of all potential impacts and associated mitigation measures and responsible parties, detailing both significant issues and those issues determined to be nonsignificant and therefore not evaluated in detail.

Chapter Three provides an overview of the affected environment on Guam and in the CNMI. It includes information on physical, biological, and cultural resources, as well as on socioeconomic conditions and existing infrastructure.

Chapter Four focuses on the significant issues identified during scoping. Each section includes data on existing conditions relevant to the issue, measurement criteria for evaluating potential impacts, proposed activities likely to generate significant impacts, and proposed mitigation for such impacts.

References contains the List of Preparers, Abbreviations, and Bibliography.

Figures and **tables** are grouped at the back of the document. Selected tables are also printed within the text of some chapters.





U.S. forces landing on Unai Chulu, Tinian in 1944 (National Archives at College Park)

CHAPTER TWO

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

2. PROPOSED ACTION AND ALTERNATIVES

This chapter describes a proposed set of land uses and land use alternatives to meet the military training requirements of Guam-based military forces and other military forces with regional responsibilities. For each land area proposed for use, this chapter identifies potential training activities and their impacts, compares alternatives, identifies the Preferred Alternative, and concludes with a matrix of potential impacts and proposed mitigation measures. The actions being evaluated are the uses of specific land areas for particular training purposes: field maneuver, aviation, amphibious landing, ground weapons with live fire, underwater demolitions, and naval gunfire/aerial bombardment. The range of alternatives for the proposed action include, for each land area being considered, greater or lesser intensities of training use, different types of training use, no new action, which is no new training uses, and no land use, which is not to use specific land areas for training.

2.1 OVERVIEW

2.1.1 Proposed Action: Use Existing DoD Lands for Training

To meet the range of training requirements, lands used for training must include large undeveloped areas, airfields, beaches, live-fire ranges, and underwater demolition sites. These features are collectively available on DoD-controlled lands on Tinian, Guam, and Farallon de Medinilla. In addition, selected training for small groups is proposed for non-DoD lands on Guam and Rota. Training lands on which multiple training scenarios can be employed are necessary to provide for the range of skills and capabilities of the assigned forces. Therefore, the proposed training sites are mutually supporting, providing complementary training venues which do not duplicate one another.

The proposed action is to use all suitable sites on DoD-controlled land areas in the Marianas for various military training activities. Figures 2-1 through 2-6 show all proposed training sites; activities proposed for each site are listed in Table 1-1. The uses proposed for most sites constitute a continuing action, that is, these sites have been used for the indicated training for some time in the past. These ongoing activities, are shown in black on the figures. A few activities have not previously occurred in the proposed sites; these are shown in green and red on the figures. The Preferred Alternative is to use each land area for the activities labeled in black and green. The activities labeled in red have been proposed but are not included in the Preferred Alternative.

2.1.2 Range of Alternatives

Reasonable alternative land uses to accomplish the purpose and need for military training in the Marianas area include *more, less,* and *no* use of DoD-controlled areas for training, greater or lesser intensity of training on each proposed area, and various types of training proposed on each training area. Because of the large number of training activities required (more than 150) and the eight training locations considered, there is a continuum of almost infinite action alternatives. For the purposes of this EIS, which is largely for continuing actions, the range of alternatives considered is as follows (in order of increasing land use):

- **No Land Use/Reduced Land Use:** Not using all or part of a land area for a given activity or category of activities
- **No New Action** (continuing action)**:** Continuation of (i.e., no changes to) ongoing land use for training
- **Preferred Alternative**: Continuing land use plus several new training land uses
- **Not-preferred Action Alternatives:** This collection of alternatives includes ongoing land use, plus land use for training activities which were proposed by operators but are not included in the Preferred Alternative (usually because of significant impacts which cannot be mitigated to nonsignificance)

The No Land Use/Reduced Land Use Alternative does not comprise "no action" because "no action" represents the existing condition and existing training uses of a particular area. To have No Land Use for training would be an action with substantial negative effects, some of which cumulatively or indirectly would have significant impacts on the human environment including national defense.

Reduced Land Use is, in effect, the preferred action alternative proposed. Reduced or compatible land use alternatives insure that training is confined to land areas with minimal or no significant impact after mitigation. Reduced land use includes those preferred action alternative land uses previously open to training without substantial restrictions but now to be used for training subject to the proposed mitigation restrictions.

Alternative training locations outside the Marianas were discussed in Chapter One. These locations are not alternatives to use of training areas in the Marianas for accomplishing the necessary training activities. Therefore, the range of alternatives evaluated in this chapter consider only locations within the Territory of Guam and the CNMI.

2.1.3 Chapter Organization

The action being analyzed is the use of specific land areas for specific training activities. For each DoD land area, this chapter describes existing resources, training activities feasible in that area, particular sites for particular activities, and a summary of site-specific potential impacts including cumulative impacts in each of the following sections:

2.2 **Military Lease Area, Tinian**: field maneuvers, aviation, amphibious landings, live fire ranges, and cumulative impacts on Tinian
2.3 **Waterfront Annex:** field maneuvers, aviation, amphibious landings, underwater demolitions, live fire ranges, and cumulative impacts on Waterfront Annex
2.4 **Ordnance Annex:** field maneuvers, aviation, live fire ranges, and cumulative impacts on Ordnance Annex
2.5 **AAFB and Communications Annexes:** field maneuvers, aviation, live fire ranges, and cumulative impacts
2.6 **Farallon de Medinilla:** naval gunfire, aerial bombardment, and cumulative impacts
2.7 **Non-DoD Lands:** Guam, Rota
2.8 **Comparison of Alternatives:** compares alternatives for each site, summary of impacts and mitigation

2.2 PROPOSED USE OF MILITARY LEASE AREA, TINIAN

Land resources. The MLA consists of the 30 km^2 Exclusive Military Use Area (EMUA) and the 37 km^2 Leaseback Area (LBA), both undeveloped with the exception of World War II-era historic structures. Most of the MLA is forested with tangantangan, except areas previously grazed by cattle. The island's central plateau in the LBA drops over several clifflines to the northern lowlands of the EMUA. The area is crossed by a handful of old paved roads, with a variety of smaller coral roads largely overgrown by vegetation.

The EMUA is currently used for military training, and is also a historic landmark and civilian recreational resource . Access to the EMUA is not controlled by fencing or gates. Under mitigation agreements associated with previous NEPA documentation,[1] certain training activities are limited in approximately 40 percent of the EMUA, which contains historically significant Chamorro and World War II-era resources. North Field, in the EMUA, is a National Historic Landmark. Tourists regularly visit the World War II sites, as well as beaches, a blowhole, and several shrines in the EMUA.

The LBA is an area which may be used for training but which has been leased back to the CNMI government for compatible economic agricultural use.

Training considered on Tinian. The MLA contains undeveloped land suitable for relatively large field exercises, two airfields appropriate for a variety of aviation training, a surveyed parachute drop zone (DZ), and beaches which were American WW II amphibious landing sites and are suitable for modern amphibious training. Tinian is the only location in the Marianas suitable for large-scale amphibious assaults and joint training exercises. It is currently used for field maneuvers, aviation training, and certain amphibious landings (see black-labeled activities

[1] Belt Collins & Associates (June 23, 1993) *Environmental Assessment: Military Exercises, Island of Tinian, Commonwealth of the Northern Mariana Islands.* Prepared for the Commander, Pacific Division, Naval Facilities Engineering Command; and Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.* Prepared for Commander, Pacific Division, Naval Facilities Engineering Command.

on Figure 2-1). This DEIS proposes one or more sites in the MLA for the following new training and related activities:

- Live-fire training (small arms range, mortar range, shooting house, breaching house)
- Assault amphibian vehicle (AAV) landings
- Construction of a small logistic support base camp (e.g., vehicle and materiel storage, restrooms and showers, fuel stands)
- Construction of EMUA access gates on Broadway and Eighth Avenue

These proposed new training activities and sites are shown in green and red on Figures 2-1a and 2-1b. The Preferred Alternative for Tinian is to allow all activities except the mortar range and certain amphibious vehicle landings. Activities shown in red were proposed but are not included in the Preferred Alternative, on the basis of environmental analysis in Chapter Four. These activities are discussed in Sections 2.2.1 through 2.2.5.

2.2.1 Field Maneuvers and Logistics Support

Field maneuvers and logistics support are defined here as all general military training that occurs on land, with the exception of live weapons fire and aviation-related activities. It includes tactical maneuvers on foot, travel in wheeled and tracked vehicles, use of signals and flares, special operations by small groups of clandestine raiders, and miscellaneous other activities such as security and dog training. Extended field maneuvers require bivouac training and some small-scale site development (excavation and temporary construction), as well as logistics support transportation of materiel by land, sea, and air, equipment maintenance, and quarantine services.

2.2.1.1 Description of Field Maneuver Training Proposed for Tinian

This training ranges from basic land navigation and cross-country movement skills for individuals (use of a map, compass, and Global Positioning System [GPS]) through exercises for up to 1,000 or more participants combining many offensive and defensive maneuvers and logistics support. The training group could be a fire team of 1 to 4 persons, a 12- to 16-man patrol, a 130-person infantry company, 560-person battalion, or 2,000-person reinforced brigade. Large-scale training may occur several times a year, whereas exercises training individuals or small units may occur on a daily, weekly, or monthly basis. The maximum training event duration would be a large-scale exercise lasting several weeks and combining many activities. Most of this training already occurs on Tinian.

Action photographs and technical information on field maneuvers are provided in Appendix B-1 and B-2. Typical training unit sizes and training frequencies and photographic examples are provided in Table 1-1.

Field maneuvers commence with the introduction of forces (bringing in troops) either directly into the EMUA or via West Tinian Airport or San Jose Harbor. Troops brought in at the airport and harbor would conduct a "movement to contact" through the MLA—tactically moving north

by vehicle or on foot to make contact with a deployed "enemy" force in the EMUA. Field maneuvers in the EMUA may consist of initial probes by patrols, followed by raids and assaults by larger units on foot or transported by tracked or wheeled vehicles and helicopters. The defenders may employ similar tactics to retain or to give ground slowly. Small arms and mortars use blank ammunition only; signal flares and smoke can be used to coordinate troop movement or to call in tactical air support. Reinforcements can be introduced into the North Field area by amphibious craft, fixed wing aircraft, and helicopter.

Both offensive and defensive forces may require some **site development**, which would require digging with hand tools, mounding dirt at firing positions, selectively cutting vegetation for camouflage, some small-scale carpentry, use of concertina wire, and mounting camouflage nets.

Certain maneuvers require specific geographic features:

- **Airfield seizure and defense** is practiced on both active and abandoned airstrips. Rapid runway repair (RRR) is practiced by filling and compacting shallow holes in the existing runways.
- Use of the harbor, as well as West Field, as ports of entry for troops, vehicles, and equipment provides realistic challenges for **logistic support** personnel. Military activities must be integrated with ongoing commercial port operations. Staging, maintaining, and inspecting equipment and cargo in transit is critical ensuring that quarantine of brown tree snakes (BTS) and other noxious species is effective.
- **Training in an urban environment** (TRUE) requires one or more buildings for certain special operations training activities such as clandestine reconnaissance and raids, *in extremis* hostage rescues, and noncombatant evacuations.

During field maneuvers, combat service support units establish logistic support bases and camps (**bivouacs**) for housing, feeding, and supporting the exercise force. Bivouac activities include food preparation (heating prepacked meals), gray water disposal, field sanitation (portable toilets, on Tinian), water purification, field medical and dental support, and solid waste disposal, as well as blank ammunition storage and issue.

Because there is no permanent military facility and no personnel stationed on Tinian, the proposed action for Tinian includes **construction of a small, permanent logistic support camp** for use by training units. Alternative locations are at the two main roadway entrances to the EMUA. One of the two locations is within the site assigned to the Voice of America (VOA) program for a transmitting station. The camp would be manned only during exercises and would be available to training units as a command and control, or logistics support center. It would include showers, toilets, a septic tank and leaching field system, a gasoline and diesel fuel stand with aboveground fuel tanks, a small electrical generator, and utilities. The camp would be surrounded by a chain-link security fence.

Construction of permanent security gates is proposed for the entrances to the EMUA on Broadway, Eighth Avenue, and Ninth Avenue. The gates would remain open except during

training in the EMUA was in use for training in which public safety would be compromised by allowing uncontrolled access.

Impacts and mitigation. BTS import from Guam during cargo transport would be a significant impact. Mitigation consists of implementing exercise-specific BTS control plans, in accordance with guidelines established in the *Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises* (see Section 4.1).

Personnel on foot do not, in general, significantly impact the environment. Vehicles traveling off-road may disturb or destroy cultural resources, ground-living endangered species, or habitat. Bivouac activities may disturb cultural resources, harm endangered species or habitat (primarily through the possibility of fire), and affect local water resources. Logistics support exercises may disturb the ground surface or generate noise which disturbs protected species. Mitigation of these activities consists of avoiding disturbing activities in areas known to contain endangered species or significant cultural resources (see Sections 2.8 and 4.2 for details). Pyrotechnics and flares may cause fires. Mitigation includes possession of appropriate fire response capabilities by training units.

Increased exercise tempo would reduce the availability of EMUA visitor resources, which could effect tour operators. Mitigation by advance coordination of training activities to minimize the events for which closure is required and to allow tour operators to make alternative plans.

2.2.1.2 Feasible Field and Logistics Training Sites on Tinian

Tactical maneuvers are, by their nature, not site-specific and currently occur throughout much of the EMUA and Lease-back Area. This DEIS does not propose any new sites for field maneuvers or logistics support training on Tinian. Site development only occurs at designated bivouac areas (see Figure 2-1a); pyrotechnics and flares are used only on paved areas within the EMUA.[2] North Field's four runways, associated taxiways, and parking aprons that support a variety of tactical scenarios without interfering with commercial aviation. Logistics support activities currently occur at the two public ports of entry, West Tinian Airport and San Jose Harbor, as well as within cleared areas of the EMUA. The size of the EMUA and its associated remaining World War II structures provide the structural components for TRUE training without direct involvement of an urban setting.

2.2.2 Aviation Training on Tinian

Aviation units train to deliver personnel and cargo to a combat area and to provide various support functions to forces already on the ground, such as close air support, cargo delivery, fire fighting, and search-and-rescue.

[2] See mitigation measures proposed in the 1993 and 1995 Environmental Assessments for Tandem Thrust exercises on Tinian (Belt Collins & Associates 1993 & 1994), most of which are replicated in this DEIS.

2.2.2.1 Description of Training Proposed for Tinian

Aviation training involves both aircrew and supported ground units, to integrate their capabilities and functions in a three-dimensional battlefield. Field maneuver training areas need adjacent landing fields or surveyed helicopter landing zones (LZs) and parachute drop zones (DZs) to support integrated training. Aviation training other than CAS is categorized either as "airmobile" (the aircraft lands on the ground to deliver something or someone) or "airborne" (the aircraft does not land but provides parachute air delivery). Both fixed-wing and rotary-wing aircraft train at and near Tinian.

Aviation photographs and technical information are provided in Appendix B-3 and B-4. Frequency and duration of training are included in Table 1-1.

AIRMOBILE TRAINING

Fixed- and rotary-wing aircraft are used to transport ground forces, vehicles, and cargo to North Field Runway #1 and West Tinian Airport. Training consists of staging, takeoffs, landings, and offloads.

- Strategic and tactical lift is provided by the USAF using three cargo and two refueling aircraft deploying to and from AAFB. The C-141B Starlifter is the workhorse of the Air Mobility Command, designed to **airlift combat forces and equipment over large distances** (e.g., to resupply employed forces, and to extract the wounded and sick. The C-141 can lift about 200 troops, or 103 litter patients. A payload as large as 41,400 kg is possible. For airmobile cargo delivery, a load of 30,600-kg can be palletized for rapid offload by forklifts. The cargo bay is large enough for wheeled and small tracked vehicles, or helicopters (with folded or removed blades).
- A strategic airlift partner to the C-141 is the C-5A/B Galaxy which is designed to **carry larger, heavier cargo loads and up to 73 equipment operators and crews**. This is one of the world's largest aircraft, configured to transport the 74-ton M1A1 Main Battle Tank, scissors bridge, or various helicopters. Its maximum payload is 92,207 kg.
- The C-17 Globemaster III is the latest addition to the strategic lift inventory with a payload capacity of **59,020-kg, 102 troops, or 48 litter and 54 ambulatory patients** and attendants. All of these cargo aircraft can be refueled in flight by either the KC-10A Extender or KC-135 Stratotanker, military variants of the DC-10 and Boeing-707, respectively.
- The four turbo-prop USAF MC-130E/H Combat Talon (USMC KC-130 Hercules) is designed to **operate from unimproved, shorter runways** than those required by the C-141. Its carrying capacity is smaller: 92 combat-equipped troops or 74 litter patients. It too is designed for carrying pallet-loaded cargo.
- The USMC CH-53E Super Stallion helicopter is used to carry up to 37 passengers (up to 55 if center seats are installed). This helicopter is often used to **deliver combat equipment externally**. The CH-53E can haul a 7,264-kilogram M198 Howitzer, or a

11,804-kilogram Light Armored Vehicle (LAV) from ship-to-shore. The CH-53E can also be used to **lift a downed aircraft** up to CH-53 size/weight.

- The Navy and Marine Corps medium-lift CH46-E Sea Knight helicopter delivers ground forces to North Field and West Tinian Airport. A maximum of 14 combat-equipped troops can be lifted. Supply and equipment delivery is a secondary mission. Primary missions include **combat and assault support, search and rescue, FARP support, and medical evacuation**, all of which can be practiced on Tinian as part of airmobile (and airborne) operations.

  The CH-46E will be replaced by a tilt-rotor aircraft in a few years. The MV-22 Osprey is designed with a tilting wing with two large propellers at each end that are tilted up for vertical takeoff and landing, and may be rotated forward to transition to conventional fixed-wing aircraft flight. The aircraft will require no landing strip, but will use landing zones and landing decks designed for helicopter activity. It will achieve forward air speeds that are twice as fast as the CH-46 E (270 knots vice 130 knots) and provide 50 percent more payload. Troop seating capacity will be 24. Similar models of the MV-22 may also be adopted by the U.S. Navy and USAF.

AIRBORNE TRAINING

All of the aircraft noted above have the capability to **airdrop personnel and equipment** when runways and LZs are not available.

- **Cargo drops** of palletized vehicles and equipment from low and high altitudes are conducted using C-130 and C-141 aircraft. USAF low-altitude cargo delivery training using a Container Delivery System (CDS) is conducted at North Field Runway #1. USAF Combat Control Team (CCT) training is included, providing communication and coordination between airborne operations and the FAA.
- **Parachute operations** are conducted by the USAF, U.S. Army, USN, and USMC using fixed- and rotary-wing aircraft. Paradrops can be made from various altitudes and distances from designated DZs. Training activities may involve small to large organizations based on the size of the drop zone and the number of aircraft in support. A C-141 can carry 155, the C-17 102, and the C-130 64 parachutists.[3] Examples of Marianas training range from a large strategic airlift of 600 US Army soldiers from Alaska in six C-141s to insertions of smaller groups of special operations forces. Army helicopters can be used after being transported to the Marianas by strategic airlift.
- Large and small groups may perform **static-line jumps** from low-altitude aircraft approximately 300 to 350 m above ground surface). The aircraft makes one or more passes fairly directly over the DZ; jumpers exit the aircraft wearing round canopy parachutes which open as jumpers leave the aircraft.
- Small groups of parachute-qualified special operations personnel may conduct **high-altitude operations** from fixed-wing aircraft. Jumpers are equipped with steerable

[3] One-third of all airdrops during Desert Storm were conducted by USAF MC-130Es.

canopies which they deploy at high (>1,200 m) or low altitudes (high altitude, high opening [HAHO] or high altitude, low opening [HALO], respectively). Most HAHO and HALO operations commence at 3,000 to 6,000 m and allow clandestine entry of an area, as personnel exit the aircraft at a long distance from the target DZ. For HAHO operations, jumpers open parachutes 600 m below the aircraft and glide up to 40 km, arriving silently with no associated aircraft noise. HALO jumpers freefall to within 1,200 m of the ground, then open their parachutes and steer silently to the DZ.

OTHER AVIATION TRAINING

Airmobile and airborne training often includes simulated close air support (CAS) to the forces being landed or airdropped. Various **fighter and attack aircraft** fly simulated missions, attacking "enemy" positions to provide cover for ground traps. These aircraft are high speed and fly relatively close to the ground. Example aircraft include the Navy's F-14 Tomcat and the F/A-18 Hornet and the Marine Corps' AV-8B Harrier and AH-1W Super Cobra helicopter gunship. USAF assets in the Marianas may include transient squadrons of F-15E Strike Eagle and F-16 Fighting Falcons, and AC-130H Spectre gunships.

Helicopter insertion and extraction. Small tactical units exit a hovering helicopter in a rapid descent by rappelling or using a fastrope. An additional method of rapid troop insertion and extraction uses the special purpose insertion and extraction (SPIE) rig—a suspended rope with hookups for four to five soldiers/marines. They are not winched into the helicopter; instead, the troops are quickly transported away while remaining suspended below the helicopter. These systems eliminate the need for large LZs and are suitable for tactical situations requiring surprise and speed.

Helicopter night-flying support missions using special **night vision goggles** (NVG) must be practiced in remote airfields with little or no ambient light. The training involves flying multiple circular or oblong patterns in the vicinity of the designated airfield. Helicopters circle the airfield, land or hover briefly, and repeat the loop at low altitude. The training can only occur on moonless nights (about 8 nights per month) and takes place from one hour after sundown to 10:00 PM.

Firefighting. Helicopters may carry external water containers offshore to load with water and back to empty overland for firefighting. On Tinian, this activity is not a routine training activity, but is available as needed to provide firefighting support to large exercises.

Aviation support includes **forward area refueling** (FARP) training, employing fuel bladders transported by helicopter for fixed-wing, helicopter, or ground vehicle refueling. Personnel construct fuel bladder support structures (earthen berms) to establish temporary refueling stations at airfields and LZs.

Impacts and mitigation. Air traffic management is made more complex by adding military aircraft and parachutists to the mix of large and small commercial aircraft using Saipan and West Tinian airports. Safety impacts will be mitigated by implementing routine notification procedures, including notification of local authorities on both islands and by real-time

coordination using common air-control frequencies. Fires caused by aircraft accidents could cause personal injury and destroy vegetation. Fuel spills and fire could occur at FARP sites. SOPs for FARP operations include spill containment and emergency response measures. For larger exercises, crash-fire-rescue equipment is stationed near flight lines.

Since the EMUA and MLA are accessible by the public, injury could occur to nontraining personnel entering aviation training areas. Barricades and sentries are used to isolate training areas from civilian access when hazards may be present.

2.2.2.2 Feasible Aviation Training Sites on Tinian

No new aviation training sites are proposed in this DEIS. Airmobile training has occurred for many years at North Field in the EMUA as well as at West Tinian Airport. Airborne training and CAS have occurred at North Field and at a designated DZ east of West Tinian Airport. Helicopter LZs are used on existing hardstands where clearance is adequate for safety.

2.2.3 Amphibious Landing Training on Tinian

Amphibious landings deliver troops and equipment from ship-to-shore for subsequent maneuver inland to seize combat objectives. Tracked amphibious vehicles deliver troops from offshore amphibious ships to the beach and continue inland under combat conditions. Large landing craft transport vehicles, equipment, and personnel from the ships for offloading on the beaches or shoreline. Small boats are used to land reconnaissance teams, SEALs, and special operations forces under cover of darkness.

2.2.3.1 Description of Amphibious Landing Training

Tinian is proposed to support amphibious landings of three major landing craft:

- Landing craft, air cushion (LCAC)
- Amphibian assault vehicle (AAV) and advanced AAV (AAAV)
- Landing craft, utility (LCU)

Landing craft photos and technical information are provided in Appendices B-5 through B-10. Training frequency and duration are included in Table 1-1.

LCAC landings. The LCAC is the largest landing craft in the inventory; it is designed to transport 63,500 kg at high speed. When at full speed, the LCAC rides above the water surface on an air "cushion" captured within an inflatable skirt that surrounds the craft. Fans beneath the craft create the pressure that lifts the LCAC off the surface of the water, creating the cushion of air between the hull bottom, water surface, and any underlying substrate (such as coral).[4] As the vehicle increases in speed, the depression diminishes until there is no bow wave, and the vehicle

[4] The water surface is depressed approximately 30-50 cm when establishing formal momentum, depending on the loaded weight of the vehicle. See Appendix B.

is said to be "on-cushion." At full speed, the water surface is depressed approximately 2 cm, depending on the loaded weight of the vehicle. At full stop in the water and no cushion, the craft's draft is about 0.85 meters.

An LCAC can cross the high-water line on-cushion and traverse relatively flat terrain before decreasing lift and coming to rest on the ground surface to offload cargo. As the craft lowers to the ground surface to rest on its skids, its cushion vanes close to prevent lift fan air from creating a deep depression in sand or light soil.

When the craft rises back up on the air cushion, the steady increase of lift fan air temporarily suspends sand and small objects in air, creating a leveled beach surface as the craft rises and moves away. Over land, there is a one- to three-cm hover gap between the ground surface and the skirt, allowing air to escape from the air chamber. Unlike a tracked or wheeled vehicle, an LCAC does not leave "tracks" or other indentations on a beach, although its cargo vehicles (i.e., trucks or tanks) may affect the beach surface or vegetation after departing the LCAC, with wheel and track ruts evident in soft sand.

Amphibious landing training starts at a ship offshore. The LCACs are pre-loaded with land vehicles, materiel, and personnel. The craft exit the ship's well deck, cross up to 25 km of ocean, and ride up on the shoreline to unload or to continue inland to a combat objective. LCACs return to the ship's well deck to take additional vehicles aboard for the trip to the beach.

Training consists of landing one to five LCACs (per wave) and offloading vehicles and personnel in support of combat operations. An LCAC can transport one tank or four AAVs at a time or, when properly configured with a large protective container, it can transport up to 250 persons. It may also transport a collection of smaller vehicles such as trucks or light armored vehicles (LAVs). Upon reaching the beach, transported vehicles drive off a ramp (either fore or aft) onto the beach and may proceed to adjacent maneuver areas.

LCU landings. The Landing Craft, Utility is a 42-m-long displacement hulled craft with a large open center bay and ramps for loading and unloading equipment fore and aft. With a draft of 2.1 meters when fully loaded, the LCU can move into relatively shallow waters, where it lowers a ramp onto the shoreline or a pier. For beach offloading, the LCU is beached at the bow, using a stern anchor if necessary to keep the craft perpendicular to the shoreline. An LCU can deliver artillery, a 5-ton truck prime mover, and combinations of smaller vehicles and trailers to a beach or pierside. It has the capacity to carry 400 persons. It is not landed at beaches protected by reefs, as the reef may damage the hull and precludes offloading vehicles.

Training consists of landing one to four LCUs and offloading carrying vehicles and equipment onto the beach.

AAV landings. An AAV is a lightly armored personnel carrier armed with a .50 caliber machine gun and 40mm grenade launcher (see photos and illustrations in Appendix B). It is propelled by water jets in the ocean and by track suspension in shallow water and on land. While an AAV is capable of climbing a wall up to one meter high, the preferred beach approach is on a less abrupt gradient, with tracks gradually coming into contact with the substrate at a depth of about 1.8 m.

On land, the AAV operates as a tracked motorized vehicle. Its rubber-padded tracks minimize road damage. In about five years, the AAV will be replaced with an advanced amphibious assault vehicle (AAAV) with beaching and land operation characteristics that are similar to the AAV. The major difference will be that the new vehicle will travel at much higher water speeds, and will launch from greater distance from the beach.

Training consists of a group of 12 to 15 AAVs approaching a landing area either side by side or one after the other. An AAV can carry up to 23 combat-equipped Marines or 4.5 metric tons of cargo from ship to shore. Upon reaching the beach, the Marines may or may not debark. The AAV is designed to cross beach obstacles and continue inland without pausing at the beach.

Boats and swimmers. Two types of inflatable boat are used to transport small groups to a beach or river bank, or offshore for swimming in to a beach. This training is often conducted prior to an amphibious assault for reconnaissance/information gathering by MEU personnel, SEALs, and Army special operations forces. The CRRC (combat rubber raider craft) is the military version of the Zodiac inflatable boat. It is pulled ashore and hidden near the beach. A larger craft used by the SEALs is the RHIB—rigid hull, inflatable boat—which may be used to drop swimmers offshore when a shallow reef prevents access to the beach.

Impacts and mitigation. Landing craft may damage coral, and a craft or its offloaded vehicles may damage archaeological resources or compact sand over sea turtle nests.

An LCU hull may compress the substrate surface, depending on the surface's density. Coral could be damaged by the craft's hull or by the stern anchor. However, areas with extensive coral outcroppings and unsuitable depths would not be selected for landing due to damage to the craft, and difficulty in offloading embarked troops and equipment.

LCACs are relatively noisy (similar to propeller-driven aircraft), and surface deposits (e.g., sand, small archaeological resources) under the fans are temporarily suspended in air. Offloaded wheeled or tracked vehicles can disturb surface materials as they travel inland from the beach. If only partially up on cushion, an LCAC may create a surge wave capable of breaking coral in shallow water. The only potentially significant impacts would be to reef in shallow waters or to archaeological resources or endangered species on the beach and in offroad areas traversed by the LCAC or offloaded vehicles.

The 25- to 30-ton tracked AAVs crush materials under their tracks and will significantly impact coral reef or cultural resources in their paths (damage by crushing). They may compress the sand over sea turtle nests and may leave tracks parallel to shorelines which baby turtles might find difficult to cross on their way to the ocean

Mitigation of impacts to coral consists of selecting beaches with no or limited coral at shallow depths, requiring LCACs to maintain full speed when over a shallow reef, and limiting AAV landings to a single approach lane at a single beach with the least good coral. Potential impacts to turtles will be mitigated by pre-exercise surveys to flag-off possible nest areas for avoidance. Areas with known cultural resources will be designated as areas where tracked and wheeled vehicles may not travel off-road.

2.2.3.2 Feasible Amphibious Landing Training Sites on Tinian

Nine Tinian beaches were surveyed for possible amphibious training, six in the EMUA plus Leprosarium, Kammer, and Tachogna beaches. Beach selection criteria were military control of the land, suitable ocean and beach characteristics for landing, and adjacent training land potential. Surveys provided information on:

- **Breakers, tides, and currents.** These determine whether swimmers and vehicles can safely transit the offshore area to reach the beach.
- **Beach width, depth, gradient, and trafficability.** This information determines which, if any, vehicles have room to land, turn, and offload on a beach. LCACs cannot climb over obstructions or land on beaches steeper than 6°. Some beaches are too soft to support wheeled vehicles without beach matting; others have too many obstructions such as large boulders, walls, or picnic pavilions.
- **Adjacent maneuver training and live-fire ranges.** The existence of adjacent maneuver and/or range training areas to support realistic amphibious assault scenarios, e.g., seizing an inland objective. Beaches with no adjacent maneuver or range area are suitable for administrative landings only.
- **Beach exits.** The existence of roads and trails suitable for vehicle and troop passage provides a means to protect strand vegetation and potential cultural sites from damage.

Most surveyed beaches are feasible for small-boat landings, depending on tide and surf conditions that will allow the craft or its delivered swimmers to approach and cross the beach safely. Hydrographic surveys conducted at each beach identified the landing craft or vehicle that was feasible at the time of the survey. The results are summarized in Table 2-1 together with key environmental resources present at each beach (see Chapter Four for details). Actual use of any of the beaches will require a pretraining hydrographic survey or surf report, since the characteristics of a beach can be changed drastically by major storms and heavy seas.

LCAC landing sites. The most feasible LCAC landing sites on Tinian are Unai Chulu and Unai Dankulo, which are currently used for LCAC landings (see Figure 2-1a). Kammer Beach is topographically excellent, but is limited because of picnic pavilions, sidewalks and fences. Tachogna Beach is also suitable and once was remote. However, nearby casino development could increase tourist use of Tachogna and impair convoy movement from the beach to the EMUA along public roads.

LCU landing sites. The only location suitable for an LCU is the concrete boat ramp in Tinian Harbor.

AAV landing sites. Tinian Harbor has a concrete boat ramp that is wide enough for AAV landings. The latter could move administratively through San Jose and use Broadway to enter the EMUA. Of the three beaches used for AAV landings during WWII, all are feasible but only one (Unai Babui) remains suitable for AAV landings without causing extensive damage to coral.

Small boat landing sites. Most beaches in the MLA are suitable for landing small boats and swimmers, except for Unai Chiget and Unai Masalok which have very powerful surf zones. Leprosarium and Kammer beaches are also suitable, but they do not provide access to inland maneuver areas.

2.2.4 Live Fire Ranges on Tinian

Weapons ranges are the only locations in which live ammunition may be used for training. Both ground and aviation units train on weapon simulators at their home bases, use blank ammunition during field exercises (see Section 2.2.1.1), and use live ammunition on known distance and fire-and-maneuver ranges located on military installations. All ranges must be surveyed and are certified for a limited set of weapons; different ranges accommodate different weapons, e.g., small arms (pistols, rifles, light machine guns), "crew-served" weapons (heavy machine guns and mortars), hand grenades, and demolition (see photographs and technical data in Appendices B-11 through B-15). All ranges have associated safety zones (Appendix B-14).

2.2.4.1 Description of Firing Ranges for Tinian

Weapons training is performed in a variety of settings, including use of simulators and use of blank ammunition during field training. Firing ranges and shooting houses are the only ground-based facilities on Tinian where live ammunition is or will be used.

- A small arms **firing range** is specifically designed for a certain size of weapon, to ensure that safety margins have adequate boundaries. Each range has a surface danger zone (SDZ) including areas for projectile dispersion and ricochet, plus an extra margin of safety (see Appendix B). A range is either "known distance" (shooting from a static position at a target) or "fire-and-maneuver" (moving among various shooting positions and firing at several targets). A fire-and-maneuver range has a wider safety fan, due to a greater range of permitted angles of fire. The former Tinian small arms range (closed for three years) was used for rifle, pistol, rifle grenade, and 60mm mortar firing. The proposed Tinian range would be restricted to 5.56mm and 7.62mm rifles, squad automatic weapons, and light machine guns. These weapons fire lead bullets cased in copper or plastic only, not exploding projectiles.
- A **mortar** range is specifically designed for training crews equipped with the 60mm or 81mm mortar. This range has designated firing positions and directions of fire, a SDZ, and additional safety distances. The crew is trained to receive an order to fire upon a specific location, calculate the necessary firing data, adjust the tube, prepare the ammunition, load, fire, and then adjust fire on target. Mortar rounds are exploding projectiles; some rounds may not explode upon impact, leaving unexploded ordnance (UXO) in the range area. As proposed for Tinian, a mortar range would be constructed to allow for a maximum range of 700-900 meters, which would cause the mortar round to climb to an elevation of about 1,930 m before falling to earth. High explosive rounds would be used for training.

- No specific range is required for training with a 60mm nonexplosive mortar round (to be available starting in 1998). This round (M766) is a reusable, flash-bang device that imitates the high-explosive round in size and performance, without the danger of explosion or duds. It is designed to be used safely in any open field. There is no danger of UXO, and training areas can be less than a football field in size, and used for purposes other than dedicated mortar training.
- A **shooting house** is designed so that bullets are absorbed by the walls and can neither ricochet nor exit the building. As an alternative, an existing building may be set up as a modified shooting house, with temporary, portable bullet traps mounted on the walls. Shooting houses are used by small groups of specially trained forces to simulate various close-quarters urban warfare activities (TRUE training), such as hostage rescue.
- A **breaching house** is designed for forcibly blowing in a door or window with a small (1/4 lb.) explosive charge, and then engaging targets in the building with simulated munitions ("SIMUNITIONS"—similar to paint guns). Training such as hostage rescue can be conducted in close quarters with standard issue rifles and pistols, without the danger of live rounds being fired at or near "hostages", "terrorists" or "rescuers".

Impacts and mitigation. The only potentially significant impact of small arms ranges, TRUE training, and shooting/breaching houses is public safety hazards, mitigated by strict adherence to long-standing SOPs. SDZs and controlled air spaces would be established, into which entry would be prohibited when firing was occurring. CNMI and Tinian agencies and the public would be notified prior to live fire training. The measures would isolate nontraining personnel from the range area. Observers would order range users to immediately cease firing if anyone entered the range area and its SDZ. Firefighting and medical support equipment would be maintained on hand.

Training with mortars leaves UXO in the designated impact area. This results in long-term loss of land use and, if the area is accessible to the public, a public safety hazard. The mitigation is regular clearing of UXO and controlling (prohibiting) public access to the impact area. Mortar trajectories would intersect the normal flying altitude of aircraft crossing Tinian; aircraft safety hazards would be mitigated by official arrangements with the FAA prior to opening the range.

2.2.4.2 Feasible Firing Range and Shooting House Sites on Tinian

The existing small arms range has been closed due to design concerns and will not be reopened. This DEIS proposes using an adjacent area in the EMUA to develop a small arms fire-and-maneuver range and a 60mm mortar range. The reconfigured ranges, as described below, are conceptual. Specific range design review and approval would be conducted by the Naval Facilities Engineering Command, with approval of all safety measures by Chief of Naval Operations. If approved for Tinian, range operations will require pretraining coordination with the FAA, USCG, and local authorities.

Proposed fire-and-maneuver range. This range would be restricted for training with 5.56mm and 7.62mm rifles, squad automatic weapons (SAW), and light machine guns (LMG). These weapons fire lead bullets only, not exploding projectiles. The Tinian range would be approximately 200 m wide by 500 m long, oriented to fire west to east (see Figure 2-1b). Targets with individual sandbagged backstops would be constructed at the east end of the area (west of the public road) to stop projectiles. Construction would consist of removing a limited amount of tangantangan brush and minor excavations and buildings backstops at each target point. The range would be situated so that the SDZs—areas calculated to contain all possible strays and ricochets from the weapons used on the range—would not include the cliff of Puntan Chiget. During range use, safety observers with radio communication with the Range Safety Officer would remain alert to land and sea traffic from north and south. They would be posted on Puntan Chiget and at the northern end of the SDZ near the shoreline. Roads into the EMUA would be closed by temporary barriers, with guards to prevent civilians from entering the EMUA during range use. The range would be used by groups of up to 16 persons at a time, for several days duration, up to 12 times a year, and by very large groups (150-500) for three weeks several times a year.

Proposed mortar range. The 60mm mortar range would be a one-km^2 box, with an impact area extending approximately 700 m from the firing line, plus an additional 300 m depth for overshots (see Figure 2-1b). The range would be fenced and would require clearing vegetation in the target area. Vegetation would be periodically maintained with a pesticide such as Roundup to facilitate clearing the range of UXO. Roads into the EMUA would be closed by temporary barriers, with guards to prevent civilians from entering the EMUA during range use. Additional guards would be posted on runways and on the dirt coast road near the range. The range would be used approximately four times a year; each training session would last approximately two days. Safety observers would be responsible for initiating "cease fire" if approaching ground and air traffic inadvertently approached into the danger area.

Proposed shooting or breaching house(s). Two shooting or breaching house locations are proposed for the EMUA. The Japanese command post building is currently used as a shooting house with temporary bullet traps mounted in the northern (enclosed) room. A 14 m x 14 m shooting house or breaching house could be constructed at one of two locations north of North Field (see Figure 2-1a). Shooting houses have very small safety zones and do not require closing the EMUA; guards would be posted at all points of approach, to prevent civilians from entering the shooting house perimeter during training. No live ammunition is used at the breaching house, and there is no requirement for a safety exclusion zone. The shooting and/or breaching house(s) would be used by groups of up to 16 highly trained personnel. Training would be coordinated with an infiltration exercise occurring about one week per month.

2.2.5 Cumulative Impacts on Tinian

Cumulative impacts on resources result from incremental effects of the proposed action when added to other past, present, and reasonably foreseeable future projects in the region of influence, i.e., on Tinian.

Cumulative impacts may result from continuing use of sites on Tinian for training, in combination with proposed new training uses and past, present, and future development pressures on Tinian. These cumulative impacts, discussed in the impacts analyses in Chapter Four, include:

- Risk of BTS introduction from Guam, in combination with civilian shipping (see Section 4.2.1.2)
- Risk of damage to cultural resources in the EMUA, in combination with a projected increases in tourism on Tinian (Section 4.2.2)
- Impacts on public safety and local economic activity generated by live-fire and aviation training, associated temporary closure of the EMUA, and a projected increase in tourism (Sections 4.2.5, 4.2.6, and 4.2.7)
- Impacts on endangered species habitat, in combination with clearing for the Voice of America facility currently under construction in the EMUA (Section 4.2.1)

Mitigation measures proposed in Chapter Four would reduce all of these impacts to nonsignificance.

2.3 PROPOSED USE OF COMNAVMARIANAS WATERFRONT ANNEX

Land resources. The Waterfront Annex includes Orote Point and most of the shoreline of Apra Inner and Outer harbors. Much of the annex is developed, but the end of Orote Point around the old airfield is mixed open and forested areas. Few accesses to the annex are gated; civilians are able to visit historic trails and sites associated with the runway. Some of the developed areas around Inner Apra Harbor are in the process of being transferred to civilian authorities.

The DoD also controls much of the Outer Harbor and all of the Inner Harbor. Certain areas of submerged land have been transferred to the jurisdiction of GovGuam. Other areas are under DoD control, although there is ongoing disagreement with local authorities on this point. The harbor contains significant historic resources in the form of various ships sunk during World Wars I and II. Protected turtle species are known to frequent the harbor, and migratory seabirds nest along the southern cliffs of Orote Point.

Training considered at the Waterfront Annex. The Waterfront Annex has been used for all training activities except naval/aerial bombardment. It contains two small arms firing ranges, a shooting house, a runway suitable for fixed- and rotary-wing aviation training (including LZs and DZs), a rappelling tower, and adequate undeveloped land for small-scale field maneuvers. Beaches in the harbor are DoD-controlled and have been used for amphibious landings, and both inner and outer harbors have been used for underwater demolition training and various helicopter training activities.

Figure 2-2a shows training activities feasible in the Waterfront Annex. The No New Action Alternative is represented by all activities shown in black on the figure; these have occurred

regularly in the locations shown. Activities in green on the figure represent additional locations proposed for the Waterfront Annex as part of the Preferred Alternative. Activities shown in red were proposed but are not recommended, on the basis of environmental analysis in Chapter Four. The activities proposed for the Waterfront Annex are described in Sections 2.3.1 through 2.3.6.

2.3.1 Field Maneuvers and Logistics Support at the Waterfront Annex

Description of training. The Waterfront Annex is suitable only for small-unit field maneuvers, as it does not contain the large undeveloped areas required for more substantial ground exercises.

Field maneuvers, and logistic support training proposed for the Waterfront Annex are primarily small-unit activities conducted by organizations assigned to Guam (see Section 2.2.1.1. and Appendix B for details on field maneuvers). A unit bivouac may be combined with small unit tactics, range firing (see Section 2.3.4), and land navigation. NBC (nuclear-biological-chemical) training provides simulated devices (without harmful chemicals) for disassembly training.

Logistic support training consists of deployment training for Seabee battalions that rotate through Guam about every six months. Each new battalion learns how to establish, operate, maintain, and secure a base camp prior to its deployment for construction tasks in more remote locations in the Pacific.

Related to field maneuver training are the security training events, involving both base security personnel and EOD conducting various scenarios within the base proper. Based on antiterrorist or hostage scenarios, EOD trains to neutralize "improvised explosive devices" (IED), and security police conduct various antiterrorist neutralization/hostage rescue scenarios. These functions do not require special or dedicated training areas.

Impacts and mitigation. No significant impacts are expected from field maneuvers, special and security operations, or logistics support training at the Waterfront Annex. Bivouac areas have been disturbed for many years and do not contain endangered species habitat or significant historic resources that might be harmed by the training.

Feasible sites. Undeveloped areas on Orote Point are suitable for field training. Orote Point has grassy areas used for bivouacs by Army Reserve and National Guard forces on weekends and at other times by Seabees stationed at Camp Covington. TRUE training and rappelling facilities exist on base. Camp Covington has provided sites for Seabee training for many years.

2.3.2 Aviation Training at the Waterfront Annex

Description of training. The Waterfront Annex is suitable for both land- and water-based aviation training. Ongoing and proposed aviation training considered for the Waterfront Annex consists of:

- **Helicopter insertion and extraction** of tactical units at LZs (see Section 2.2.2.1)

- **Paradrops** to DZs (see Section 2.2.2.1)
- Small-unit paradrops to water DZs
- **Firefighting bucket** offload at a simulated fire. Helicopters carry external water containers (loaded offshore or at Fena Reservoir) and practice offloading the water at various designated practice sites.
- **Search and rescue** training by helicopter crews consists of searching for, and retrieving, personnel swimming in the water or in small boats.
- Tactical airlift of SEALs in fixed-wing aircraft, in support of contingency operation training
- **Helicopter insertions** of small reconnaissance units and raiding craft (small boats) into the harbor
- Helicopter **cast and recovery training** supports various special-function forces. The cast consists of hovering over the water at 6 m altitude proceeding at 5 knots. Twelve to sixteen swimmers jump into the water and swim (or ride in a CRRC dropped from the helicopter) to the objective. The recovery is accomplished at 6 m/5 knots using a Jacob's ladder or retrieval ring to get the swimmers back into the helicopter.

Impacts and mitigation. Potential public safety hazards will be mitigated by continued adherence to routine notification and safety SOPs and regulations.

Feasible sites. Waterfront Annex areas suitable for aviation training include the old Orote Point runways, various surveyed DZs, and the waters of Apra Harbor and Agat (including several designated water DZs).

Fixed-wing airmobile operations are conducted in support of the SEALS, using the Orote Point Runway for tactical movement for exercises and contingency operations. The runway area can also be used for paradrops.

Parachute training is conducted at water DZs in Outer Apra Harbor and south of the base at the Agat (water) DZ. Reconnaissance insertions of team members and raiding craft from helicopters are conducted in Outer Apra Harbor and the open ocean.

2.3.3 Amphibious Landings at the Waterfront Annex

2.3.3.1 Training Description

Ongoing and proposed **amphibious landing training** in the Waterfront Annex would include LCAC, LCU, AAV and small-boat landings (activities described in Section 2.2.3.1 and Appendix B). AAVs and vehicles offloaded from LCUs and LCACs would travel through some portions of the base from some landing locations (see below). A transiting MEU may conduct special operations training using helicopters, landing craft, and assault amphibian vehicles to enter the base at various points from offshore amphibious ships.

Riverine training is ongoing at the Atantano River. It consists of a SEAL team of 10 to 16 persons attempting small boat (RHIB or CRRC) insertion (anchoring the boat, swimming and wading to shore), coming under ambush, and then fighting their way back to the raiding craft. Weapons with blank ammunition are fired.

Impacts and mitigation. Landing craft may damage coral, and the craft or their offloaded vehicles may damage archaeological resources or compact sand over sea turtle nests (see Section 2.2.2.2. for details). Mitigation consists of avoiding landing activities at areas with important natural or cultural resources.

No significant impacts will result from riverine training. The Atantano River area used for training is not a section inhabited by moorhens. Training does not extend into portions of the river that are beyond government property. Potential impacts to mangrove roots will be mitigated by prohibiting landings and hiking in the mangrove swamp.

2.3.3.2 Feasible Amphibious Landing Training Sites in the Waterfront Annex

Locations in the Waterfront Annex suitable for landing amphibious vehicles include several beach areas, a WWII pier area, and a boat ramp in Sumay Cove. Table 2-2 summarizes the training pros and cons of these locations; other beaches in Apra Harbor or south of Orote Point were not considered, due to conflicting land use, inappropriate hydrography and terrain, or the presence of live coral.

LCAC landings. Dadi Beach, Tipalao Beach, Toyland Beach, Polaris Point, and Drydock Island are all feasible LCAC landing locations, provided storms do not cause beach slopes to exceed 6°. According to site surveys perform by the Marines in September 1997, most of these sites require some modification to provide adequate clear turning space for one or more LCACs.

- Tipalao Beach requires grading the beach and clearing existing boulders in the surf zone. There is room for one LCAC on the beach and 4 LCACs in the adjacent grassed ball field. The slope to the ball field requires regrading, and a fence must be removed.
- Dadi Beach requires removal of two trees but is otherwise a feasible location for 2 LCACs to land and turn. Landings are only possible when the beach slope does not exceed 6°. Archaeological resources at Dadi Beach were surveyed as part of a previous NEPA document[5] and will be avoided. No offloads are planned for this location.
- Toyland Beach requires some regrading, removal of up to a half dozen trees and a few boulders along the shoreline. The offshore substrate is sand, silt and rock with no live coral; onshore the area is crushed coral and mown grass. The trees consist of mature coconut trees (about 6 m tall) and immature ironwoods (less than 6 m tall). There is room in a former parking lot to stage offloaded vehicles. Wheeled vehicles can access

[5] Helber, Hastert & Fee, Planners (March 1995) *Environmental Assessment for the Navy Lodge, Waterfront Annex, U.S. Naval Activities, Guam.* Prepared for Navy Exchange Service Command.

inland portions of the Waterfront Annex by traveling along a short (500 m) portion of Marine Drive to and through the Main Gate.

- Polaris Point requires relocation of swim buoys and of structures near the beach to avoid sandblast damage from the LCAC fans.
- Drydock Island is suitable for 1 LCAC and can accommodate 2 LCACs if three to four trees are removed.

LCU landings. LCU landings are feasible at Toyland Beach, Sumay Cove Marina, the former WWII refueling pier, Polaris Point, and Drydock Island.

- Toyland Beach [same modifications as identifed above]. Offloaded vehicles can assemble in parking lot.
- No modifications are required at the marina boat ramp, but ramp may require repairs upon completion of each exercise. Small boats would be required to navigate around an LCU. The adjacent parking lot provides a large vehicle offload and assembly area.
- Submerged lands at the refueling pier require extensive clearing, the sea wall requires modification and repair, the beach requires regrading, and five to six trees must be removed along the beach line. Offloaded vehicles can travel along a dirt road adjacent to a wetland.
- Polaris Point requires no modifications for 2 LCU. It could accommodate 4 LCU if the old (broken) seawall were removed and the shoreline slightly regraded. Swim buoys must be temporarily removed during exercise.
- Drydock Island requires no modifications for 1 LCU. Modifications for 2 LCUs are the same as for 2 LCACs [see above].

AAV landings. Tipalao Beach, the former WWII refueling pier, Sumay Cove Marina, Toyland Beach, Polaris Point, and Drydock Island are feasible AAV landing areas. From all locations except Polaris Point and Drydock Island, AAVs could travel along existing roads to perform limited training on Orote Point.

- Tipalao Beach requires the modifications identifed above for LCACs.
- The refueling pier require modifications identified for LCUs. The only exit road is unpaved and is immediately adjacent to a large wetland.
- The marina boat ramp requires no modifications, but may need repairs after an AAV landing.
- Toyland Beach requires modifications identified for LCUs, and mown grass may be disturbed by AAVs.
- Polaris Point and Drydock Island require no modifications, although mown grass may be disturbed by AAVs.

Riverine Training. No additional riverine training sites are proposed, in addition to the area of the Atantano which has been used for this training for a number of years. Because the groups are

small and there is a variety of usable ambush areas, additional sites are not required to provide variability of scenario. The existing training area includes the mangrove swamps and cleared areas upstream of the swamp as far as the Marine Drive overpass.

2.3.4 Live Fire Ranges at the Waterfront Annex

Weapons training activities are explained in Section 2.2.4.1. Waterfront Annex firing ranges consist of:

- A **small arms known distance range** with 200-, 300-and 500-yard firing lines. Former range berms on the left flank of the KD range are available for reuse as weapons siting ranges. The 500-yard firing line is proposed for initial training with 7.62mm sniper rifles. The range is oriented so that personnel fire to the southeast at targets placed against a 20-m-high backstop (see Figure 2-2a). Although the SDZ extends out over the ocean southwest of Orote Point, the backstop effectively stops the flight of rounds beyond land.
- A **pistol range** behind the KD range target line. This range can only be used when the rifle range is inactive. The pistol range uses the same 20-m-high backstop.
- A former pistol range, which would be modified to create a **fire-and-maneuver range**. This modification requires constructing a new target array and firing positions. It would widen and lengthen the range's SDZ due to the range of angles of fire permitted during fire-and-maneuver (see Figure 2-2a and Appendix B). The range would be oriented to fire towards the same 20-m-high backstop.
- **A shooting house** east of the KD range. It is in use by SEALs and other special operations units.
- A former small arms range corridor parallel to the KD range is proposed for a small arms **stress course**, incorporating physical obstacles for the shooters as well as targets for live-fire weapons training.

Impacts and mitigation. The two public safety hazards associated with Orote Point small arms ranges are to (1) tourists traveling the historic trail who may encroach a range area, and (2) recreational boaters and divers in the offshore areas of the SDZs. These hazards will be mitigated by strict observations of standard range safety procedures that emphasize road barriers, safety observers, range communications, and large warning signs posted seaward.

Feasible sites. The KD ranges, stress course, and proposed fire-and-maneuver range are on the west shore of Orote Point, with over-water SDZs. The shooting house is adjacent to the Orote Point runway. When not in use, all four locations are accessible by civilians but pose no danger.

2.3.5 Underwater Demolitions at the Waterfront Annex

Underwater demolition training consists of setting explosive charges to neutralize enemy mines (mine countermeasures [MCM]) or to neutralize underwater obstacles. Different water depths

and amounts of explosive material are required to simulate particular combat situations. Both EOD and SEAL units are required to train with live demolition for certification and maintenance of skills and to create a realistic awareness of danger and the need for attention to details under controlled circumstances. [Note: This training relates directly to real world activities performed repeatedly during Desert Storm.] Several photographs of mines are included in Appendix B.

2.3.5.1 Description of Training Performed or Proposed at Waterfront Annex

Diving to neutralize mines is very hazardous and requires extensive training with the employment of explosive charges. The three types of underwater demolition training considered are:

- **EOD deepwater MCM** requires detonating explosive charges in waters between about 20 and 40 m deep. Divers approach an "enemy mine" (training device), set a charge to neutralize the mine, and swim away to a safe distance prior to the blast. A correctly set charge creates a shock wave sufficient to neutralize the simulated mine. Once the "enemy mine" has been neutralized, divers retrieve it to the surface and tow it ashore for dismantling. Water surface areas within 300 m of the site are temporarily closed to civilians and are routinely surveyed for absence of marine animal and civilian presence prior to any detonations. A larger area is closed to divers.
- **SEALs very shallow water MCM** involves detonating strings of up to 20 one-pound charges in water between 2 m and 6 m deep. A typical scenario would involve clearing a landing beach of any underwater obstacles or mines that may damage or destroy landing craft and vehicles. SEALs approach the site in small raider craft or by swimming, to set strings of small charges and swim away without being detected. No equipment is discarded. Similar precautions are taken as described above to secure the training area.
- EOD also trains to **neutralize floating mines** designed to sink passing ships. 10-lb charges are attached to simulated mines in open ocean waters. They are detonated within 3 m of the surface. Personnel approach and leave the site by raider craft or helicopter and swim to the simulated mines. Surveys for marine mammals and reptiles are performed prior to the shot.

Impacts and mitigation. Underwater demolition training may impact public safety and marine life. Both deep- and shallow water MCM have the potential to damage substrate structure through direct effect or by propagated shock wave. The shock wave can also affect fish or other marine animals, as well as swimmers and divers. Site selection purposely minimizes these risks. Safety measures, such as temporarily closing the use of certain commercial dive sites to ensure personal safety, can have economic impacts to those enterprises.

Mitigation includes (1) continuing to survey the effects area for marine mammals or turtles, (2) selecting training locations to avoid areas with coral substrate, (3) following SOPs regarding advance notification of the activities and clearing the blast area of civilians, and (4) preferentially using a site outside Apra Harbor to reduce the number of temporary dive site closures.

2.3.5.2 Feasible Underwater Demolition Sites at the Waterfront Annex

Deepwater MCM sites. The feasibility criteria for deepwater MCM sites are as follows:

- Is accessible by small boat, with access to a nearshore area suitable for dragging in the neutralized device at the end of the exercise
- Has sandy bottom, water about 20 to 40 m deep
- Offers protection from weather and stormy seas
- Has sand or rubble substrate, remote from structures that would sustain damage by explosive overpressure
- Is remote from heavily used areas and readily secured

The existing deepwater site is near the Glass Breakwater in Outer Apra Harbor (see Figure 2-2a). The site has a sandy bottom, a water depth of about 38 m, is about 600 m from the nearest known submerged historic ship, and is a safe distance from commercial and Navy shipping operations. An area of about 1,000 m radius around the site is closed to civilian water traffic during the exercise.

A proposed alternative deepwater site is south of Orote Point, offshore of Dadi Beach in waters 13 to 30 m deep. This area is approximately 450 m offshore (see Figure 2-2b). There are no significant submerged historic resources in the general area, which is geographically isolated from harbor traffic. The nearest recreational dive sites are Haps Reef (about 2 km away) and Blue Hole (about 3.5 km away). Both marine mammals and turtles are known to visit the area, but are not continuously present. The area is also popular with manta rays who can be cleared from the area prior to detonations.

Shallow water MCM sites. Seven sites are proposed, five inside Apra Harbor and two on the south shore of Orote Point. All sites meet the feasibility requirements for access and water depth. Two sites would affect areas of live coral with associated aggregations of reef fish. One of these is a commercial recreational dive site. One site near Tipalao Beach provides a remote location, appropriate depth, and lack of coral, but is near military family housing. One remote site near Glass Breakwater also provides the appropriate depth, clear bottom, and no nearby developed area.

Table 2-3 summarizes proposed alternative MCM sites.

Floating mine neutralization site. The existing site is in open ocean (see Figure 2-2a). No additional sites are proposed.

2.3.6 Cumulative Impacts on the Waterfront Annex

Most of the ongoing and proposed training land uses occur in separate portions of the Waterfront Annex and will not generate overlapping or cumulative effects with one another. Cumulative

impacts may result from civilian recreational and commercial use of Outer Apra Harbor and nearshore waters southwest of Orote Point:

- Continuing use of Orote Point live fire ranges generates public safety hazards offshore. This would be augmented by the larger over-ocean SDZ generated by the proposed fire-and-maneuver range and by use of the proposed deepwater MCM site offshore of Dadi Beach (see Section 4.3.3).
- Continuing use of the Apra Harbor deepwater MCM site together with the ESQD arc generated by ammunition ships periodically docked at Kilo Wharf cumulatively put a large area of the harbor, the south shore of Orote Point and portions of the ranges and bivouac area off limits to civilian activities, including commercial recreation, as well as to training military personnel. There are, however, alternative dive sites and touring sites available for the majority of these commercial operations (Section 4.3.5).

Mitigation measures proposed in Chapter Four consist primarily of public notification procedures, and would reduce these cumulative impacts to nonsignificant levels.

2.4 PROPOSED USE OF COMNAVMARIANAS ORDNANCE ANNEX

Land resources. The Ordnance Annex consists of 36 km^2 of mostly undeveloped land. Permanent structures are prohibited within the ESQD arcs generated by ordnance stored in magazines in the central portion of the annex. Development consists of the magazines and a few support buildings, and roadways. The annex contains Guam's only major surface water body, Fena Reservoir, and a variety of endangered species, notably the Mariana common moorhen and the island swiftlet. Multiple Chamorro latte sites have been identified in the annex. Wild carabao wander through the annex and are an attraction to civilian poachers. A commonly traveled hiking trail passes through the southwest edge of the annex.

Training considered at the Ordnance Annex. The annex was evaluated for small-scale field maneuvers, aviation training, and weapons ranges. It does not contain any beaches useful for amphibious landings, or rivers useful for riverine training. Fena Reservoir is a drinking water source and was not considered for underwater demolition or other water-related training other than fire bucket training with HC-5 helicopters and water purification unit training. An aerial bombing range is not possible, and live-fire training areas are limited due to the presence of ammunition storage magazines.

Training activities feasible in the Ordnance Annex are shown in Figure 2-3 and described in Sections 2.4.1 through 2.4.4. The No Action Alternative is represented by all activities shown in black; these have occurred regularly at the Ordnance Annex in recent years. Activities in green and red represent additional proposed training locations; only those in green are included in the Preferred Alternative.

2.4.1 Field Maneuvers and Logistics Support Training in the Ordnance Annex

The only field maneuvers suitable for the Ordnance Annex are small-unit patrolling, land navigation, and command post exercises. Bivouacs are possible for extended stays in the training area.

2.4.1.1 Training Description

The Ordnance Annex is proposed for continuation of five activities in the category of field maneuvers and logistics support. All have occurred in this area before and are thus part of the No New Action Alternative:

Water purification by Army engineers equipped with reverse osmosis water purification units (ROWPUs) is a logistics support training exercise. A small team sets up near Fena Reservoir, with a discharge water percolation area away from the reservoir.

Land navigation by up to 500 Army Reservists and National Guardsmen assembled into small groups has occurred in the northeast corner of the Ordnance Annex one weekend per month for many years. This activity consists of personnel moving on foot on- and off-road. The southern portion of the Ordnance Annex is also proposed for land navigation; training would involve two groups of up to 10 people for one day of training, as many as 15 times per year.

Small-unit reconnaissance patrolling in the Ordnance Annex consists of groups of no more than 5 persons proceeding on foot under stealth conditions. It does not include cutting or crushing vegetation or otherwise marking the surroundings. This has occurred in the southern portion of the annex and along the western ridge.

Command post exercises in the Ordnance Annex consist of establishing a base camp in the bivouac area on the western ridge or in the land navigation area in the northeast corner of the annex.

Bivouac (small to medium units). National Guard and Reserve units often train over a weekend, establishing a bivouac for overnight stays. The maximum number anticipated to be supported is about 500.

Impacts and mitigation. Bivouacs have the potential to cause fires, which are avoided by adherence to SOPs for fire control. Personnel moving on foot are otherwise expected to have little impact on the environment.

2.4.1.2 Feasible Field Maneuver and Support Sites in the Ordnance Annex

The central magazine area of the Ordnance Annex is not available for training. Wooded areas in the west and northeastern edges are appropriate for field maneuvers and bivouacs and have been

used for such training for many years. The area south of the magazine is also well suited to small field maneuvers.

2.4.2 Aviation Training in the Ordnance Annex

2.4.2.1 Training Description

The Ordnance Annex has limited areas suitable for aviation training. There are no runways, limited helicopter landing zones, and altitude limitations for aircraft over much of the annex. Feasible aviation training activities are described in Section 2.2.2.1 and include:

- Use of existing helicopter LZs to **land and recover embarked personnel and** equipment.
- Use of an existing DZ for **paradrops** of small groups from helicopters.
- **Personnel insertions and extractions** by helicopter rappel, fastrope, or special insertion and extraction equipment (SPIE).
- **Simulated TRAP and CAS** in areas north of the ammunition storage area. A typical scenario may be rescuing a downed pilot by helicopter, providing the rescue team air cover by helicopter gunship (AH-1) and AV-8B Harrier jets.
- Use of Fena Reservoir to train helicopter crews to load an external **firebucket**.

Impacts and mitigation. Aircraft noise may disturb endangered species in the vicinity of Fena Reservoir. No public safety impacts are likely, as the Ordnance Annex is not routinely accessible by civilians.

2.4.2.2 Feasible Sites

There are two existing LZs and one proposed near the old West Tower that would support the west ridge, bivouac area, and sniper range. A parachute training DZ is proposed using an existing LZ in the north central area of the annex. Helicopter insertions and extractions are also practiced on the west ridge near Mount Alifan.

The parachute training DZ is also proposed as a site for simulated CAS with aircraft flight restricted to altitudes of about 630 m above ground level (AGL) for fixed wing and 315 m AGL for helicopter gunships aloft in support of a rescue team on the ground.

Use of the north half of Fena Reservoir for firebucket training is feasible. No firebucket training is conducted beyond the spillway.

2.4.3 Live Fire Ranges in the Ordnance Annex

The Ordnance Annex does not currently have any firing ranges. The explosive ordnance demolition pit is used for detonating real WWII ordnance in addition to EOD training exercises (see Figure 2-3).

2.4.3.1 Description of Firing Range Proposed for the Ordnance Annex

A new range area has been proposed, combining a sniper range, breaching house, and jungle sniper trail within one SDZ.

- The **sniper range** would be designed for long-distance range fire with 7.62mm sniper rifles, to be fired only by experienced marksmen. It would be used daily by small groups (two to six snipers) each firing up to 20 rounds. There would be several shooting positions and a variety of targets mounted 750 m to 1000 m from the firing line(s) (Figure 2-3). Training at the range would involve two snipers patrolling on foot to a designated firing position, determining the direction of fire, the distance to the target, and the difference in elevation, and checking this information with the range safety officer. The RSO would ensure that firing would remain within the designated SDZ and would clear the team to fire. If criteria were not met, the team would be directed to a different firing position to recalculate.

  The RSO will be responsible to orient the lines of fire, keeping the SDZ within the boundaries of the Ordnance Annex. The SDZ would be approximately 4 km long and about 3 km wide at its widest point, encompassing the maximum range of the weapon fired at a variety of angles. "Construction" would consist of hand-placing targets (cardboard or plastic silhouettes on wooden or plastic stakes).

- The **breaching house** would be used for forced entry and firing with nonlethal "Simunitions" (see Section 2.2.4.1). Personnel could shoot at the house from selected external firing positions and would shoot from the roof of the house at selected targets. An area about 30 m by 30 m would be cleared on a currently grassy area near the end of an existing roadway. The house would be about 14 m by 14 m and would be located within the sniper range SDZ.

- The **jungle trail range** would be a 200-m-long trail with pop-up targets installed along its length. The trail would require minimal clearing, as it is intended for use by only one SEAL team member at a time using 9mm and 5.56mm weapons. Targets would be dug into the soil and have elevated dirt backstops.

- The existing demolition pit west of Fena Reservoir is used for demolition training (as well as for demolition of UXO discovered around Guam) by EOD. Training is conducted on or about three days per month by 14 persons. This range is certified for up to 3,000 pounds net explosive weight, and is used for detonating unexploded ordnance discovered at other locations on Guam.

Impacts and mitigation. Potentially significant impacts are to public safety on a hiking trail in the southwestern edge of the annex, and to historically significant archaeological resources located throughout the Ordnance Annex. Public safety hazards will be mitigated by narrowing the range SDZ to completely avoid the trail. Targets will be located so that natural (topographic) backstops limit the path of the bullets. Impacts to cultural resources will be mitigated by designing firing position/target combinations to ensure that no significant resources will be exposed to direct fire.

2.4.3.2 Feasible Range Sites in the Ordnance Annex

The proposed range is in the only location in the Ordnance Annex which is (1) outside endangered bird and bat nesting/roost areas and (2) situated so that the SDZ is oriented away from the magazines and entirely contained within government property.

2.4.4 Cumulative Impacts on the Ordnance Annex

Non-training land uses of the Ordnance Annex consist of ammunition storage, demolition of WW II-era bombs (as discovered), recognized hiker encroachment in the southwestern edge of the annex, and strictly limited civilian fishing in Fena Reservoir. None of these generate impacts cumulative with those of the proposed action.

2.5 PROPOSED USE OF ANDERSEN AFB AND COMMUNICATIONS ANNEXES

Land resources. AAFB, Andersen South, and the two Communications Annexes (Barrigada and Finegayan) together comprise about 92 km^2 of largely undeveloped land. While AAFB Main Base contains a large airfield, various low buildings, and is planted in grass, Northwest Field and the Munitions Storage Area (MSA) are wooded and crisscrossed with old roads. The few remaining Mariana crows inhabit portions of AAFB (primarily in the MSA), and endangered fruit bats roost along the cliffs near Pati Point. A National Wildlife Refuge overlay has been established over much of northwest AAFB; it is intended to protect endangered species and their habitats while still giving priority to the military mission. An Ecological Reserve Area has been established at Communications Annex Finegayan, including Haputo Beach.

Training considered at AAFB. Many of the undeveloped areas of these bases are suitable for small-scale field maneuvers, including specialty training such as Security Police training with military working dogs. The two USAF airfields are suitable for airmobile and airborne training, and bivouacs. Rapid runway repair (RRR) will be conducted on a former taxiway of Northwest Field. Small-boat insertions and over-the-beach (OTB) training are suitable at several beaches. Live-fire training occurs at the AAFB and Finegayan small arms ranges. Abandoned structures at Mount Machanao, above Ritidian Point, are used for small-scale TRUE training. There are no sites suitable for amphibious vehicle landings, underwater demolition, or bombing.

Figure 2-4 shows training activities feasible in these areas. All training is ongoing (labeled in black), with the exception of rapid runway repair and firebucket offloads (labeled in green). Most activities are described in preceding sections (2.2 through 2.4); the remainder are described in Sections 2.5.1 through 2.5.4.

2.5.1 Field Maneuvers and Logistics Support Training at AAFB and Communications Annex

2.5.1.1 Training Description

Field maneuvers feasible at AAFB consist of bivouacs, small-unit maneuvers, military working dog training, and airfield security (see Sections 2.2.1.1 and 2.4.1.1). **RRR training** will involve creating four permanent craters for periodic reexcavation and repair. One will be created with an explosive charge as a demonstration crater. The remaining three craters would be excavated prior to each training session, then refilled with gravel and compacted as part of the exercise. Fiberglass traffic covers would be used to preserve the four craters and site materials until the next evolution of excavation/gravel fill and compaction.

Impacts and mitigation. Establishing bivouacs and conducting maneuvers could disturb the ground surface and might disturb endangered species due to noise and surprise. RRR generates craters in paved areas. Mitigation consists of permanent locations for bivouac sites and RRR. Existing and proposed training locations avoid known nest locations of the endangered Mariana crow.

2.5.1.2 Feasible Field Maneuver and Logistic Support Sites at AAFB

Northwest Field provides the most undeveloped wooded area for small-unit maneuvers and bivouac sites. The area's roadways (a series of former runways, taxiways, and parking aprons) are not accessible by the public and allow free tactical maneuvering by foot or small vehicle. Field maneuvers can be supported by aircraft using the south runway, established CAL sites, and a simulated LHA landing deck. The large, paved areas are suitable for personnel and cargo inspection by military working dogs and their handlers, and for riot control drills. An abandoned paved area has been selected as a RRR training location. The SEALs use Northwest Field to maneuver toward Mount Machanao where they conduct TRUE training within abandoned buildings. All of these maneuver activities can be conducted without interference to AAFB's primary mission of aviation support at Main Base.

Finegayan is suitable for small unit clandestine maneuvers to Northwest Field, following small-boat landings at Haputo or Double Reef beaches. Maneuver at Barrigada is restricted to land navigation training by Army Reserves during weekend drills.

Limited maneuvers and training support can be conducted at Andersen South. Its open fields, wooded areas (and, at times, vacant dormitories) are made available to transient units for staging, bivouac equipment inspection, and small-unit tactics prior to movement for training on other islands.

2.5.2 Aviation Training at AAFB

2.5.2.1 Description of Training

The primary mission at AAFB is aviation support. Aviation training at AAFB includes:

- **Field carrier landing practices** (FCLP) by Navy fighter/attack and patrol aircraft simulating aircraft carrier landing and takeoff patterns. Exercises consist of repeated high speed approaches to an airfield and simulated landings, followed by takeoff and tight turn to repeat the maneuver. Aircraft include F/A 18s, F-14s, and P-3s.
- Helicopter **confined area landings** (CAL) consist of flying a prescribed route from the Main Base and landing in a tightly configured areas marked on pavement. This training is primarily performed by CH-46 helicopters.
- A simulated ship's landing deck is painted on the pavement at Northwest Field. Helicopter crews practice **landing on the simulated deck spots of a landing helicopter, assault** (LHA) ship. The training includes transported troops and may be incorporated with ground maneuver training activities.
- **Night vision goggle** (NVG) training requires night flights and landings in unlighted areas while the crew wear special goggles. Helicopters circle the airfield, land or hover briefly, and repeat the loop at low altitude. The training can only occur on moonless nights (about 8 nights per month) and takes place from one hour after sundown to 10:00 PM.
- **Firebucket training** (offloading a water-filled steel tank suspended beneath a helicopter) is proposed for the Main Base area.
- **Combat search and rescue** consists of CH-46 helicopters training to locate and rescue downed aircrews in wooded terrain.

Impacts and mitigation. Both airborne training and landing training may disturb endangered birds and bats due to noise and visual disturbances.

2.5.2.2 Feasible Aviation Training Sites at AAFB

AAFB's two airfields provide excellent training sites for aviation and aviation support training. Main Base provides an active airfield and is activated for airmobile training related to large-scale exercises on Tinian. Northwest Field is excellent for specialized aircraft landing exercises as it is not a busy active airfield.

2.5.3 Live Fire Ranges at AAFB and Communications Annexes

Firing ranges are described in Section 2.2.4.1. No new ranges are proposed at AAFB or the Communications Annexes (see Figure 2-4). Existing ranges consist of:

- A **small arms range** at AAFB's Tarague Beach is used for pistol and rifle fire, with no tracer rounds permitted. The range is oriented to fire west-to-east, parallel to the adjacent cliffline, with half of the SDZ over water. M203 rifle grenade launchers may also be used on this range with non-explosive 40mm rifle plastic training projectiles, which create a small flash and produce no UXO.
- A **small arms range** at the Finegayan Communications Annex is oriented to fire southeast-to-northwest on the cliffs above and between Haputo and Double Reef Beaches. It is protected along its sides and rear by high dirt berms. The SDZ is over water. This range is used for pistol and rifle requalification fire and shotgun orientation training.

Impacts and mitigation. These ranges have been in use for many years. Potential safety impacts on ocean recreation consist of published notifications and observers watching for civilians encroaching the over-water SDZs.

2.5.4 Cumulative Impacts on AAFB and Communications Annexes

Other activities at AAFB consist of aviation, administration, maintenance of the USFWS overlay, various studies (some relatively intrusive) of the few remaining Mariana crows, tryouts of new BTS-control strategies, ongoing land ownership disputes regarding shoreline areas, and cleanup of soil and groundwater contamination. Also, Andersen South may be transferred to civilian authorities in the future. Several of these activities may generate cumulative stress on endangered Mariana crows, the Guam population of which has dwindled to 14 individuals as a result of BTS predation (see Section 4.5.1).

2.6 FARALLON DE MEDINILLA

Land resources. FDM is an uninhabited island approximately 2.8 km long and 400 m wide. It consists of a hilly plateau, with cliffs dropping up to 100 m to the ocean on all sides. The island is surrounded by a narrow submerged shelf with limited coral development. There is no evidence of permanent habitation, and there is no source of potable water. It is home to several migratory seabird colonies, and individual endangered Micronesian megapodes have been observed on the plateau. The island has been a bombing range for over 25 years and contains an abundance of UXO, including highly sensitive cluster bombs. Non-EOD (Explosive Ordnance Disposal) personnel are no longer allowed to land or move about on the island.

Training considered on FDM. The island is suited as a target area for continued bombardment by aircraft and naval gunfire. A ground-based training range for crew served weapons has also been proposed. Figure 2-5 shows training activities; those in black are ongoing, those in green are proposed, and those in red are proposed but are not in the Preferred Alternative.

2.6.1 Firing Ranges on FDM

This island has been proposed as a site for firing the following crew-served weapons that cannot be used in live-fire training on any other range in the Marianas:

- 60mm and 81mm mortars
- 155mm towed artillery
- AT-4 (shoulder-launched) and TOW (mounted, wire-guided) antitank missile systems

The proposal, primarily to support the transient Marine Corps MEUs, would have weapon crews, weapons, and ammunition airlifted by helicopter and landed on the north end of FDM. The direct fire would be from north to south down the length of the island.

The mortars and artillery are indirect fire weapons, meaning that the projectiles are "lobbed" over any intervening obstacles. The topography of the island does not provide clear observation from suggested gun emplacements to the impact areas. Observation of the strike of the round may require either an observation tower near the weapons' fire positions or use of an aerial observer. The AT-4 and TOW are direct-fire weapons used against visible targets, and target hits would be visible to the gunners.

The proposal to add crew-served weapons to the list of ordnance used at FDM is not included in the Preferred Alternative due to personnel safety considerations. As a result, impacts have not been analyzed in detail and no mitigation is proposed.

2.6.2 Bombardment of FDM (Navy Range 7201)

Four types of bombardment are performed on FDM. The range (Navy Range 7201) includes FDM and the area encompassed within a 3-mile radius of the island. Photographs of aircraft, ordnance, and bombing on FDM are shown in Appendix B-16 and B-17.

Air-to-surface gunnery. Navy and Marine Corps fighter/attack aircraft operating from transiting aircraft carriers practice routine interdiction, strike, and CAS. The carriers' relatively low-flying, fast-moving fighter and attack aircraft deliver bombs (mostly 500 lbs) and air-to-ground missiles to the southern end of the island. Fixed wing AV-8B Harriers and AH-1W Super Cobra helicopters from a transiting MEU also conduct gunnery training at FDM, engaging surface targets with machine gun, cannon and missile fire. Ordnance expended annually from Navy aircraft is about 80 missiles, 840 rockets (400 2.75-inch, 400 5-inch), and 4,020 conventional bombs (1,400 small [(250 to 500 lbs] 1,240 large [1,000 to 2,000 lbs) and 1,380 inerts)]. Annual training consists of four five-day Naval exercises, three 3-week Marine Corps exercises, and five 14-day combined force exercises. Transiting USAF AC-130 gunships use FDM for air-to-ground bombardment with 20mm cannon and the 105mm howitzer.

Strategic bombing. Each of the USAF Air Combat Command (ACC) bomber wings is required to complete a number of global power-projection missions per year, the majority at the FDM range. These aircraft may conduct high-, medium- and low-altitude bombing runs dropping

conventional 500-, 750-, and 2000-lb bombs, precision-guided munitions, and mines. These missions, together with bomber deployments to Guam, account for about 160 flying days and approximately 320 FDM range sorties per quarter. Between 5 and 612 live and inert weapons are dropped each month, with lower numbers being more typical. Approximately 45 percent of the sorties drop inert weapons only.

Naval gunfire. COMSEVENTFLT ships fire 5-inch deck-mounted guns at the west cliffline (see photo in Appendix B-16). Ordnance includes high-explosive, point-detonating rounds, with mechanical and variable time-fused rounds. Illumination rounds may be used to light up the impact area so that strikes may be observed and adjusted by spotters either aboard ship or airborne. These activities may occur monthly during Pacific transits, with a ship remaining on station for about two days and expending about 100 rounds, and as part of joint exercises in the Marianas for approximately 12 days every two years. A total of approximately 1,040 5"/54 shells and 400 76mm shells are expended annually.

Small arms fire. Navy SEALs in RHIBs offshore of FDM fire AT-4, 40mm grenades, 7.62 mm rifles, and .50 caliber machine guns at the same cliffside impact areas designated for naval gunfire. The SEALs do not go ashore for range training. Ordnance expended annually is about 11,700 rounds of 7.62 mm, 600 rounds of .50 caliber ammunition, and 2600 rounds of 40mm grenades, and 40 AT-4s (about 10 AT-4s per quarter). Training lasts one day and occurs approximately four times per year.

Impacts and mitigation. Bombs and missiles are designed to explode either upon contact or at some elevation above the ground surface. Missiles and high-explosive, point-detonating bombs may generate craters, whereas variable time or mechanical time-fused bombs do not form a crater but distribute bomb fragments over an area of the ground. Either type may scare, harm or kill birds, or destroy vegetation. Bombs and naval gunfire may also accelerate mass-wasting of the cliffs. Bombs missing the island tend to detonate upon hitting the water surface, except for duds which drop to the ocean floor. There is a public safety hazard to civilian aircraft or watercraft illegally entering the restricted area during bombing training.

Mitigation consists of minimizing impacts to the eastern cliffs by avoiding targeting the clifs, and by using inert ordnance whenever possible. This restricts the air-to-ground impact zone to the central interior portion and/or the southern tip of the island, and restricts naval gunfire to the west cliffline only (see Figure 2-5). Cluster bombs shall not be used on FDM. Mitigation also includes quarterly monitoring of training effects on cliffs, habitat, and bird population.

2.6.3 Cumulative Impacts on FDM

Over 25 years of bombing, UXO has accumulated on the island, increasing hazards to personnel on the ground. Repeated bombing has not destroyed the seabird population, but long-term effects cannot be quantified due to lack of reliable historical data.

2.7 NON-DOD LANDS

Training ongoing or proposed for areas not controlled by the DoD consists of (1) paradrops in an established DZ in Dandan, Guam, (2) riverine training on the Talofofo and Ylig rivers, Guam, (3) SEAL small-scale advance support base operations in Rota's main harbor, and (4) NVG helicopter training at Rota International Airport.

2.7.1 Guam

2.7.1.1 Drop Zones in Dandan

Parachute jumps by small units are practiced bimonthly at the Casper and Ghost DZs, located near NASA Road in Talofofo on private land in Dandan. The surveyed DZs have been established in accordance with a lease with the landowner, and are used primarily by the Guam Army National Guard.

Impacts and mitigations. No significant impacts result from this training.

2.7.1.2 Riverine Training on Talofofo River

Riverine training (see Section 2.3.3.1) is proposed at the mouth and lower 1 km of the Talofofo and Ylig rivers. However, due to potential lease problems, this training is not considered logistically feasible and is not recommended.

2.7.2 Rota

2.7.2.1 Forward Staging Base

The SEALs land small boats or swim in and bivouac overnight on a small sandy island in Songsong Harbor (see Figure 2-6). The island serves as a stop-over point for RHIB transport north to Tinian and FDM, and south to Guam. Boats and equipment are inspected and maintained. There are no significant impacts from this activity, which is ongoing and welcomed by the Rota population.

2.7.2.2 Aviation Training at Rota International Airport

The only aviation activity proposed is NVG training by helicopter pilots at Rota International Airport (see Figure 2-6). This land use is not the Preferred Alternative. The exercise would consist of CH-46E helicopters hovering and flying at low altitude (approximately 150 m) above the airfield, circling to the northwest along established civilian flight tracks at an altitude of no less than 400 m, and repeating the airfield portion of the exercise for a maximum of 19 closed loop patterns. Approximately two helicopters would participate in any given exercise, which would occur only on moonless evenings (approximately 10 evenings per month). Training

exercises would commence one hour after sunset or after the last commercial flight, whichever is later, and would end by 10:00 PM.

Impacts and mitigation. The impacts of helicopter noise at night on endangered Mariana crows cannot be assessed without further data. The area is routinely subject to fixed-wing aircraft noise during daylight hours.

2.8 COMPARISON OF ALTERNATIVES

The alternatives consist of using various land areas for training of a greater or lesser intensity (including not using them), as proposed above. The following sections compare alternative uses of each land area. In cases where no significant adverse effects are identified, the Preferred Alternative maximizes training use of sites with appropriate geographic features and facilities. The Preferred Alternative eliminates, where practical, use of lands for training that would result in significant impacts which cannot be mitigated. Training land uses that were proposed but are not recommended are identified under Maximum Land Use.

Vulnerability to impacts. The resources with greatest potential to be significantly impacted by training are protected species and cultural resources. Such resources exist at virtually all DoD-controlled lands in the Marianas, partly due to the protection afforded by restricted access and restricted development. In general, these resources are vulnerable to ground-disturbing activity. Endangered bird species are vulnerable to predation by the BTS and, in some cases, to noise disturbance. Potential impacts to infrastructure and public safety are site-specific issues. They are discussed in various sections of Chapter Four.

Generic mitigation. Potentially significant impacts of the Preferred Alternative to natural and cultural resources will be mitigated primarily by avoiding disturbing training activities, in accordance with three basic constraints applied to vulnerable areas of land (Figures 2-7 through 2-11 and Chapter Four):

- **No cultural resource disturbance** (NCRD) areas: No vehicular travel off-road, no pyrotechnics, no demolition, and no digging without prior written approval from COMNAVMARIANAS
- **No wildlife disturbance** (NWD) areas: No vehicular travel off-road, no pyrotechnics or open fires, no firing blanks, no live ammunition or training demolition, no digging, no mechanical vegetation clearing, no flights below 305 m (1000 ft) AGL, no helicopter LZs
- **No training** (NT) areas: No training allowed, except troop and vehicle movement along established roads. (Protects wetlands and other rare habitat, as well as particularly vulnerable archaeological resources.)

By implementing these constraints, all DoD land areas will be used at less than their full potential, as shown in Table 2-4:

Table 2-4 Constraints on Training Land Use

LAND AREA	APPROXIMATE PERCENT RESTRICTED FROM FULL TRAINING USE
Tinian EMUA	40
Waterfront Annex	20
Waterfront Annex: Outer Apra Harbor	5
Ordnance Annex	50
AAFB	42
NCTAMS Finegayan	10

2.8.1 Comparison of Tinian Alternatives

Alternatives for military training areas on Tinian are illustrated in Figures 2-1a and b. The alternatives are compared below and in Table 2-5 with regard to whether they meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.2; a summary comparison of the alternatives follows:

- **No new action** (continuing action): This alternative would continue using Tinian lands for the activities shown in black on Figures 2-1a and 2-1b, with some location restrictions previously defined for recent large-scale exercises.[6] Because it does not include landings with AAVs, this alternative does not fully meet the purpose and need for large-scale amphibious assault training.

  Analysis in Chapter Four indicates that this alternative does not have any significant impacts which cannot be mitigated to non-significance. Impacts of using the former Japanese command post for TRUE training would be monitored to verify that no significant impacts are occurring. If monitoring shows that training is impacting the structure's walls, such training can be modified or discontinued.

- **No training land use** [not illustrated]**:** This alternative would fail to meet the purpose and need for military training in the Marianas with regard to several critical capabilities. The MLA is the only location in the Marianas capable of supporting a relatively large-scale joint services training exercise with amphibious assault and inland maneuver. As no significant impacts (including cumulative) result from continuing ongoing training and a loss of military readiness would result if it were imposed, this alternative is not preferred.

- **Reduced land use** [not illustrated]**:** Some small-unit training currently conducted on Tinian feasibly be conducted on Guam and therefore could theoretically be discontinued on Tinian. However, with only a single training venue, the value of training would be decreased for Guam-based forces, as training at a variety of sites is

[6] See the EAs for Tandem Thrust 93 and Tandem Thrust 95.

necessary to challenge unit leaders and their personnel in making tactical decisions on unfamiliar terrain.

Training of battalion-sized maneuver forces and similar sized organizations require substantial land/sea/air spaces. This type of training, as well as large-scale joint training with amphibious assault, is not feasible on Guam because of insufficient land area available for training. The Tinian land leased for training and multiple use with training is the only such area in the Marianas. Any reduction in training land use on Tinian would reduce this unique training capability. As no significant impacts (including cumulative) result from continuing ongoing training, this alternative is not preferred.

- **Preferred alternative:** This alternative consists of using Tinian land for activities identified in black and green on Figures 2-1a and 2-1b, with approximately 40 percent of the EMUA constrained from use of certain vehicles and equipment (Figure 2-7). This alternative meets the purpose and need for training, although with substantial restrictions on amphibious vehicle landings and with mortar fire restricted to blank rounds only.

  This alternative will reduce the likelihood of BTS introduction by providing long-term storage of vehicles and equipment on Tinian, thereby reducing the volume of material shipped from Guam for each exercise.

  This alternative will allow destruction of some coral by AAVs landing at a single beach with approximately one percent live coral coverage on its reef flat. The impact will be minimized to a maximum of 35 m^2 poor quality coral, by restricting AAVs to a narrow approach corridor. Beaches used for AAV and LCAC landings will be monitored for unpredicted impacts on natural resources; if significant impacts are identified, damaging activities will be suspended while supplemental impacts analysis is performed and procedures are modified.

- **Maximum land use:** This alternative would consist of using Tinian land for all activities illustrated in Figures 2-1a and 2-1b, with no restrictions on land use for training in the EMUA. This alternative would meet the purpose and need for training, as it would include live mortar fire and full-scale amphibious assault landings.

  This alternative would generate a new UXO-contaminated area, with public safety hazards which could not be fully mitigated without establishing a permanently fenced-off impact area. It would also impact larger areas of offshore reef at Unai Babui, Unai Chulu, and Unai Dankulo, as AAV landings would not be restricted to a single narrow corridor.

The **environmentally preferred alternative** is the Preferred Alternative, as it does not generate any significant impacts which cannot be mitigated and as sufficient training is possible to meet the purpose and need.

2.8.2 Waterfront Annex

Alternatives for military training areas at the Waterfront Annex are illustrated in Figures 2-2a and 2-2b. The alternatives are compared below and in Table 2-6 with regard to whether they meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.3; a summary comparison of the alternatives follows:

- **No new action** (continuing action): This alternative would continue using the Waterfront Annex for the Guam-based small-unit activities shown in black on Figure 2-2a. This alternative would largely meet the purpose and need for training, failing only to provide a site for fire-and-maneuver training and AAV landings (which may be possible on Tinian). In comparison to the Preferred Alternative, this alternative would result in fewer locations supporting a given number of training evolutions, instead of providing multiple sites to be used at a lower intensity.

  Analysis in Chapter Four indicates that this alternative does not have any significant impacts which cannot be mitigated to non-significance. Although continued underwater detonation of 10- and 20-lb charges has been controversial, there is no evidence of significant impacts on endangered species from this activity. The socioeconomic impacts of related temporary harbor closures could be partially mitigated by establishing a more effective public notification system.

- **No training land use** [not illustrated]**:** This alternative would fail to meet the purpose and need for military training in the Marianas with regard to many small-unit water-related exercises, special forces aviation training, underwater demolitions training, and small arms qualifications training. Apra Harbor is the only sheltered water in the Marianas able to be easily secured by military personnel during underwater demolitions training. It is the home base of EOD and SEAL units which must train constantly to maintain a high skill level at high-risk tasks and need training areas close at hand.

  As no significant impacts (including cumulative) result from continuing ongoing training and because a loss of military readiness would result if No Training were imposed, this alternative is not preferred.

- **Reduced land use** [not illustrated]**:** Most activities currently conducted at the Waterfront Annex are not feasible at other training areas, particularly others on Guam. The most controversial land use is underwater demolition in Apra Harbor. This training is essential to the omissions of the EOD unit based on Guam and cannot be eliminated. The only reduced land use which would meet the purpose and need would be eliminating training duplicated elsewhere, i.e., eliminating one of the two LCAC landing locations and eliminating live fire (also available at the Finegayan Communications Annex). [The AAFB small arms range does not duplicate the capabilities of the Orote Point range.]

  No significant impacts result from LCAC landings at Polaris Point, so there is no environmental advantage to eliminating it and only using Drydock Island (where

LCU landings and inert mine stripping also take place). Eliminating the small arms range at Orote Point would eliminate an over-water SDZ (which represents theoretical public safety hazards), but the Communications Annex range cannot be scheduled to provide all training required by units on Guam. Because no significant impacts result from ongoing training, this alternative is not preferred.

- **Preferred alternative:** This alternative consists of using the Waterfront Annex for activities identified in black and green on Figure 2-2a, with approximately 20 percent of Orote Point and 5 percent of Outer Apra Harbor waters constrained from full training availability (Figure 2-8). This alternative meets the purpose and need for water-related aviation and demolition training, small arms fire, and localized amphibious landings without inland maneuver capability.

  This alternative will lower the intensity of use of any particular site by providing multiple locations for several training activities. The socioeconomic impact of closing Apra Harbor for underwater demolitions will be mitigated by preferentially using a new site outside the harbor (Dadi Beach) for such exercises whenever possible. Concerns about potential impacts of underwater demolitions on endangered sea turtles and other marine species in the harbor will also be relieved by the presence of a second underwater demolition site outside the harbor. Potential impacts of LCAC landings at Dadi Beach will be monitored for unpredicted impacts on natural resources; if significant impacts are identified, damaging activities will be suspended while supplemental impacts analysis is performed and procedures are modified.

  This alternative will expand the theoretical SDZ offshore of Orote Point, as the proposed fire-and-maneuver range has a much broader SDZ than existing ranges. The actual public safety hazard is very small, as the live fire ranges are all backed by a 20-m-high cliff.

- **Maximum land use:** This alternative would consist of using 4 additional Waterfront Annex beaches for shallow water mine countermeasures training and one additional location AAV landings (shown in red on Figure 2-2a) with no restrictions on land use. This alternative would also meet the purpose and need for training.

The **environmentally preferred alternative** is the Preferred Alternative, as it does not generate any significant impacts which cannot be mitigated, reduces the frequency of underwater demolitions training within Apra Harbor, and provides sufficient training areas to meet the purpose and need for certain types of training.

2.8.3 Ordnance Annex

Alternatives for military training areas at the Ordnance Annex are illustrated in Figure 2-3. The alternatives are compared below and in Table 2-7 with regard to whether they meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.4; a summary comparison of the alternatives follows:

- **No new action** (continuing action): This alternative would continue using the Ordnance Annex for the activities shown in black on Figure 2-3. This alternative would fail to meet the need for special purpose ranges (jungle trail, sniper) and a breaching house being made available to the SEALs based on Guam. No other DoD-controlled land on Guam is large enough to contain the SDZ of a sniper range.

  This alternative does not have any significant impacts which cannot be mitigated to non-significance.

- **No training land use** [not illustrated]**:** This alternative would fail to meet the purpose and need for various ground maneuver training which requires rugged, forested land. Army Reserve and National Guard units based on Guam depend on the Ordnance Annex for much of their training and do not have funds to travel off-island for all their training needs.

  As no significant impacts (including cumulative) result from continuing ongoing training and because a loss of Guam-based military readiness would result if No Training were imposed, this alternative is not preferred.

- **Reduced land use** [not illustrated]**:** Elimination of any training land use would be randomly based, as ongoing training generates no significant impacts and no controversy. There is no reason to eliminate any ongoing activities, and doing so would fail to meet the purpose and need. Therefore, this alternative is not preferred.

- **Preferred alternative:** This alternative consists of using the Ordnance Annex for activities identified in black and green on Figure 2-3, with approximately 50 percent of the total land area constrained from full training availability (Figure 2-9). This alternative meets the purpose and need for training and does not generate any significant impacts which cannot be mitigated to nonsignificance.

  The proposed sniper range has been configured and constrained so that its SDZ will not intersect an existing hiking trail which passes within the Ordnance Annex. Large areas of the Ordnance Annex are constrained NCRD and NWD, to continue the protective isolation of endangered species and archaeological resources.

- **Maximum land use:** This alternative would consist of expanding ground maneuvers and adding additional firing and target positions to the proposed sniper range. Significant impacts would become possible, primarily due to overlap of the sniper range SDZ with the hiking trail. This alternative would meet the purpose and need for training.

The **environmentally preferred alternative** is the Preferred Alternative, as it does not generate any significant impacts which cannot be mitigated, and provides sufficient training areas to meet the purpose and need for certain types of training.

2.8.4 AAFB and Communications Annexes

Alternatives for military training areas at AAFB and the Communications Annex are illustrated in Figure 2-4. The alternatives are compared below and in Table 2-8 with regard to whether they

meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.5; a summary comparison of the alternatives follows:

- **No new action** (continuing action): This alternative would continue using AAFB and the Communications Annex locations for the field maneuver, aviation, EOD demolition, and live fire training shown in black on Figure 2-4. This alternative would largely meet the purpose and need for training.

  Analysis in Chapter Four indicates that this alternative does not have significant impacts which cannot be mitigated to non-significance. The impact of aviation noise on endangered Marianas crows is not well understood, despite a three year USFWS study. Protective measures recently negotiated with the USFWS consist of limiting how low aircraft may fly over known crow territories, particularly during crow nesting season.

- **No training land use** [not illustrated]**:** This alternative would fail to meet the purpose and need for training in the Marianas, particularly with regard to aviation training.

  As no significant impacts (including cumulative) result from continuing ongoing training and because a loss of military readiness would result if No Training were imposed, this alternative is not preferred.

- **Reduced land use** [not illustrated]**:** This alternative could theoretically consist of eliminating any of the ongoing training activities, none of which have significant impacts. Aviation training at Northwest Field has been controversial in the past, due to the presence of endangered Mariana crows. FCLP has been discontinued in this area (a reduced land use in the recent past) and crows no longer are nesting in the vicinity of Northwest Field. Recently instituted protective measures ensure that any crow territories discovered in the area would be avoided by overflights.

  Because no significant impacts result from ongoing training, this alternative is not preferred.

- **Preferred alternative:** This alternative consists of using AAFB and the Communications Annex for activities identified in black and green on Figure 2.4, with over 40 percent of AAFB constrained from full training availability (Figure 2-10). This alternative is different from No New Action only in three activities: rapid runway repair, firebucket offload, and using mortar training rounds at the AAFB small arms range. None of these will have significant impacts. Rapid runway repair at Northwest Field will not occur on a potentially historic runway but on an adjacent taxiway (see Section 4.4.2.1). This alternative meets the purpose and need for military training.

- **Maximum land use:** No other training use of AAFB or the Communications Annex is proposed, beyond the uses included in the Preferred Alternative.

The **environmentally preferred alternative** is the Preferred Alternative, as it does not generate any significant impacts which cannot be mitigated and provides sufficient training areas to meet the purpose and need for certain types of training.

2.8.5 FDM

Alternatives for military training areas at FDM are illustrated in Figure 2.5. The alternatives are compared below and in Table 2-9 with regard to whether they meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.5; a summary comparison of the alternatives follows:

- **No new action** (continuing action): This alternative would continue using FDM for aerial bombardment and naval gunfire activities identified in black on Figure 2-5. This alternative would largely meet the purpose and need for training, failing only to provide live fire ranges for mortars, anti-tank, and mobile TOW missiles. This alternative is similar to the Preferred Alternative except it lacks mitigating restrictions on target placement.

  This alternative would have significant impacts on a small number of endangered Micronesian megapodes, if any breeding population remains on the island. This alternative would also result in mortality to seabirds which nest all over FDM. It would not impact endangered sea turtles, as no viable nesting beaches exist on the island. This alternative would meet the purpose and need for training other than crew-served weapons, but would not include mitigative measures and therefore is not preferred.

- **No training land use and reduced land use** [not illustrated]**:** These alternatives would consist of no aerial bombardment or bombardment using only inert munitions, and would fail to meet the purpose and need for training carrier battle groups and air combat command elements responding to deployment needs in the Pacific.

  Because a major loss of military readiness would result if No Training Land Use were imposed, these alternatives are not preferred.

- **Preferred alternative:** This alternative is similar to No New Action. Training activities and ordnance delivery will remain unchanged but will be more frequent than in recent years (although less frequent than in the 1970s). This alternative requires aircraft to avoid targeting the eastern cliffs, the isthmus area, and the northern end of the island, offering some protection to birds nesting in those areas. It meets the purpose and need for training except for training with crew-served weapons.

  This alternative will have significant impacts on any endangered Micronesian megapodes attempting to breed on the island. It will result in mortality to seabirds nesting on the plateau and western cliffs. Compensatory mitigation includes eradicating rats on FDM and enhancing megapode habitat on another island.

- **Maximum land use:** This alternative was originally proposed to include a ground-based range for artillery, mortars, anti-tank missiles, and .50 caliber sniper rifles, none of which can be used elsewhere in the Marianas. Those activities are no longer feasible, as submunitions were discovered scattered over the surface of FDM late in 1996. This alternative would meet the purpose and need for such training, but would have significant impacts on personnel health and safety. Therefore, it is not preferred.

The **environmentally preferred alternative** is no training land use, which fails to meet even minimal training needs of carrier battle groups and air combat command.

2.8.6 Non-DoD Lands

Alternatives for military training areas on non-DoD lands are illustrated in Figures 1-1 and 2-6. The alternatives are compared below with regard to whether they meet the purpose and need, have significant impacts which can be mitigated to non-significance, and have significant impacts which cannot be mitigated to non-significance. Detailed impact evaluations are provided in Section 4.6.

2.8.6.1 Guam

- **No new action** (continuing action): This alternative will continue using private land near NASA Road in Talofofo for paradrops. This alternative would meet the purpose and need for National Guard training and is performed in accordance with a lease with the landowner. There are no significant impacts.
- **No training land use:** This alternative would fail to meet the National Guard's need for such training. As no significant impacts result from continuing ongoing training and because a loss of military readiness would result if No Training were imposed, this alternative is not preferred..
- **Reduced land use:** Reduced land use is the same as No Training.
- **Preferred alternative:** The preferred alternative is to continue the ongoing training (i.e., No New Action).
- **Maximum land use:** This alternative would consist of performing riverine training on the Talofofo River. There is not enough data to evaluate potential impacts on archaeological resources which may exist in training areas. This training would require leases which may be difficult to obtain. This alternative would meet the purpose and need for training, but is not economically feasible to pursue.

The **environmentally preferred alternative** is No New Action.

2.8.6.2 Rota

- **No new action** (continuing action): This alternative would continue using a small island in Songsong Harbor for a small forward staging base (shown in black on Figure 2-6). This alternative would largely meet the purpose and need for training,

failing only to provide an additional NVG training area closer to Guam than the Tinian NVG site.

Analysis in Chapter Four indicates that this alternative does not have any significant impacts which cannot be mitigated to non-significance.

- **No training land use** [not illustrated]**:** This alternative would fail to meet the purpose and need for the SEALs to have a support base for training on FDM and Tinian. As no significant impacts (including cumulative) result from continuing ongoing training and because a loss of military readiness would result if No Training were imposed, this alternative is not preferred..
- **Reduced land use** [not illustrated]**:** This would be the same as No Training.
- **Preferred alternative:** The preferred alternative is No New Action.
- **Maximum land use:** This alternative would consist of performing NVG training at Rota Airport. Impacts of this training on Mariana crows and fruit bats cannot be assessed without additional long-term study. This alternative would meet the purpose and need for training.

The **environmentally preferred alternative** is No New Action, as it does not generate any significant impacts which cannot be mitigated and provides sufficient training areas to meet the purpose and need for certain types of training.

2.8.7 Preferred Alternative: Impacts and Mitigations

The Preferred Alternative accomplishes all training required to meet the purpose and need for Marianas training, while mitigating most potentially significant impacts to nonsignificance. The Preferred Alternative provides land areas to meet all the units' basic training requirements except for field firing ranges for the following weapon systems:

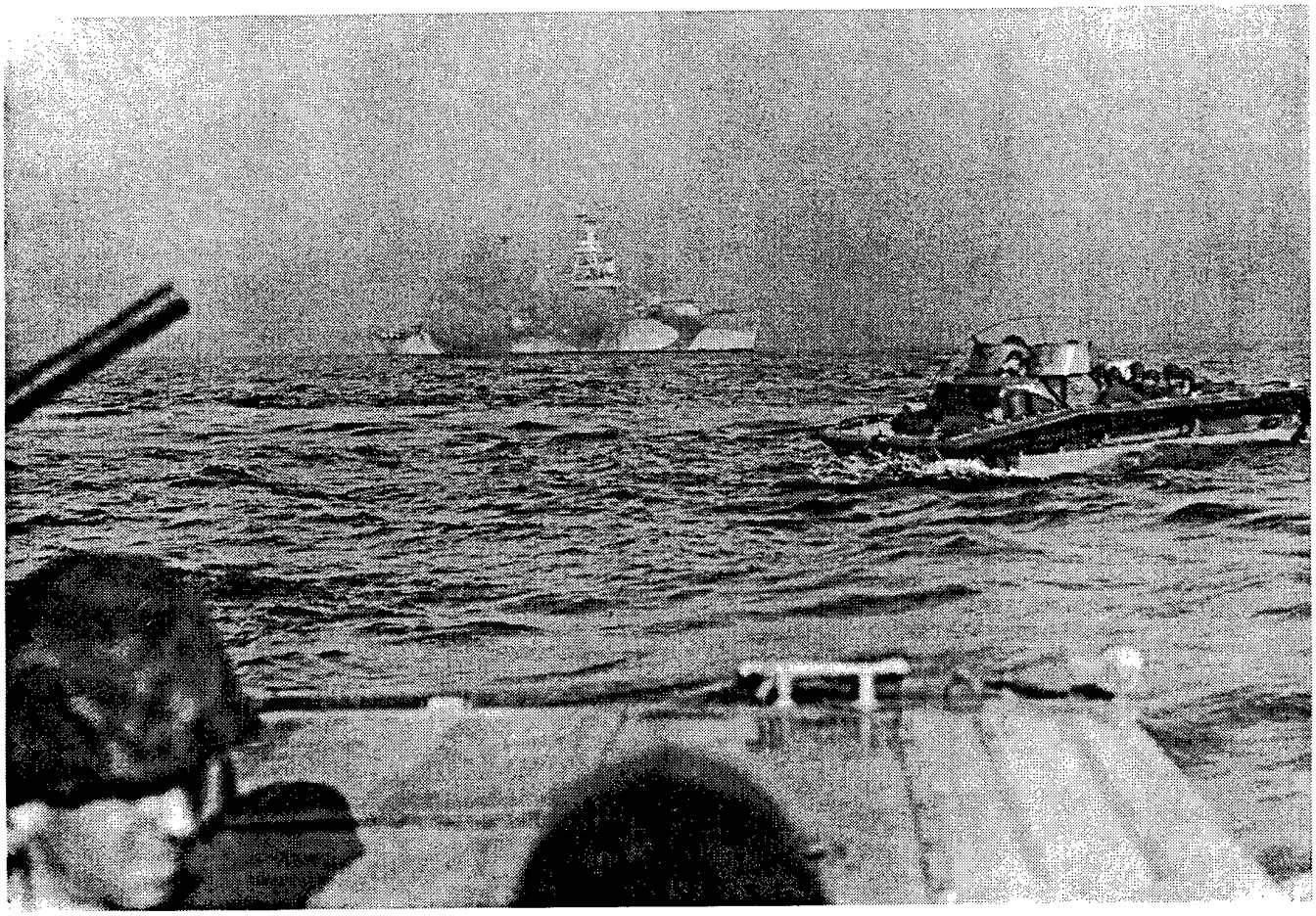
- .50 caliber sniper rifle
- .50 caliber machine gun
- 60mm and 81mm mortar ranges except with 60mm training projectiles
- 40mm grenade (except with training projectiles)
- Moving target ranges for LAV, AAV, and M1A1 tanks.
- Antitank shoulder-launches and mobile TOW missiles (other than AT-4 fire from raiding craft)
- Field artillery

These requirements must be met on the U.S. mainland or in Hawaii, or conducted during combined exercises on foreign soil as diplomatic situations, deployments, and annual training schedules allow.

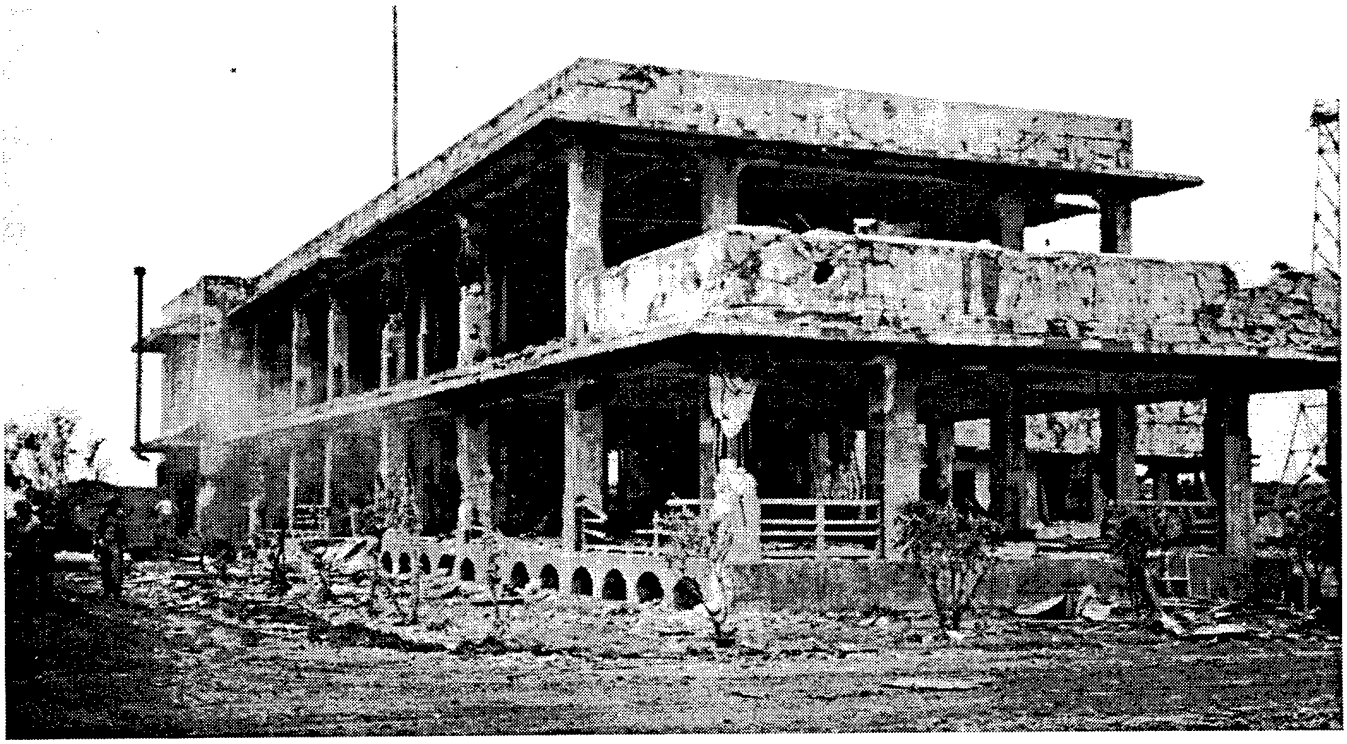
The Preferred Alternative (itemized in Table 2-10 and illustrated by the black- and green-labeled land uses on Figures 2-1 through 2-6) will have one significant impact which can only be mitigated by compensatory mitigation:

- Bombardment of FDM is likely to harm, harass, or kill individual endangered or migratory birds.

Table 2-11 provides a detailed list of both significant and nonsignificant potential impacts, together with proposed mitigation measures.



Naval gunfire support to amphibious forces, Tinian, 1944 (National Archives at College Park)



Japanese Command Post, Tinian, after U.S. landing, 1944 (National Archives at College Park)

CHAPTER THREE

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

3. ENVIRONMENTAL SETTING

The purpose of this chapter is to provide adequate background for the reader to understand the potentially significant impacts of alternatives compared in Chapter Two. Chapter Four provides a more detailed discussion of conditions relevant to the significant issues identified.

3.1 REGIONS OF INFLUENCE

The Mariana Islands are a chain of 15 volcanic islands in the western Pacific Ocean, roughly 5,790 kilometers (km) west of Hawaii and 2,250 km south of Japan. The island chain extends approximately 800 km, from Guam in the south to the uninhabited active volcano of Farallon de Pajeros in the north. Guam is approximately 52 km long with a land area of 542 square kilometers (km^2); Tinian is about 20 km long and has a total land area of 105 km^2; Rota is 19 km long and has a land area of about 83 km^2; and Farallon de Medinilla (FDM) is approximately 1.6 km long and has a land area of 0.9 km^2.

The primary regions of influence are the military lands on each of these islands or areas that will be directly affected by military training activities (see Figures 1-1, 2-1 thru 2-6). Secondary regions of influence include community or habitat areas surrounding the primary regions.

3.2 PHYSICAL ENVIRONMENT OF THE MARIANA ISLANDS

This section presents a general overview of the physical environment of the Mariana Islands, including climate, geology, hydrology, water quality, air quality, noise, visual setting/aesthetics, and natural hazards and constraints. Some details specific to each island of concern are also presented when appropriate.

3.2.1 Climate

The climate in the Marianas is generally warm and humid throughout the year, although rainfall and wind conditions vary with the seasons. Average temperatures range from 29° to 32° C during the day and 21° to 24° C in the evenings. Relative humidity is about 65 to 75 percent in the afternoons and 85 to 100 percent at night. Two primary seasons, the dry and wet seasons, are separated by periods of transitional weather. The dry season (mid-January through July) is characterized by very little rainfall and consistent trade winds blowing from the east to northeast at 24 to 40 km per hour (kph). May, June, and July are the driest months of the year. The rainy season (August through mid-January) features heavy winds and rains with occasional typhoons and tropical storms.[1]

[1] Personal communication with Gil Borja, CNMI Department of Public Safety, May 21, 1996.

3.2.2 Geology and Hydrology

The Marianas are volcanic islands developed west of the Mariana Trench, an active subduction zone where one section of the ocean crust is pushed beneath another. Coralline limestone covers much of each island, in some cases in a layer several hundred meters thick. Soils developed on volcanic rock tend to be poorly drained clays, while soils developed on limestone are usually shallow and highly porous. Surface water bodies and streams can only exist in regions with enough clay to prevent water from draining through to the porous rock below.

Tinian. Almost no volcanic rock is exposed on Tinian; its topography consists of a series of limestone plateaus and rocky shoreline cliffs. The highest point on the island is 178 m above mean sea level. There are no streams and only a few small surface water bodies on Tinian. Tinian has an aquifer of fresh water in the older limestone unit in the south-central portion of the island and may have a smaller aquifer in the north.[2]

Guam. The northern half of Guam is covered by a limestone plateau. The plateau elevation ranges from 90 to 180 meters (m) above mean sea level (MSL) and drops to the shoreline in steep cliffs. Rainwater easily percolates through the limestone, recharging Guam's only drinking water aquifer, the Northern Lens Aquifer. In the southern portion of Guam, bedrock is mostly volcanic rock with clay soils on top. Streams have carved this half of the island into a rugged mountainous region; its highest peak is Mount Lamlam (407 m MSL) near the southwest coast. No significant groundwater aquifer has been identified here. The two halves of the island are joined by a transition region of hilly terrain and mixed limestone and volcanic rock.

FDM. Although there is no published information on FDM's geology or hydrology, the island is expected to be similar to Guam, Tinian, and Rota. Because FDM has no surface water bodies, it is suspected to be completely covered by limestone and related porous soils. The existence or extent of any freshwater aquifer is unknown.

Rota. Rota is best depicted as a series of limestone terraces surrounding a volcanic core which protrudes slightly above the top terrace as Mount Manira (496 m MSL). Volcanic rock is also exposed along the south and southeast slopes of the island, an area known as the Talakhaya, where all the surface drainageways are located. A perched aquifer appears to be under the Talakhaya which gives rise to Rota's two main water sources, the Matanhanom and As Onaan springs.[3] A basal lens of fresh to brackish water is also known to exist on the central north coast.[4]

[2] David B. Doan, Harold W. Burke, Harold G. May, and Carl H. Stensland (1960) *Military Geology of Tinian Mariana Islands.* Prepared under direction of the Chief of Engineers, U.S. Army.

[3] Juan C. Tenorio & Associates, Inc. (December 1995) *Physical and Economic Master Plan for Rota.* Prepared for The First Senatorial District of Rota and the Department of Public Works.

[4] Tom Nance Water Resource Engineering and Belt Collins Hawaii (June 1994) *Groundwater Monitoring Plan SNM Rota Island Resort.* Prepared for SNM Corporation.

3.2.3 Water Quality

Marine waters. Marine water quality around the Mariana Islands is good. Various locations in Tinian Harbor are tested monthly for fecal coliform. There have been five incidents of coliform violations due to fishing boat discharges into the harbor in the past two years. Guam's ocean water quality is relatively good, with the exception of locations close to river mouths or sewage treatment outfalls. Guam beaches are tested weekly using biological parameters.[5] Several beach and harbor areas on Rota are tested quarterly for fecal coliform. There have been seven incidents of coliform violations recorded in the past two years. These violations are due to town drainage system discharges into the ocean. No testing is done on FDM, which is uninhabited.[6]

Ground- and surface waters. Ground and surface water quality in the Marianas, in general, is good. Groundwater aquifers on Tinian and Rota are vulnerable to contamination by substances introduced onto the soil surface because the porous soil and underlying limestone do not significantly impede the passage of contaminants to the shallow aquifers. Guam's groundwater is relatively free from point source pollutant discharges that are usually associated with larger land masses. This results in water quality remaining at a consistently high level island wide. Groundwater in the northern aquifer is protected from surface contamination by natural filtration through hundreds of feet of coralline limestone.

Guam's surface waters are vulnerable to contamination from sewage disposal overflows and animal wastes carried into streams during periods of heavy rainfall. Inland surface water bodies are of highest quality, whereas coastal regions contain surface water bodies of medium to low quality.[7] The surface water bodies on Tinian and Rota are similarly vulnerable to contamination.

3.2.4 Air Quality

Favorable meteorological conditions, i.e., the nearly constant trade winds, maintain generally good air quality on all islands. Guam is generally free from serious air pollution; trade winds prevent accumulation of a significant amount of pollutants in Agana-Tamuning metropolitan area and the airport. However, there are nonattainment areas associated with power plant operation at Piti, Cabras, and Tanguisson.[8] Tinian and Rota have no significant sources of atmospheric emissions at this time.

3.2.5 Noise

The primary sources of noise in the Marianas are aircraft, traffic, and industry. The sources of noise on Tinian are aircraft and vehicular traffic. The north end of the island, including the

[5] Personal communication with H. Victor Wuerch, GEPA, March 4, 1996.

[6] Personal communication with Edna Buchan, CNMI DEQ, March 5, 1996.

[7] GEPA (January 1992) Revised Guam Water Quality Standards.

[8] The U.S. EPA has designated the areas within a two-mile radius of the Piti, Cabras, and Tanguisson power plants as a nonattainment area for SO_2, and therefore, is subject to more stringent emission control requirements. The Orote Power Plant is not located in a nonattainment.

EMUA, is in the landing approach for Saipan's airport and is subject to periodic elevated noise levels from low-altitude jet aircraft throughout the day. Noise on Guam is generated by aircraft and generic traffic and industrial noise sources in the Agana-Tamuning metropolitan area. Noise from aircraft, power plant, and vehicular traffic on Rota is limited. The only source of noise on the uninhabited FDM is periodic military bombardment and aircraft overflights.

3.2.6 Visual Setting/Aesthetics

The islands visual settings are defined by the ocean and local topographic features. Various hills and cliffs provide vantage points of the ocean and coastline areas. Tinian's built environment is sparse and is concentrated in the southwestern portion of the island. In most areas, the visual setting consists of fields and wooded areas covering the relatively gentle topography. Small beaches occur intermittently around the island, and several ridges provide a backdrop to many views. Tinian's most notable physical attraction is a blowhole on the northeast coast.

On Guam, large expanses of undeveloped land exist in the northern and southern regions, while the built environment tends to dominate the visual setting in urban and suburban areas in the central part of the island. Steep cliffs edge the northern half of the island, while mountains and hills serve as backdrop to the central and southern areas.

On Rota, beaches line the northern coast of the island, and coral reefs can be found just offshore on the southwestern coast. Steep cliffs define the southern coast while gentle hills connect the southern plateau, known as the Sabana, to the northern plateau. Much of Rota is covered with vegetation and rural/agricultural land. Except for a few towns, the airport, and the increasing resort development in the northern region, very little urbanization has occurred. Most of Rota's built environment is concentrated in Songsong Village on the narrow isthmus connecting Mount Taipingot to the rest of the island.

The outline of FDM is defined by steep cliffs that drop off into the ocean. The base area of these cliffs have eroded in several places leaving behind large caverns. The northern half of the island is relatively flat and covered with vegetation. The southern portion is rocky with some vegetation. FDM has few beach areas and is completely undeveloped.

3.2.7 Natural Hazards and Constraints

The primary natural hazards are typhoons and earthquakes. The Marianas are in a typhoon belt and are frequently subjected to the powerful winds and heavy rains that characterize these storms. The typhoons are most common during the rainy season, with high winds in excess of 39 kph extending out more than 160 km from the center of a storm.

The Marianas are also in a seismically active area. The nearby Mariana Trench is a low point in the ocean floor where two sections of the ocean floor collide and one slides beneath the other, causing periodic earthquakes. Earthquakes of low magnitude occur throughout the year.

3.3 BIOLOGICAL ENVIRONMENT OF THE MARIANA ISLANDS

Several endangered species and their primary habitats occur in the Mariana Islands at or near the proposed training sites. Native species of concern on the islands of Guam, Tinian, Rota, and FDM include endangered birds, an endangered bat, threatened and endangered sea turtles, and endangered plants. There are no designated critical habitat areas in the Mariana Islands. Primary habitats for these endangered species include wetlands, native limestone forests, coral reefs, and beaches. In some cases, primary habitat for an endangered species may occur on more than one island, since some species occasionally migrate or recruit between islands.

The major terrestrial habitat types common to the Mariana Islands include limestone and ravine forests, secondary growth forests, savanna, tangantangan stands, open weedy areas, wetlands, and strand vegetation. The major marine habitat types include shoreline and strand vegetation, beaches, coral reef, and benthic communities.

Native species are those which occur naturally in a defined area. They are either endemic, meaning they are found only in one locale (such as on one island), or indigenous, meaning they are found in more than one geographic location (such as throughout the Pacific). Populations of various native species have declined or become extinct on these islands for many reasons, including historical poaching pressure, the loss and modification of habitat, noise disturbance, and predation, all of which have resulted in mortality, decreased nesting success, and reduced reproductive success. The greatest threat to terrestrial endangered species on the Mariana Islands is the brown tree snake (BTS) (*Boiga irregularis*). The BTS has reached very high densities on Guam and caused the population decline and, in some cases, extinction of many of Guam's birds, lizards, and bats. The potential for this snake to be introduced to other islands, including Tinian, Rota, FDM, and Hawaii, is high and would have catastrophic results. The BTS is discussed in more detail in Section 3.3.2.4.

An overview of biological resources of the islands of Guam, Tinian, Rota, and FDM is given below. A list of rare and protected native species in the Marianas is provided in Table 3-1.

3.3.1 Tinian

3.3.1.1 Habitat

The terrestrial vegetation community of Tinian has been disturbed during the last 300 years by both man-made and natural forces. Although historical evidence is sparse, it appears that in the late 1700s and 1800s, Tinian was densely covered with thicket. In the 1920s, the Japanese cleared most of Tinian to plant sugar cane. The cane plantations were abandoned during the intense military actions of World War II. Aerial photographs reveal that World War II bombing, fires, and military reconstruction reduced the amount of native limestone forest on Tinian so that by 1945 it represented less than four percent of the total vegetation cover. The most conspicuous change between 1946 and 1980 was the enormous increase in the introduced weedy tangantangan.

Fire is an existing periodic threat to habitat on Tinian. In addition to being a direct threat to individuals of protected species, fire has the potential to destroy vegetation and expose soil, making areas vulnerable to encroachment by undesirable species and reducing their usefulness as wildlife habitat. Since active firefighting is not practiced in all areas due to limited accessibility and few municipal firefighting resources, some fires are allowed to just burn out, which can take three to four days. Fires on Tinian may be the result of the local method of clearing forested land for grazing (i.e., burning with inadequate controls), careless use of campfires or cigarettes, or military use of pyrotechnics. The worst fire hazard occurs during the driest months (May through July) of the dry season, when 1 km^2 or more may be burned each year.[9]

Vegetation on Tinian today is predominantly disturbed secondary growth. Secondary growth forests presently cover 19 percent of the island, in areas where primary vegetation has been disturbed. Tangantangan in solid, practically pure closed stands dominate most of the level and moderately sloping area of the island and serves as important habitat for endangered species and other native wildlife. Within the EMUA the predominantly tangantangan forest is interspersed with 6-foot-tall Guinea grass (*Panicum maximum*). Small areas of primary habitat, such as wetlands, limestone forest, beaches, seagrass beds, and coral reefs, also occur in the EMUA and LBA. No federally listed endangered plant species were identified in a thorough survey of the MLA in 1984,[10] but there are many plants scattered throughout the island that have medicinal use, such as the Polynesian arrowroot or gap-gap (*Tacca leontopetaloisa*).[11]

Native limestone forest patches are restricted to clifflines and escarpments around the plateaus on the southeast side of Tinian, and a narrow corridor on the escarpment that connects Mount Lasso with Maga (Figure 3-1). The remaining limestone forest on Tinian is an important refuge for endangered species.

There are three terrestrial wetland areas within the MLA.[12] The largest is Lake Hagoi, a freshwater marsh about 0.15 km^2 in extent, and the surrounding 0.18 km^2 depression, which is seasonally immersed and dried out. Lake Hagoi, the only major body of open water on Tinian, is an important habitat for the endangered Mariana common moorhen and for migratory birds, especially during the wet season.[13] It provides seasonally abundant food sources (e.g., invertebrates, seeds) for migratory and resident waterbirds, and nesting and foraging habitat for moorhens and native forest birds. There are also two much smaller wetlands, Mahalang and Bateha (see Figure 3-1), that are used by a small number of moorhens and migratory birds. The only other area considered a wetland on Tinian is Makpo Swamp, which is outside of the MLA. This wetland no longer supports open water or emergent vegetation.[14]

[9] Tinian fire records for 1990 and 1991 from Captain John Barsinas, Tinian Fire Department, May 15, 1996.

[10] Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.* Prepared for Commander, Pacific Division, Naval Facilities Engineering Command.

[11] Personal communication with Historic Preservation Office personnel, Tinian, February 8, 1996.

[12] Belt Collins Hawaii (November 1994).

[13] When surface water disappears from Lake Hagoi during dry years or during the dry season, the number of moorhens on Tinian is significantly reduced, sometimes to zero. [Source: USFWS (February 1996) *Characteristics of Mariana Common Moorhens and Wetland Habitats within U.S. Department of the Navy's Military Lease Area and Exclusive Military Use Area on the Island of Tinian, Commonwealth of the Northern Mariana Islands, July 1994-August 1995.* Prepared for the U.S. Department of the Navy, Pacific Division, Naval Facilities Engineering Command.]

[14] USFWS (February 1996).

Tinian has several beaches supporting shoreline and strand vegetation, and the waters around Tinian support seagrasses. Chaguan-tasi (*Enhalus acoroides)*, a large seagrass, is found at Unai Chiget (which has a marine wetlands system of less than 0.004 km^2), Puntan Lamanibot Sanhilo, and possibly Tachogna Beach. Most beaches serve as green sea turtle nesting areas. Seagrass beds are preferred feeding sites for sea turtles (see Figure 3-1).

3.3.1.2 Marine Environment

Marine fauna on Tinian includes 129 coral species, 84 species of marine benthic algae, other benthic species such as the spiny lobster (*Panulirus*) and the larvae of the coconut crab (*Birgus latro*),[15] as well as 246 species of fish.[16] Coral reef is developed around much of Tinian. In general, reefs on the western (leeward) coastline are better developed and have greater species diversity than those on the eastern (windward) coast that receive more physical force from breaking waves. Exceptions to this general rule are the high-quality coral reefs at Unai Dankulo on the windward side that are protected by a wide fringing reef, and the low-quality coral at Unai Babui on the leeward side, where there is no outer fringing reef to protect coral from wave energy (Appendix C). Local regulations prohibit harvesting of corals.

3.3.1.3 Rare, Threatened, and Endangered Species

The terrestrial fauna on Tinian includes birds, mammals, amphibians, and reptiles, some of which are indigenous or endemic to the island (see Table 3-1). Tinian has three extant federally protected bird species, one extinct bird, and one extirpated bird. These birds and two species of protected sea turtles are all on the CNMI Endangered Species List. The coconut crab is locally protected from harvesting by nonresidents, and the island is sometimes frequented by the Mariana fruit bat, which is also on the CNMI Endangered Species List and a candidate for federal listing. There have been five unconfirmed brown tree snake sightings on Tinian; one snake was spotted in February 1990, and four were spotted during one sighting in November 1995.[17] The locations of protected species that could potentially be impacted by proposed training activities are shown on Figure 3-1.

The five protected bird species that have been identified on Tinian are the endangered Mariana mallard, believed to be extinct due to overhunting and loss of wetland habitat; the endangered the endangered island swiftlet, which has not been seen on Tinian since 1976 and may be extirpated from the island. Mariana common moorhen; endangered Micronesian megapode; and the threatened Tinian monarch. Populations of the Mariana common moorhen have declined due to mortality and decreased nesting success caused by historical poaching pressure, the loss and

[15] Marine Research Consultants and Pacific Basin Environmental Consultants (1994) *Preliminary Assessment of the Nearshore Marine Environments Off Of Beaches on the Island of Tinian, CNMI.* Prepared for Belt Collins Hawaii.

[16] R.S. Jones, R.H. Randall, and R.T. Tsuda (1974) A candidate marine environmental impact survey for potential U.S. military projects on Tinian Island, Mariana Islands. Univ. of Guam Marine Lab. Technical Report 9.

[17] T.H. Fritts, M.J. McCoid, and D. Gomez (January 1997) *Assessing the Risk of Brown Tree Snakes On Saipan: Incidents of the Brown Tree Snake, Boigus irregularis, Dispersing to Saipan and Other Islands in the Commonwealth of the Northern Mariana Islands.*

modification of wetland habitat, the presence of humans, and predation.[18] The Micronesian megapode was confirmed in 1995 as still occurring on Tinian but is quite rare.[19] The only endemic species on the island, the Tinian monarch, is quite common despite its threatened status.[20] An August/September 1997 USFWS report tallied approximately 55,721 individuals on Tinian.[21]

No permanent fruit bat colony is believed to exist on Tinian, but the neighboring island of Aguijan (lying approximately 10 km southwest of Tinian Harbor) has a small, resident population. Notable numbers of fruit bats fly between islands in the southern Marianas on an irregular basis.[22] These interisland movements may represent dispersing juveniles or migrants responding to roost disturbances (such as poaching) or limited food availability. The fruit bat is reported to roost in large trees surrounding Lake Hagoi and along the clifflines and forest plateau south of Lake Hagoi near Mount Lasso (see Figure 3-1). It is also known in limited numbers elsewhere, including areas near the West Tinian Airport and the Carolinas Ridge. It is protected from hunting throughout the CNMI. It is proposed for listing as an endangered species on Tinian.

The threatened green sea turtle and the endangered hawksbill sea turtle have been observed in the vicinity of Tinian. The green sea turtle nests on Tinian's beaches. Successful nesting requires a deep sand beach with open ocean exposure and minimal disturbance. Green sea turtle nesting activity occurs as early as late January and ends in mid-July on most of Tinian's beaches. The hawksbill sea turtle is known to occur in offshore waters, but is not known to nest on the island. Although poaching of sea turtles and their nests has been and is still an ongoing problem on Tinian (half of all green sea turtle nests were thought to have been poached during the 1994 nesting season),[23] public education programs, better enforcement by local officials, and continuous monitoring of beaches during nesting periods has substantially reduced poaching of green sea turtle eggs. Sea turtle nesting beaches are protected and periodically surveyed by the CNMI Division of Fish and Wildlife.

3.3.2 Guam

Guam is distinct from Tinian, Rota, and FDM in being very intensively developed in some areas. Despite this development, habitat for both birds and mammals is still extensive on the island, especially in areas under protection by the Navy and Air Force. Protected areas on the island include the Guam National Wildlife Refuge areas, Government of Guam Conservation Areas, and military overlay units. The primary use of the overlay units is for the military mission, but these areas also serve secondarily as species habitat. Floral, faunal, and wetland surveys in the Ordnance Annex were completed by the Fish and Wildlife Service (FWS) in September 1996.

[18] USFWS (April 1996) *U.S. Fish and Wildlife Service Wildlife Research Report for Navy-leased Lands on the Island of Tinian, Commonwealth of the Northern Mariana Islands.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[19] USFWS (April 1996).

[20] USFWS (April 1996).

[21] Michael Lusk, Steve Hess, Michelle Reynolds, and Scott Johnson (September 1997) *Population Status of the Tinian Monarch (Monarcha takatsukasae) from the Island of Tinian, CNMI.*

[22] Gary J. Wiles and P.O. Glass (September 1990) *Interisland Movements of Fruit Bats (Pteropus Mariannus) in the Mariana Islands.* Atoll Research Bulletin No. 343.

[23] USFWS (April 1996).

3.3.2.1 Habitat

Today only 38 percent of Guam is forested. Much of the limestone forest acreage has been reduced by a variety of human and natural influences and converted to brush and grassland. Erosion is now a major problem in some areas.[24] A long history of island settlement, combined with more recent urbanization, fire, agricultural development, and the impacts of World War II, have all contributed to the alteration of Guam's forests, so they now contain various proportions of introduced species, mostly naturalized cultivars. The most suitable habitats for native fauna are native limestone and ravine forests. Wetlands also provide important habitat for native and migratory bird species. More disturbed areas, such as tangantangan stands or weedy fields, are less suitable as habitat for native fauna.

Limestone forests occur most frequently on the limestone plateau of northern Guam, which includes AAFB, Andersen South, the two Communications Annex sites, and the limestone of Orote Point. Relatively well-preserved and pristine native limestone forest growth occurs at AAFB and Orote Point; it contains 27 endemic and 7 rare plant species,[25] including the last individual fire tree on Guam (*Serianthes nelsonii*) at Ritidian Point. The limestone forest is an important refuge for endangered birds and bats (see Section 3.3.1.3). Southern Guam also contains areas of limited ravine forest and extensive open grasslands (savanna). The *Merrilliodendron* forest in southern Guam, which is a mixed limestone forest characterized by the *Merrilliodendron megacarpum* tree, supports populations of rare species, such as the Marianas eightspot butterfly.

The dominant introduced weedy species is tangantangan (*Leucaena leucocephala*), which is rumored to have been seeded from the air to revegetate the island after the U.S. invasion during World War II.

Aquatic habitats include rivers, freshwater wetlands, estuarine wetlands, and marine waters. Freshwater wetlands offer potential habitat for the endangered Mariana common moorhen *(Gallinula chloropus guami)* and for nonendangered native and migratory waterbirds. Estuarine wetlands, including mangrove swamps, provide nursery grounds for numerous marine and estuarine animals. The protection they provide is essential to the continued survival of many marine organisms.

Coastal vegetation on Guam includes coastal strand, which borders flat sandy beaches and contains sand-binding herbs and salt-tolerant vegetation. Coastal strand is found at the Waterfront Annex, in a thin band in Apra Harbor near the high tide line. Deep, sandy beaches (important for the successful nesting of sea turtles) are located at Ritidian Point, in the Marine Resources Preserve Shoreline at AAFB, and in Apra Harbor. The shallow coastal areas, reefs, and lagoons in these areas are frequented by sea turtles.

[24] The Guam EPA developed the *Guam Soil Erosion and Sedimentation Control Manual* in 1986, and is currently spending $750,000 on erosion control in the NAVACTS Ordnance Annex, in part to prevent the siltation of Fena Reservoir.

[25] Personal communication with Gary Wiles, Guam DAWR, July 1996.

Conservation areas include the Guam National Wildlife Refuge areas at Ritidian Point, Communications Annex, AAFB, Apra Harbor, and the Ordnance Annex; the Anao, Cotal, Bolanos, and proposed Falcona Beach Conservation Areas; and the Haputo and Orote Ecological Reserve Areas(ERAs)(Figure 3-2).

3.3.2.2 Marine Environment

Approximately 220 species of marine benthic algae, three species of seagrasses, 267 species of stoney corals, and 800 species of fishes inhabit the coastal waters of Guam.[26] Coral reef surrounds at least three-quarters of the island, including several areas in the Waterfront Annex vicinity.

3.3.2.3 Rare, Threatened, and Endangered Species

Currently, three plant, three mammal, 10 reptile, four invertebrates, and 18 bird species are listed as threatened or endangered by the federal and/or Guam territorial governments, although some of these are extinct on Guam (see Table 3-1). These threatened and endangered species have benefited from inhabiting military land which indirectly serves as a wildlife preserve because it has remained relatively undeveloped and has restricted access. The locations of protected species that could potentially be impacted by proposed training activities are shown on Figure 3-2.

The three plant species listed as endangered on Guam are the fire tree (*Serianthes nelsonii*), the ufa tree (*Heritiera longipetiolata*), and the tree fern (*Cyanthea lunulata*). The only known adult endangered fire tree is found in the limestone forest at AAFB. Threats to the survival of this tree include typhoons, herbivory by feral ungulates, insect infestations, loss of genetic diversity, wildland fires, and damage from other wildlife.[27] A recovery program is currently in effect for this species. The ufa plant is a rare endemic limestone forest plant found at AAFB, Orote Point, and the Ordnance Annex. The tree fern is found in the Ordnance Annex, mostly along the banks of the Emong River south of Fena Reservoir. *Drypetese dolichocarpa*, a rare plant, has only eight individuals remaining, all at AAFB.

Two bat species on Guam, the endangered little Mariana fruit bat (*Pteropus tokudae*) and the sheath-tailed bat *(Emballonura semicaudata)* (a species of concern), have not been sighted in approximately 20 years and are thought to be extinct on the island. If any colonies of these bats exist on Guam, it is likely that they would be in the limestone forest areas of the Ordnance Annex.[28] The remaining extant species, the Mariana fruit bat (*Pteropus mariannus*), which is federally endangered on Guam, number fewer than 400 individuals. Most of these bats aggregate at a roost site on Pati Point.[29] Other smaller roosts have been recorded in recent years along the northern cliffline between Ritidian and Pati points. A small number of bats (10 to 25 individuals) occur in the Ordnance Annex, foraging at night between Mount Almagosa and East Tower. The preferred habitats for the bat include inaccessible cliffline and native limestone and ravine

[26] University of Guam Marine Laboratory (1981) A Working List of Marine Organisms from Guam. Technical Report No. 70.

[27] USFWS and USAF with Guam DAWR *(November 1995) Integrated Natural Resources Management Plan for Andersen Air Force Base, Guam.*

[28] Personal communication with Gary Wiles, Guam DAWR, May 16, 1996.

[29] Wiles et al. (1995) *The Status and Distribution of Endangered Animals and Plants in Northern Guam.* Micronesia 28:31-49.

forests.[30] They are extremely sensitive to human disturbance and have been known to abandon their roosts at the slightest interference. Two of the most important reasons for the decline of these fruit bats have been poaching by local residents and predation by the BTS. Fruit bats are considered a gastronomic delicacy by the Chamorros, and although these bats are protected by law, illegal poaching still occurs. A 1991 poaching event at the last remaining bat roost on Guam reduced the population by 30 percent.[31] BTS are capable of preying on young bats, which are particularly vulnerable to predation because they are not yet able to fly and are too large to be carried by their mothers during nighttime foraging.[32] Several snakes have been captured or seen within 100m of the colony at Pati Point.

Endangered and threatened reptile species on Guam include two sea turtles, three geckos, and five skinks (see Table 3-1). Threatened green sea turtles use the beaches at the Waterfront Annex and AAFB for nesting. The green sea turtle nesting season is generally April through August. The hawksbill sea turtle nests only sporadically in Guam, between the months of May and October.[33] Currently, the primary threat to green sea turtles is habitat destruction, followed by poaching and nest predation by feral dogs and pigs. AAFB beaches and offshore areas have been protected from large-scale development and human activity. Current management programs include law enforcement, population surveys, tagging, and nesting studies. In the Ordnance Annex, the Pacific slender-toed geckos (*Nactus pelagicus*) and moth skink (*Lipinia noctua*) have been recently located by the National Biological Survey and the USFWS.[34] Both occur in substantial numbers (500 to 2000/ha).

Protected invertebrates on Guam considered to be rare are the endangered Mariana Islands fragile tree snail (*Samoana fragilis*), threatened Pacific tree snail (*Partula radiolata*), and the Marianas eightspot butterfly (*Hypolimnas octocula marianensis*), all of which occur in the Ordnance Annex. *Partula radiolata* also occurs in the valley behind Haputo Beach in the Haputo ERA, along with the Guam-endangered snail *Partula gibba*, which occurs in only two locations on the island.

The avifauna of Guam once included many native forest birds, waterbirds, seabirds, and numerous migrant species. Today, however, many of the native birds are experiencing severe population declines due to both human activities, such as habitat destruction, and brown tree snake predation. Native birds listed by the territory of Guam as endangered are the rufous fantail (*Rhipidura rufifrons*), Mariana fruit-dove (*Ptilinopus roseicapilla*), cardinal honeyeater (*Myzomela rubrata saffordi*), Micronesian starling (*Aplonis opacus guami*), white-throated ground-dove (*Gallicolumba x. Xanthonura*), wedge-tailed shearwater (*Puffinus pacificus*), and white-browed crake (*Porzana cinerea*). All of these species are presumed to be extinct on Guam with the

[30] BioSystems Analysis, Inc. (September 1990) *Natural Resources Management Plan: Naval Station, Guam.* Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[31] USFWS and USAF with Guam DAWR (November 1995).

[32] Gary Wiles, DAWR (November 1990) *Mariana Fruit Bat and Little Mariana Fruit Bat Recovery Plan.*

[33] Karen L. Eckert, Ph.D. (September 1991) *The Biology and Population Status of Marine Turtles in the North Pacific Ocean.*

[34] USFWS (December 1996) *Faunal Survey for the Ordnance Annex, Naval Activities, Guam.* Prepared for the Department of the Navy.

exception of the Micronesian starling, which is found on AAFB in the southeastern section near the base housing and is also found in the Anao Conservation Area to the south.

Federally listed endangered native birds presumed to be extinct on Guam include the bridled white-eye (*Zosterops conspicillatus conspicillatus*), Micronesian megapode (*Megapodius laperous*), Guam broadbill (*Myiagra freycineti*), nightingale red-warbler (*Acrocephalus luscinia*), and Mariana mallard (*Anas oustaleti*). The Micronesian kingfisher (*Halcyon cinnamomina*) and Guam rail (*Rallus owstoni*) are probably extirpated from the wild but are the subject of captive breeding programs.[35]

Federally listed native birds still known to occur on the island are the endangered Mariana crow (*Corvus kubaryi*), island swiftlet (*Aerodramus vanikorensis bartschi*), and Mariana common moorhen. The Mariana crow (endemic to Guam and Rota) is estimated to have a current Guam population of fewer than 12 individual crows restricted in distribution to AAFB, mostly occurring in the MSA and East to Pati Point. The exact population includes four birds that are survivors of a group of six captive crows that originated on Rota and were transferred to Guam from the National's Zoo's Conservation and Research Center in Front Royal, Virginia and the Houston Zoo and released into the wild.[36] Crows have not been recorded from southern Guam since the 1960s or 1970s. The island swiftlet occupies limestone caves in the COMNAVMARIANAS Ordnance Annex, located southeast of Fena Reservoir near the Bonya River and the Maemong River drainage area and also in the Talafofo River Valley. Swiftlets are found in the Fachi Cave, but the Mahlac Cave harbors the most significant colony of swiftlets on Guam. Approximately 300–350 individuals remain on the island.[37]

The complex of marshes, ponds, and mangrove swamps near the entrance to Apra Harbor provides breeding, nesting, and foraging habitat for the Mariana common moorhen. No moorhens are found on the Atantano River, but approximately one-quarter mile due east of Atantano River and Marine Drive,[38] they are found in man-made wetlands at the Shell and Island Equipment businesses. This area, one of Guam's three primary habitats for the Mariana common moorhen, is considered to have the highest habitat quality of the primary moorhen sites.[39] However, these wetlands dry out seasonally, forcing the birds to move to permanent water sources, such as Fena Reservoir, the largest of four moorhen-supporting wetlands in the COMNAVMARIANAS Ordnance Annex. The southern half of the reservoir is a moorhen sanctuary, and is also used by several species of migratory shorebirds and waterbirds. Moorhens also occasionally use two small wetlands to the east and one to the northwest of the reservoir. Both the Fena Reservoir and the Waterfront Annex marsh were identified in the 1992 Mariana common moorhen recovery plan as areas that should be secured and managed as primary moorhen habitat.

[35] BioSystems Analysis, Inc. (September 1990) *NRMP: Naval Station, Guam.*

[36] Personal communication with Robert Anderson, Guam DAWR, April 27, 1998.

[37] Personal communication with Gary Wiles, Guam DAWR, July 1996.

[38] Personal communication with Mike Ritter, Guam FWS, August 22, 1996.

[39] USFWS (September 1992) *Recovery Plan: Mariana Common Moorhen (Gallinula chloropus guami).*

3.3.2.4 Brown Tree Snake

The introduced brown tree snake (BTS) has become a serious pest species on Guam. Native to the Solomon Islands, Papua New Guinea, and the northern coast of Australia, it is believed to have been introduced in the postwar years in cargo shipped from Papua New Guinea. Snakes became conspicuous throughout central Guam by the 1960s, and by 1968, they had probably dispersed throughout the island. Today, up to 12,000 snakes per square mile occur in some forested areas of Guam. In the absence of natural predators and other population controls, the snake population has reached very high densities, causing the decline and, in some cases, extinction, of many of the island's birds, lizards, and bats. The snake is nocturnal and cryptic. Difficulty of detection is compounded by the snake's slimness, exceptional climbing ability, potential to survive for weeks without food, and propensity to seek dark, cool hiding places during the heat of the day. Due to their nocturnal habits and hiding ability, the snakes are frequently accidental stowaways in cargo leaving Guam. Unless intercepted, the BTS could become established on Tinian, Rota, FDM, or Hawaii, causing ecological and economic problems similar to those found on Guam. The BTS has already been sighted on Oahu,[40] Saipan, and Rota, but is not thought to be established on those islands.

The October 1996 *Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises* implements a Memorandum of Agreement (MOA) signed by the Department of Defense, the U.S. Department of Agriculture, the Government of Guam, and the State of Hawaii. The MOA states that these agencies will cooperate in efforts to participate in and pursue BTS research, control, inspection, and eradication efforts.

3.3.3 Farallon de Medinilla

3.3.3.1 Habitat

Farallon de Medinilla (FDM) is an uninhabited island that has historically been used by the military as a bombing site. Steep, eroding sea cliffs make it virtually inaccessible except by helicopter. With the exception of sharp, irregular limestone outcroppings, the entire top of the island is vegetated, mostly by herbaceous and shrubby vegetation, dominated by littoral species.[41] The vegetation structure is not homogenous, but rather a mosaic of several types, lacking clear boundaries. Birds nest, forage, and shelter in the dense vegetation.

There are no threatened or endangered plant species on the island. Nearly all the species encountered on the island are widespread, littoral plants. However, there are two plant species that are considered rare or uncommon: the bunch grass *Digitaria gaudichaudii* (the only endemic species recorded from the island), and the seaside cotton (*Gossypium hirsutum* var. *taitense*).

[40] T. H. Fritts, G. H. Rodda, and E. F. Kosaka. *Brown Tree Snake Update. Memorandum to Brown Tree Snake Cooperators* dated July 1, 1995.

[41] Art Whistler (December 1996) *Botanical Survey of Farallon de Medinilla, CNMI.* Prepared for Belt Collins Hawaii.

There are apparently no sensitive types of vegetation on the island. The one wetland area observed was too small and lacked some of the prerequisites to be considered an official wetland. However, these areas may be vital to the presence of land birds on the island that need fresh water, such as the endangered Micronesian megapode.

Eleven of the 40 plant species identified in a half-day botanical survey (Appendix D-3) were introduced. Two of these species, tangantangan (*Leucaena leucocephala*) and morning glory vine (*Operculina ventricosa*) pose a potential threat to the environment. Once established they are difficult to eradicate.

3.3.3.2 Marine Environment

The emergent shoreline consists primarily of large boulders and rock outcrops that have calved off of the island margin. There are two small beaches, one on the northern part of the eastern shoreline, and one in the central area of the western shoreline (Figure 3-3). These are wave-swept beaches, composed of very coarse carbonate sand and small rubble/cobble fragments, and do not serve as good turtle nesting habitat.[42] There is little shoal area around most of the island, with the exception of the northern and southern ends. Deep water surrounds much of the island, and the submarine slope of the island is very steep. UXO occurs in waters around the entire island, concentrated primarily in the middle portion of the island, and in some cases is colonized by living coral and algae.

The combination of steep vertical profiles of the submarine shoreline and the massive physical forces from breaking waves on the windward (eastern) side of the island results in a limited assemblage of benthic biota, at least to the depth of wave base. Marine resources are primarily concentrated on the leeward (western) side of the island, where substrate drops gradually seaward; coral growth of *Pocillopora, Acropora, Porites, Montiport* and *Millepora* is good, with approximately 50 percent coverage of the available substratum. Coconut crabs *(Birgus latro)* inhabit cracks in the rocks near the shoreline, and green sea turtles have been observed in the nearshore waters.

The nearshore fishery resources surrounding FDM are popular for commercial and subsistence fishermen; low numbers of commercially desirable reef fish in this area indicate fishing pressure. The greatest abundance and diversity of fishes are found primarily on the western side, particularly in the areas offshore of the central and northern portions of FDM.

3.3.3.3 Rare, Threatened, and Endangered Species

Avifaunal surveys of FDM conducted between November 1996 and August 1997 (Appendix D) have recorded a total of 17 avian species, including 9 species of seabirds, 5 species of migratory birds, and 3 species of resident land birds. All of the avian species observed are native to the Marianas except for the Eurasian tree sparrow.

[42] Marine Research Consultants (September 1997) *Assessment of the Marine Environment, Farallon de Medinilla, CNMI, Military Training in the Marianas EIS.* Prepared for Belt Collins Hawaii.

The only endangered species recorded was the Micronesian megapode. Although only up to four megapodes have been observed during any one survey, the USFWS estimates that up to ten individuals occur on the island.[43] Three bristle-thighed curlews (*Numenius tahitiensis*), listed by the USFWS as a species of concern, were observed on FDM, as were two Mariana fruit bats, which are not protected federally but are proposed for federal listing, listed on the CNMI Endangered Species List and protected from hunting throughout the CNMI.

Of the species found nesting on the island, the most widespread were seabirds: three species of boobies (masked [*Sula dactylatra*], red-footed [*Sula sula*], and brown [*Sula leucogaster plotus*]) and the common fairy tern. FDM is the site of the largest known masked-booby breeding colony in the Marianas, and represents one of only two small breeding populations of the great frigate bird in the Marianas. The other species of birds nesting on FDM are broadly distributed throughout the Pacific. Masked and brown boobies nest along the eastern (windward) side where they can more easily take flight from their ground nests (see Figure 3-3). Red-footed boobies and great frigate birds breed on the western side of the island where there is less wind and higher brush to support their nests. Terns and noddies nest primarily in the limestone sea caves at the base of the island. Megapodes and doves inhabit densely vegetated areas where shelter and food are more readily available. Shorebirds, such as the plover, curlew, and turnstone, require open habitat and are found in barren or sparsely vegetated areas.

3.3.4 Rota

3.3.4.1 Habitat

Although some areas were cleared by the Japanese for sugar cane, Rota was much less disturbed during the war than the other islands, and no military bases were established there. Vegetation consists primarily of native forest with some secondary vegetation and minor stands of tangantangan.

The largest remaining limestone forest in the Marianas is found on Rota, where it covers 60 percent of the island. These areas are important refuges for endangered species, such as the Mariana fruit bat and the Mariana crow. Nine percent of the land area on Rota is covered by secondary vegetation, characterized as mixed brush and weeds which developed after the removal of native forest. The secondary vegetation scattered throughout the island is mostly a remnant of formerly cultivated fields and coconut groves. Rota supports only minor stands of tangantangan, which are relatively homogeneous and make up less than one percent of the island's land area.

Three conservation areas were established on Rota in 1994: the Sasanhaya Marine Reserve, Puntan Taipingot (Wedding Cake) Conservation Area, and Sabana Heights Wildlife Conservation Area (Figure 3-4). Additional conservation areas are proposed, including the Sasanlagu Marine Preserve, Paliii Medicinal Plant Reserve, Kantan Aftao Commonwealth Forest, and a conservation area between Saguagaga and Puntan Fina Atkos.[44]

[43] USFWS (May 16, 1997) *Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at Farallon de Medinilla, CNMI.*

[44] Juan C. Tenorio & Associates, Inc. (December 1995).

3.3.4.2 Marine Environment

Coral reefs are found offshore nearly the entire island. The seagrass *Enhalus acoroides* has limited distribution, occurring in a narrow band along the shore between West Dock and Anjota Island near Songsong Village. Other marine resources will not be discussed in detail since no training in offshore waters is proposed.

3.3.4.3 Rare, Threatened, and Endangered Species

Native species on Rota include the endangered Mariana crow (endemic to Rota), threatened green sea turtle, Mariana fruit bat (a species of concern on Rota), and the Rota bridled white-eye, which is a candidate for listing as a federally endangered species. According to a 1996 study,[45] the population of the Mariana crow on Rota has decreased 56 percent between 1982 and 1995, likely due to habitat loss. The remaining approximately 600 crows are widely distributed throughout the island, both in mature and secondary forests and coastal strand vegetation.[46] There is also a fairly large roost of Mariana fruit bats that depend on the native forest in the Sabana Heights area for habitat (see Figure 3-4). Some of these bats migrate from Rota to Guam.

Brown tree snakes are not established on the island. The only confirmed siting of a brown tree snake was in October 1991 at a seaport: two dead brown tree snakes were found inside a cargo container that had been shipped from Guam.[47] Presumably the snakes died of dehydration or high temperatures from being in the container during hot weather.

The first permanent BTS barrier was installed in November 1997 around the Rota commercial port. Made of fine metal mesh that the snake cannot climb, it was attached to the existing port facility's high fence. Any BTS arriving in cargo by boat or ship will be contained.[48]

3.4 ARCHAEOLOGICAL AND HISTORIC RESOURCES

The history and cultural resources of Guam, Tinian, Rota, and FDM are discussed in this section. This historical overview spans from the time of initial human settlement to the present day and includes information on Chamorro, Spanish, German, Japanese, and U.S. influences. As each of these cultures took turns in controlling the Marianas, they left behind many cultural artifacts that can still be seen today.

3.4.1 Brief History

The Mariana Islands are historically part of Micronesia and have been controlled by many different nations since their discovery by Magellan in 1521. The oldest dated archaeological remains indicate that humans first settled the Mariana Islands about 1500 B.C. Early historical

[45] Grout, Daniel J., Michael Lusk, and Steven Fancy (FWS)(June 1996) *Results of the 1996 Mariana Crow Survey on Rota.*

[46] USFWS (July 1996).

[47] T. H. Fritts (May 1996).

[48] Pacific Daily News, Monday December 1, 1997, page 3, "Snake-proof Fencing will protect Rota."

documents indicate that at the time of first European contact, the Chamorro people in the Mariana Islands exhibited a typical Oceanic economy, consisting of farming and exploitation of marine resources.

The Chamorros had their first contact with European explorers in 1521. The Spanish claimed the islands in 1565 and left them undisturbed until they established a Jesuit mission on Guam in 1668, significantly changing the lives of the Marianas Chamorros. By 1698, the Spanish resettled most of the Chamorros, except for those hiding on Rota, into church towns on Guam, leaving the northern Marianas virtually uninhabited. Religious activities were not Spain's only concern. The islands also served as a valuable port for the golden galleons and other Spanish merchantmen. Tinian was used by the Spanish as a store for supplying the Guam garrison, as noted in British reports from their first visit in 1742.

Guam became a possession of the United States in 1898 as a result of the Spanish-American War. Under the administration of the U.S. Navy, Guam became a coaling station and later a naval base for the Western Pacific. Spain sold the other (northern) Mariana Islands to the Germans in 1899. The short-lived (1899-1914) German administration was marked by little change, except for the reorganization of the Tinian cattle ranch established by the Spaniards. Tinian was leased by the Germans in 1904, primarily to the Japanese for the purpose of copra cultivation.

The northern Mariana Islands came under control of the Japanese at the outbreak of World War I, and the League of Nations awarded the mandate over Micronesia to Japan in 1920. The Japanese then began economic exploitation of the Marianas. In 1926, Tinian was leased by Naniyo Kohatsu Kaisha (NKK or South Seas Development Company), which established sugar cane plantations and developed Tinian Town. Most of the indigenous forests and local vegetation on Tinian were bulldozed to make way for sugar cane and other crops.

Rota became the focus of the Japanese in 1930. NKK started its agricultural efforts in the Sinapalo area. Once the land was cleared of vegetation, sugar plantations were laid out and infrastructure was constructed. A refining mill was built on the west side of Songsong village, and a railroad was built to connect Songsong and Sinapalo. The Japanese also undertook small-scale mining on Rota. In 1939, the Japanese constructed an airfield at the north end of Tinian, using Korean slave labor.

The Japanese military government took control of Tinian in 1940. Guam was occupied by the Japanese shortly after the beginning of World War II. As discussed in Section 1.1.3.1, the Mariana Islands became battegrounds during World War II. Tinian and Guam were eventually invaded and occupied by U.S. troops in mid-1994. Rota and FDM were not occupied by the U.S. The B-29s carrying the atomic bombs dropped on Hiroshima and Nagasaki departed from Tinian's North Field, which was designated a National Historic Landmark in 1987.

Tinian was essentially abandoned by the U.S. military within a year of the end of the war, and in 1947, the U.S. and the United Nations reached a trusteeship agreement for the Trust Territory of the Pacific Islands. Guam remained under the jurisdiction of the U.S. Navy until 1950, when President Harry Truman signed the Organic Act which ended military control and made Guam a U.S. territory. Negotiations in the 1970s resulted in the signing of a Covenant to Establish a

Commonwealth of the Northern Mariana Islands in Political Union with the United States of America. The covenant included an agreement to lease approximately 71 percent (72 km^2) of Tinian's land area to the Department of Defense for military training use and as a contingency base should future conditions require significant forward deployment in the Western Pacific. The amount of land leased has since been reduced to approximately 60 percent of the island.

3.4.2 Cultural Resources

Significant historic and prehistoric sites remain from the different cultures which have occupied the Mariana Islands. The most notable artifacts of the ancient Chamorro culture are sets of latte stones. These are upright pyramidal stone pillars topped by semispherical capstones, set in two parallel rows in groups of 6 to 12 (see cover of Executive Summary). Numerous latte sites, complexes, and remnants can be found throughout Guam and Tinian. In fact, latte sets are still being identified and discovered. The most famous is Tinian's House of Taga in the village of San Jose. Its twelve columns once supported a structure at least 54 feet by 10 feet. Other artifacts that can be found on Guam and Tinian include pottery scatters and stone adzes.

Many cultural resources are located on DoD land on Guam and Tinian. Cultural resources include buildings, structures, objects, sites, districts, and archaeological resources. Because access to areas under DoD control, such as the Ordnance Annex, is restricted, the cultural resources have been left undisturbed and are well preserved. Detailed information on sites within military lands and training areas is provided in Chapter 4.

3.4.2.1 Tinian

Tinian's cultural resources include precontact Chamorro sites, primarily in the EMUA, and many World War II-era sites and artifacts associated with Japanese and U.S. invasion of the island. The latter includes the pits where two atomic bombs were loaded in the *Enola Gay* and *Bockis Car* for employment against Japan. The U.S. World War II airfields and support facilities, including the two atomic bomb pits, are part of the North Field National Historic Landmark, designated by the National Park Service in 1987.

Cultural resources in the LBA were identified in a series of surveys (Figure 3-5) and motivated the Navy to implement various measures, such as a Memorandum of Agreement signed in 1994 prior to the Tandem Thrust 95 training exercise. To supplement these agreements, the Navy also developed an interpretive program and trail (Figure 3-6) for north Tinian, the purpose of which is to inform the public of Tinian's cultural and natural resources and to instill an ethic that emphasizes preservation and protection.

3.4.2.2 Guam

Guam's oldest archaeological sites are from the Chamorro period, prior to Western contact in 1521. Other sites show evidence of Guam's status as a possession of Spain, while numerous structures and relics attest to the island's major role in World War II. Many of the known historically significant sites are located on DoD land, and are described in detail in Appendix J.

Complete inventory surveys for all Guam training areas have not been performed; Figures 3-7 through 3-9 show locations surveyed to date. Surveys are currently being performed on portions of AAFB and areas of the Ordnance Annex. Surveys are ongoing at the Waterfront Annex and Ordnance Annex. No current surveys are in progress at Communications Annex Finegayan, although portions have been surveyed in the past. No surveys have been performed of Communications Annex Barrigada.

Proposed training areas on Guam known to have or suspected of having significant cultural sites[49] and proposed as training areas include:

- Southern and western portions of Ordnance Annex (numerous latte sites)
- Orote Airfield (World War II site)
- Outer Apra Harbor (submerged World War I and II shipwrecks)
- Haputo Beach (vicinity of a major latte complex)
- Northwest Field at AAFB (World War II site)

Although most of the known cultural resources within the training areas are not vulnerable to training activities, there is a potential for impacts to some important sites on Guam which are listed on either the Guam or National Register of Historic Places, or both.

Ordnance Annex. The COMNAVMARIANAS Ordnance Annex has many ancient Chamorro latte sites and World War II Navy structures. In the Ordnance Annex, the Alifan Ridge Complex, the latte complex, and recently discovered large latte village are located within training areas.

Waterfront Annex. The COMNAVMARIANAS Waterfront Annex contains several pre-World War II and World War II Navy structures. The three areas of concern in the Waterfront Annex are the Orote Peninsula, which includes Orote Airfield and the Orote Historic Complex, the underwater resources in Apra Harbor, and Dadi Beach. Orote Airfield, a significant World War II site, is listed on both the National Register and Guam Register. The Orote Historic Complex contains several important historic features. Outer Apra Harbor contains several submerged historic resources, including the *TOKAI MARU* (Japanese vessel torpedoed in WWII) and *S.M.S. CORMORAN* (German vessel scuttled during WWI) which are listed on both the Guam and National Registers. Dadi Beach has several significant sites associated with World War II.

AAFB. The coastal areas and Northwest Field are the main areas of concern at AAFB. Several sites listed on the Guam Register, including burial areas, lattes, rockshelters, and remnants of prehistoric villages, are located at Pati Point and Tarague. AAFB sites associated with World War II and the Vietnam conflict include primarily the runways at Northwest Field, for which nominations to the Guam and National Registers are pending. The only known historic structure at Andersen South is Building 1125. Andersen South also has one prehistoric site, the Pagat Point latte site. Both Building 1125 and the Pagat Point latte site have potential significance, although their eligibility status has not been determined.

[49] Significant sites are defined as those eligible for listing on the National Register of Historic Places.

Haputo Beach in the Communications Annex is the site of a latte complex that is listed on the National and Guam Registers. Also located in this area are the Pugua Point rock shelters and Tweed's Cave, both of which are potentially eligible to be listed on the National Register.

3.5 INFRASTRUCTURE, UTILITIES, AND PUBLIC SERVICES

Tinian, Guam, and Rota all have infrastructure, utilities, and public services in place. Each island has its own roads, airports, drinking water systems, municipal solid waste landfills, electrical power plants, fire departments, and telecommunications systems.

In the case of telecommunications, the islands have both individual systems and a shared system. Public telecommunications is operated by the Guam Telephone Authority (GTA) on Guam and the Marianas Telecommunications Corporation (MTC) in the CNMI. The telephones on each island are also connected to each other by a microwave system. Presently, plans are being made to install an undersea fiber-optic cable between the islands to make telecommunications more efficient and cost-effective. Although the resources available on each island are similar, they have developed at very different rates and will be discussed separately. Guam is the most developed of the islands addressed by this DEIS. FDM is not discussed since it is an uninhabited, undeveloped island.

3.5.1 Tinian

Roads. Tinian has approximately 110 km of roads, most of which were constructed prior to and during World War II. Most roads were graded and paved, and successfully supported heavy military truck traffic during the war. Roads throughout Tinian are now in fair to poor condition and traffic is extremely light. The road system is administered by CNMI's DPW.

Airports. Tinian has one commercial airport and one harbor. The West Tinian Airport is equipped with a navigational light system but has no other navigational aids or a control tower. The airfield has a single east-west runway, primarily for commuter air taxi operations. Takeoffs and landings are coordinated by the control tower at the Saipan International Airport, radio advisories among the aircraft, and by visual observations from aircraft and from the ground. The airport may be expanded if planned casinos are successful.

Harbors. Tinian Harbor is protected by a deteriorating breakwater constructed during World War II. Wharfage includes a concrete wharf and two somewhat deteriorated finger piers with slips parallel to the main wharf. A small marina pier has low-draft berths along a quay and stern-to moorings; the quay is used to moor commercial barges operating between Tinian and Saipan. Commercial shipping traffic is serviced by two stevedore companies. Gasoline and diesel fuel are available at the Mobil Oil tank compound in the harbor area. The position of the Mobil refueling point and the direction of the harbor flow directs any fuel spill toward the closed end of the two finger piers. A boom is on hand and is used by any boat that is refueled. There are no tug boats at this port.

Power. Electric power is supplied by three 1000 KW generators operated by the Commonwealth Utility Commission (CUC). Peak demand on Tinian was 2 Megawatts (MW) as of 1994. The system has operated without unplanned outages. The only existing generators of radio frequency electromagnetic radiation (EMR) on Tinian are air traffic and government radios (VHF 118.0—135.0 MHz and VHF 160—166 MHz, respectively). The proposed VOA transmitter would have four 2.5 MW primary power electrical generators and one supplemental generator of approximately 500 MW.

Water and wastewater. Potable water on Tinian is supplied by the CUC from a single well located in Makpo Swamp. A 1.9 billion cubic meter (m^3) tank and 0.95 billion m^3 tank provide potable water storage. Agricultural water is supplied by a well also located in Makpo Swamp. Tinian does not have a wastewater treatment plant; public and private buildings are equipped with septic tanks or cesspools.

Solid and hazardous wastes. Solid waste is disposed at an open dump located north of and downwind from San Jose near the former leprosarium. It is managed by the CNMI DPW. Most residents bring their own trash to the dump. The dump is not presently in compliance with federal solid waste regulations. Tinian also does not have a hazardous waste disposal facility.

Firefighting capabilities. The Tinian Fire Department is undermanned and relies on residents acting as a volunteer fire department. Firefighters only protect inhabited structures. Otherwise, they allow the fires to burn out on their own. San Jose Village has two fire engines, one pickup for brush fires, and an ambulance. The village also has a tanker truck which holds approximately 3.8x 10^6 m^3 to help fight fires.

3.5.2 Guam

Roads. Guam's public road network consists of over 650 km of paved roads which range from two-lane rural to seven-lane urban arterial roads. The roads are managed by the Government of Guam Department of Public Works. Most of the highway infrastructure was built by the U.S. military following the end of World War II and is a reflection of the desire for efficient connections between various military installations. After a vigorous road improvement program was undertaken, the network of roads are in relatively good condition.

Traffic on Guam is heavy in certain areas. The traffic on major routes is particularly heavy during the afternoon hours.

Airports. The only civilian air transportation facility on Guam is the Guam International Air Terminal (GIAT), operated by the Guam International Airport Authority (GIAA), a public corporation and autonomous agency of Government of Guam (GovGuam). GIAT, about 5 km northeast of Agana, uses two runways and related facilities that are part of the now closed Naval Air Station (NAS) Agana. GIAT handles nearly all military and commercial flights into and out of Guam. Eight major airlines operate here, making it the hub of air transportation for Micronesia and the Western Pacific. The only other major aviation facility on Guam is at AAFB, which handles Air Mobility Command flights for military personnel and their dependents. Commercial

aircraft may occasionally fly through Andersen's airspace, but only with permission from the Andersen control tower.

Harbors. Apra Harbor is an improved natural harbor which provides sheltered anchorage. The outer harbor features a general anchorage area for the commercial port, as well as 14 Navy moorings. The Navy owns and operates the entire inner harbor south of the main port area; the inner harbor has 11 moorings. Both Navy and civilian facilities exist in the outer harbor; control of the outer harbor submerged lands is currently in dispute. The commercial Port of Guam handles all commercial activity and is managed by the Port Authority of Guam (PAG). All goods shipped to Guam (with the exception of military weapons, ammunition, and heavy equipment) are received at the Port of Guam. As the tourist industry grows and Guam continues to ship in approximately 90 percent of its commercial goods, the port stands as one of the busiest and most important areas on the island.

Power. The Guam Power Authority (GPA) is the main supplier of Guam's electrical power. Electricity is produced primarily by three base load steam-electric generating stations at Cabras, Tanguisson, and Piti. Cabras generates more electricity than the other two plants combined. Prior to the construction of GPA facilities, the Navy provided electrical power to the entire island. A series of joint-use agreements since 1972 have gradually turned power generation responsibilities over to GPA. In August 1992, a Customer Supplier Agreement established the Navy and Air Force as customers of GPA. In addition to the regular supply from GPA, all Navy and Air Force installations maintain facilities for emergency power and peak power generation.[50]

Water and wastewater. The Public Utility Agency of Guam (PUAG) maintains and operates the island wide water distribution system. This integrated system has a capacity of 11,400 cubic meters per day (m^3/d) and services a majority of the civilian areas on Guam. About 70 percent of PUAG's water is supplied by 92 wells tapping the Northern Lens Aquifer, which has an estimated sustainable yield of up to 60 mgd. In south-central Guam, PUAG's Ugum River Diversion Project diverts 7,500 to 15,000 m^3/d from the Ugum River to supply the districts of Talofofo and Umatac. The PUAG system relies on direct well-to-consumer service, with only minimal water storage. Therefore, power outages significantly hinder its water distribution capability. The Navy and Air Force acquire potable water from five and ten wells, respectively. The Navy sells water to PUAG from its Fena Watershed system for distribution to civilian areas in southern Guam. Eight private water supply wells are located on civilian property in various locations on Guam.

The civilian wastewater collection system is operated and maintained by PUAG. A separate wastewater collection system serves the Navy's Waterfront Annex. The PUAG-operated system is divided into three regions, two of which contain DoD commands. One additional region is formed by the Navy-owned and -operated Waterfront Annex collection system. A total of eight wastewater treatment plants service the island.

[50] Guam Power Authority (1992) 1992 Long Range Transmission Planning Study.

Solid and hazardous wastes. Municipal solid waste (SW) is collected by the Department of Public Works (DPW) and private haulers, and disposed of at the Ordot Sanitary Landfill. The landfill is presently in violation of several federal regulations and by law, must have been closed by April 1997. Unfortunately, the Ordot landfill did not make this deadline because a new landfill was not constructed by that time. The main problem delaying the closure of the Ordot facility is choosing the site of the new landfill. The two proposed sites at Malaa and Gautali both have drawbacks.[51] The military also maintains sanitary landfills on Guam. The Air Force operates a landfill at AAFB, and the Navy's Public Works Center (PWC) operates one in the Orote Peninsula area of the Waterfront Annex. No military-generated municipal SW is disposed of at the Ordot landfill.

All civilian-generated hazardous waste (HW) is handled by private operators, while the cataloguing and storing of HW and hazardous materials (HM) for military installations are the responsibilities of the Defense Reutilization and Marketing Office (DRMO). This office receives the HW/HM, stores and packs them as necessary, and arranges for their eventual disposal or recycling. DRMO Guam is also responsible for the disposal of HW/HM from DoD activities at places such as Yap, Chuuk, Saipan, and Diego Garcia. The packing and transporting of hazardous wastes and materials from most Navy activities to DRMO are handled by the Navy PWC. The PWC goes to the activity storage area, loads the HW/HM, and returns to the PWC HW/HM storage facility, where they further pack the materials. The HW/HM are then transported to DRMO for inventory control and storage until they can be sent off-island for disposal. The materials generated by the Air Force are stored and packaged at AAFB and transported by Air Force personnel to the DRMO facility.

Firefighting capabilities. Guam has both civilian and military firefighters, either of which may respond to emergencies as necessary. There are approximately 300 full-time professional civilian firefighters operating eight civilian fire stations. The Navy operates seven fire stations and the Air Force operates three fire stations. Both the Navy and Air Force have mutual aid agreements with the Government of Guam fire department as well as an interservice support agreement with each other. In addition, the Navy contributes water buckets that can be used as external loads for fire extinguishing. HC-5, the Navy's search and rescue aviation unit on Guam routinely provides MEDEVAC service from Rota to Guam.

3.5.3 Rota

The information in this section is summarized from a master plan study regarding the physical and economic resources of Rota which was prepared by Juan C. Tenorio & Associates, Inc.[52]

Roads. Rota's roadway system consists of 140 km of road and village streets. All of the streets are in the villages of Songsong and Sinapalo. Most of the roads were built during the Japanese period and are presently in poor physical condition. Only about 19 km of the roadway system are

[51] Adrienne Loerzel (March 15, 1996) *Landfill shutdown hinges on new site*. Pacific Daily News.

[52] Juan C. Tenorio & Associates, Inc. (December 1995) *Physical and Economic Master Plan for Rota, Commonwealth of the Northern Mariana Islands, Rota Island.*.

paved, between Songsong and the airport and within the village itself. Although the roadway system is in relatively poor condition, the entire island, except for the southern sloped areas, is accessible by roads.

Airports. Rota International Airport, located about 18 km northeast of Songsong, is surrounded by agricultural activities and pasture land. The facility is serviced by a single asphalt runway. The terminal lies approximately 730 meters from the east end on the south side of the airfield. A single taxiway connects the runway with the air passenger terminal aircraft parking apron.

Harbors. Rota has two harbors, the West Harbor at Sasanlagu and the East Harbor at Sasanhaya. The West Harbor is west of the Tapingot Peninsula and was originally developed to serve a Japanese sugar mill operation. The existing facilities were constructed around 1978 and consist of an entrance channel and turning basin. The narrow channel entrance combined with the prevailing crosswinds and variable currents prevent navigation except for boats and other small crafts.

The East Harbor is on the southeastern tip of the island. The East dock is mainly used for discharge of fuel and as a docking facility for glass-bottomed boat operations.

Power. Electric power is supplied by a 5.2 MW power plant located in Songsong Village and operated by the CUC. The power plant contains two 2.6 MW Mitsui diesel engines. As of June 1, 1995, Rota's power has been rationed because one 2.6 MW unit is out of service. Nonessential services, such as street lights, have been temporarily disconnected.

Water and wastewater. Potable water on Rota is supplied by the Matanhanom and As Onaan springs. A ductile iron water line connects the springs to 3.8 billion m^3 and 1.9 billion m^3 reservoirs which supply Songsong and Sinapalo, respectively. The existing water supply and distribution system barely meet the population's needs. Primary concerns are the lack of adequate pressure in some areas of Songsong and Sinapalo, water rationing during evening and night hours, and the inability to provide adequate and consistent water supply disinfection (chlorination).

Presently, Rota does not have an operating sewer system. The Variable Grade Sewer (VGS) system installed on certain streets of Songsong was never activated, due to a storm which destroyed the outfall shortly after completion. Public and private facilities are presently serviced by either septic tanks or cesspools.[53]

Solid and hazardous wastes. A majority of the SW is disposed of in the Songsong Dump, located in Northern Rota approximately 3 km from Songsong and operated by the CNMI DPW. The Tatachog dump, granted permits by the CNMI's Department of Environmental Quality (DEQ), is located in an abandoned quarry site. Residents and businesses are responsible for transporting their own waste to the dump. Neither dump site is in compliance with federal SW regulations. Rota does not have a HW disposal facility, and there are no provisions for off-island transport of HW.

[53] Personal communication with Crispin M. Ayuyu, Office of the Mayor, Rota, January 20, 1997.

Firefighting capabilities. The existing fire station in Songsong Village is staffed by ten firemen, two cadets, and three civilians. There are three fire trucks, one large and two small. As of 1996, one small truck was out of service. The fire station also has two ambulances which service the entire island.

3.6 SOCIOECONOMIC ENVIRONMENT

Residents born in Guam, Tinian, and Rota are U.S. citizens. Since the end of World War II, Guam has experienced steady and considerable growth of its tourist industry and business community. It has become a hub of Western Pacific transportation and communication, in addition to being the home of the only U.S. military installations on U.S. soil in the Western Pacific. Tinian and Rota continue to develop but at a much slower pace than Guam. FDM is not discussed in this section because it is uninhabited.

3.6.1 Culture and Economy

The majority of Marianas residents are Chamorro or part-Chamorro. The main employers are the government, tourism, construction, and the military. Tourism is the fastest growing industry in the islands and may soon surpass other industries as more resorts are developed.

3.6.1.1 Tinian

Tinian's population is concentrated in the village of San Jose, on the southwest coast at the site of a natural harbor. As of the 1990 census, there were 2,118 residents and nonresidents on the island, of whom about half were of Micronesian ancestry. No military personnel are permanently stationed on Tinian. Languages spoken include Chamorro, English, Tagalog, Carolinian, Japanese, Korean, and Sri Lankan (Tamil).

Tinian is a largely undeveloped island. Its economic growth has been slow despite the 1989 initiative to legalize casino gambling. Tinian's economy can be broken down into the following sectors: government employment, tourism, agriculture and fishing, consumer trade, and air service and airport operations. About 75 percent of the Tinian labor force is employed by the government.[54] Many also engage in subsistence farming/fishing. Island residents hope that its casino and hotel industry will flourish and expand.

3.6.1.2 Guam

Guam's population is concentrated in the central portion of the island, particularly in the capital city of Agana. In 1994, the population of Guam was 145,881. The ethnic composition of the island is 43 percent Chamorro or part-Chamorro, 23 percent Filipino, 14 percent Caucasian, 5 percent other Pacific Islanders, and 15 percent other ethnic groups. Approximately half of all

[54] Ernst & Young (March 1996) *Draft Socioeconomic Report.* Prepared for Belt Collins Hawaii.

residents were born on Guam, and 70 percent of them were under the age of 34 in 1990.[55] Languages spoken include English, Chamorro, and Japanese.

The major components of Guam's economy are the government, military, tourism, and construction. Government and military employment account for approximately one out of every three jobs, while tourism is the fastest growing industry. Unemployment on the island was about 7.8 percent at the end of 1995.[56] In several industries, most notably construction, a severe labor shortage requires the importation of foreign workers to fill the positions.[57]

3.6.1.3 Rota

In 1992, the population of Rota was 2,561, comprising mostly residents of Chamorro descent. The people reside in Songsong and Sinapalo villages. The main languages spoken are Chamorro, English, and Carolinian. Most of Rota remains agricultural or natural habitat with a few scattered, mixed-use residential, commercial, and industrial areas located in the rural interior.

Rota's economic base relies primarily on the CNMI government, construction, and small-scale tourism activities. There is a high degree of subsistence activity with many families supplementing their income with farming and fishing. Several new hotel/golf resort developments are either proposed, permitted, or under construction.

3.6.2 Military Land Use

The Mariana Islands offer a prime strategic location for military installations. Guam's and Tinian's use as major bases for wartime operations dates back to World War II, when they served as launching points for bombing raids on Japan. During the Korean War and Vietnam War, additional forces were sent to Guam to perform long-distance reconnaissance and combat missions. To keep a strong presence in the Pacific and Asia, the U.S. military has continued to maintain several bases on Guam. These bases currently have fewer personnel than in the past, as they primarily perform a support role for military exercises in the Pacific. Military installations comprise approximately 30 percent of Guam's land area (including NAS Agana, which is in the process of being returned to the Government of Guam [GovGuam]). The U.S. military does not have any personnel permanently stationed on Tinian, Rota, or FDM.

On Tinian, use of military land is affected by the terms of various lease agreements and the allocation of a portion of the EMUA to the Voice of America. Training in the LBA is permitted, provided that the CNMI is notified in writing prior to a given exercise. Training on the VOA parcel will not be possible once the transmitting station is operational.

The main initiatives affecting the military use of land on Guam are the Guam Land Use Plan Update (GLUP 94) and the Base Realignment and Closure (BRAC) program. GLUP 94 is an

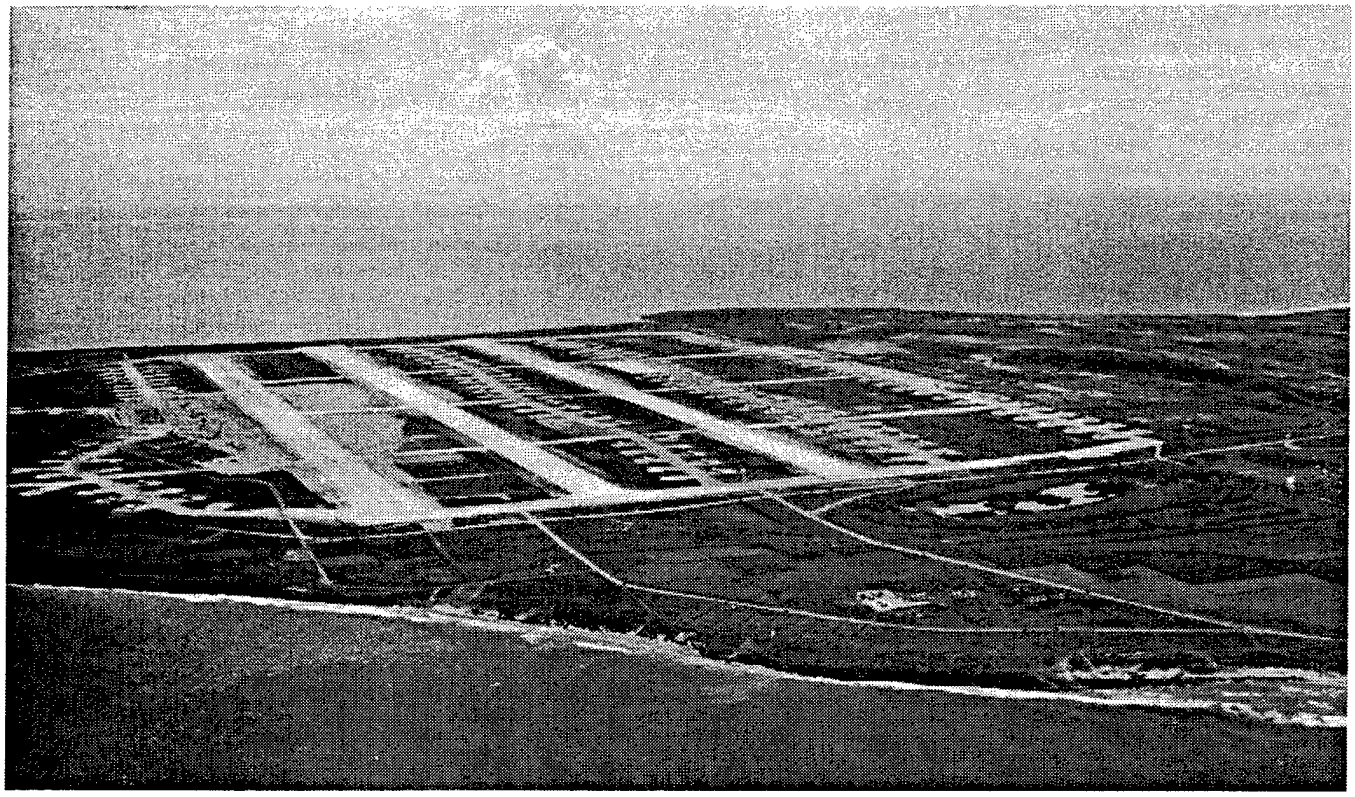
[55] Community Resources, Inc. (August 1992) *Socioeconomic Impact Assessment of New U.S. Navy Activities in Guam.* Prepared for Belt Collins & Associates.

[56] Personal communication with Rick Boice, Ernst & Young, May 29, 1996.

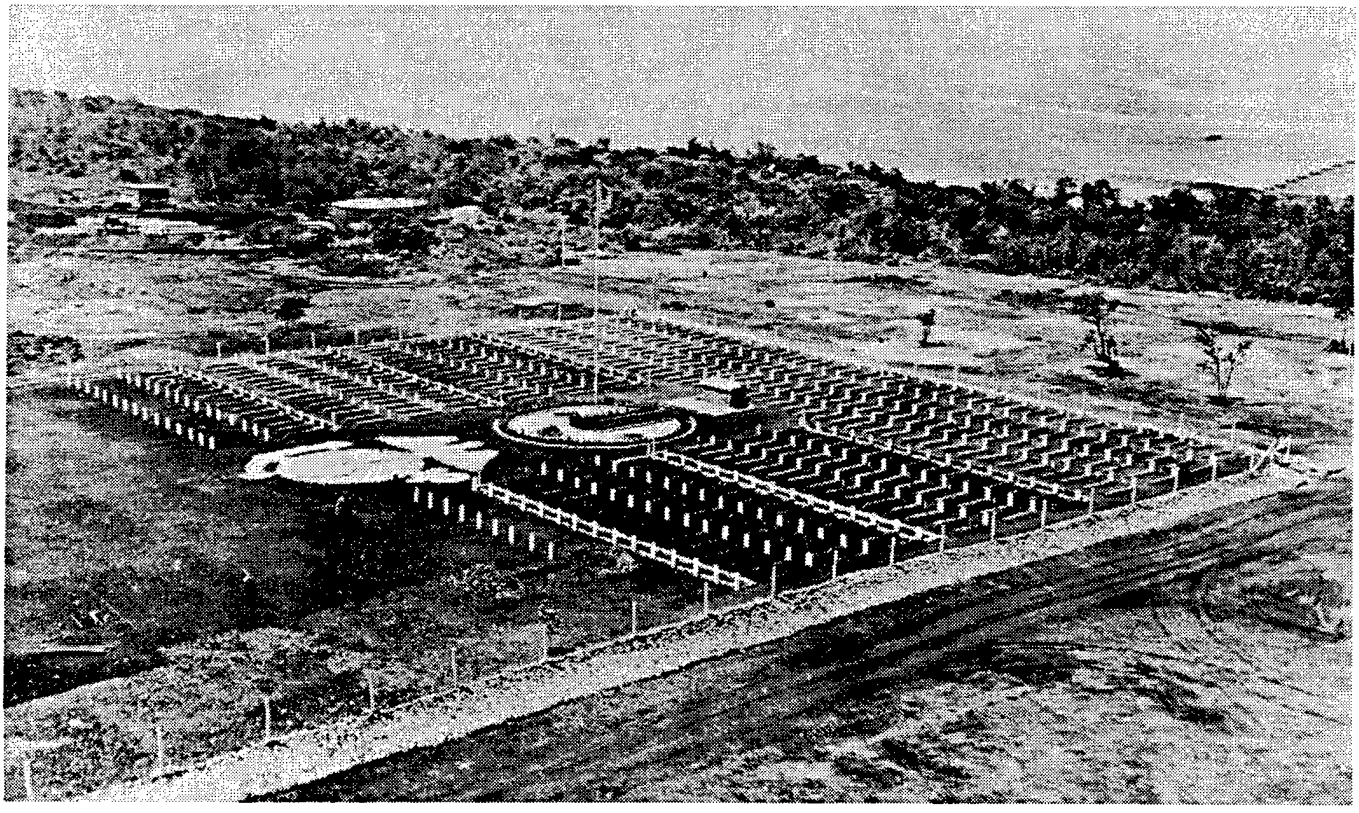
[57] Community Resources, Inc. (August 1992).

update to a previous military land use plan dated September 1977. Its purpose was to develop a plan for all DoD land requirements on Guam, considering the rationale for military landholdings, combined service use of real property where feasible, and environmental effects of military land use. GLUP.94 identified over 30.8 km^2 of land considered to be releasable and another 1.82 km^2 as potentially releasable. Obtaining development controls was recommended for approximately 0.53 km^2.

BRAC is a congressional program to decrease the number of bases operated by the U.S. military at home and abroad. It has resulted in the planned closure and release of various military lands on Guam. Before the lands can be transferred to the GovGuam, local officials must decide on how to use the land. GovGuam has submitted a proposed master plan for the future civilian use of NAS Agana. Business Reuse Plans are also prepared for the Ship Repair Facility (SRF) and portions of the Fleet Industrial Supply Center area. The Navy leased the SRF area to GovGuam on 1 October 1997. The SRF was subleased by GovGuam to XenoTechnic Corporation, which now operates the Guam Shipyard. Repair of Navy vessels will continue at the facility. Certain wharf areas once used by FISC may be released to GovGuam. The target date for permanent release of the SRF is 1 October 1999. Presently, there are no plans being made for civilian use of other released lands.



North Field, Tinian, 1944-1945 (National Archives at College Park)



American cemetery, Tinian (Smithsonian Institute, National Air and Space Museum)

CHAPTER FOUR

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

4. ENVIRONMENTAL CONSEQUENCES

This chapter provides detailed evaluation of significant issues identified during scoping: protected species, archaeological resources, range safety, aviation safety, socioeconomic impacts, and two issues specific to Tinian—wastewater disposal and solid waste (SW) disposal. Nonsignificant issues were also analyzed; these impacts and proposed mitigations are presented in Table 2-11 but are not reviewed in detail in this chapter.

4.1 IMPACTS OF BROWN TREE SNAKE

The most significant impact which could result from the proposed action is export of the brown tree snake (BTS) from Guam [or Australia] to Tinian, Rota, FDM, other Pacific islands, or the U.S. mainland. This threat is common to most civilian commerce originating on Guam. This section discusses the situation for all training land use locations.

Evaluation criteria. Establishing a BTS population at a new location would be a significant impact.

Existing conditions. A BTS population was established on Guam in the years after WW II, and as many as 12,000 snakes per square mile now occupy some forested areas of the island. Tinian, Rota, and FDM are believed to be free of BTS infestation, although BTS have been sighted on Rota. Potential prey populations are present on all three islands.

The primary existing management tool for preventing BTS introduction is the *Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises* (BTS Plan; see Appendix E-1). The BTS Plan and associated MOA (Memorandum of Agreement) were developed and signed in March 1993 by the DoD, USDA, GovGuam, and the State of Hawaii. The MOA states that these agencies will cooperate in efforts to participate in and pursue BTS research, control, inspection, and eradication efforts. It is subject to review, updating, and re-endorsement every 5 years by the USFWS and Assistant Secretary of the Interior; the first review is underway. All revisions must be agreed to by the original signatories of the BTS Plan. Funding in support of the plan has been provided by the DoD, Department of the Interior, and USFWS.

The plan establishes all necessary requirements to prevent spreading the BTS as a result of military training activities, while providing flexibility in execution. The USDA Wildlife Services (WS) [formerly Animal Damage Control] office on Guam is the primary agent for BTS control. While WS has no enforcement authority, the BTS Plan has been incorporated into military training orders and training personnel must comply with its requirements. A detailed protocol was developed by USDA and is implemented for all military exercises (Appendix E-2). On Guam, WS has standing arrangements and infrastructure to isolate and inspect military cargo staged at AAFB and in Apra Harbor. A flagging system is in place to prevent aircraft from taking off without appropriate WS inspection. All training units arriving on Guam are provided with a BTS information packet, and WS provides additional information and assistance. WS maintains

continual trapping and night searches at high-risk areas at airfields and ports, whether training occurs or not. [Cargo to be transported by major commercial shippers is also inspected prior to containerization.]

For all training exercises involving interisland transport, COMNAVMARIANAS or AAFB environmental personnel advise WS as many days in advance as possible. WS delegates available manpower and dogs, constructs cargo containment areas [snake-proof enclosures or exclosures], ensures that military personnel steamclean all heavy equipment and vehicles prior to their entry into WS-controlled areas, sets traps, and conducts inspections on Guam and on the receiving island (CNMI or Hawaii). In the CNMI, BTS control is tailored to specific exercises, as the conditions are more variable. WS provides personnel, traps, lights, bait, and guidance for exercises on Tinian. CNMI now has 2 trained Jack Russell terriers to help with inspections.

Potentially significant impacts. BTS could be transported in military cargo, vehicles, or construction equipment shipped from Guam. A single gravid female snake could establish a BTS population, having devastating long-term impacts on native bird and bat populations and potentially extirpating many species.

Proposed mitigation. Mitigation consists of strict compliance with the most recent version of the BTS Plan and full cooperation and coordination with local and federal natural resource agencies in tailoring BTS measures for various specific training exercises. All training personnel arriving on Guam for an exercise will be briefed on the BTS hazard prior to leaving Guam for Tinian or Rota. Any person sighting a BTS should attempt to kill or trap the snake and report the incident immediately to WS officials.

The WS office on Guam will continue to coordinate cargo-handling requirements with the military for cargo departing Guam. Requirements include establishing snake-sterile zones for staging equipment and cargo, steam cleaning all vehicles to flush out BTS prior to transport, and inspecting equipment with the aid of the snake-detecting Jack Russell terriers. No materiel will be transported to Tinian from Guam without a label indicating that it has been inspected. COMNAVMARIANAS will monitor compliance by coordinating with WS and base environmental personnel on at least a quarterly basis to keep abreast of lessons learned and new problem-solving techniques.

WS will establish quarantine procedures on Tinian in coordination with local wildlife and/or customs officials and perform a second inspection of all arriving cargo, in coordination with WS and CNMI FWS. Quarantine activities required at all ports of entry include erecting temporary barriers, establishing sterile areas, and activating snake traps.

4.2 IMPACTS ON TINIAN

4.2.1 Protected Species and Habitat on Tinian

Biological resources of particular concern are listed threatened and endangered fauna and their habitat, migratory birds, wetlands, threatened and endangered or medicinal plants, and coral reef.

Training activities can impact protected species and their habitat through noise, visual disturbance, vegetative clearing, ground disturbance, fire, projectile impacts, underwater shock waves, explosions, or BTS introduction. Whether these impacts are potentially significant has been determined using evaluation criteria presented below.

The proposed mitigation measures are subject to consultation with and concurrence by several government agencies. The USFWS and NMFS have purview under Section 7 of the Endangered Species Act, and the Guam Bureau of Planning and the CNMI Office of Coastal Resources Management administer the Coastal Zone Management Act. Consultation has been initiated with these agencies.

Evaluation criteria. The fundamental evaluation criteria for significance are:

- Are threatened or endangered plants or animals or migratory birds (collectively referred to as protected species) present at the training site, and is training land use likely to result in takes or in habitat reduction that would affect species survival potential or otherwise reduce chances of survival and recovery?
- Are wetlands, coral reefs, important habitat areas, or culturally or economically important plant or animal communities present at the training site, and will the natural function or usefulness of these areas or communities be appreciably reduced?

If the answer to either of the above queries is yes, the potential impacts are considered significant.

In addition, survival and recovery of protected species could be affected by training activities with side effects such as noise, visual disturbance, vegetative clearing, ground disturbance, fire, projectile impact, underwater shock waves, or explosions (Table 4-1). Training activities with potentially significant side effects could result in individual takes or cause reduced survival and recovery of protected species populations by causing disturbance, distress, disruption or abandonment of nests or feeding grounds, decreased breeding success, forced relocation, interruptions of feeding, sleeping, or mating activities, or habitat invasion by weedy species. The likelihood of reduced species survival and recovery depends on the characteristics of a training activity's side effects. Impacts of training activities on site-specific species were evaluated for significance based on these criteria.

Table 4–1 Evaluation Criteria for Side Effects Which Could Result in Reduced Species Survival or Recovery

ACTIVITY SIDE EFFECT	PARAMETER	SIGNIFICANT IF
BTS introduction	Transport from Guam	Population is established at a new location
Loud noise generation	Unexpectedness, especially during times of heightened sensitivity: -Breeding season for Mariana crows -Night (foraging time for Mariana fruit bats)	During an atypical time of day OR By an atypical source at a sensitive location and time

Table 4-1 *(continued):*

ACTIVITY SIDE EFFECT	PARAMETER	SIGNIFICANT IF
Visual disturbance	Appearance	Threatening enough to trigger nest abandonment (Mariana crow)
Vegetative clearing	Loss of habitat	More than 10% of the population is affected OR No substitute of equivalent function available
Substrate disturbance	Land: Destruction of eggs, nests, or young Water: Destruction of coral	Land: Ground-nesting species known to be present in nesting habitat Water: Greater than 1% total island coral reef is impacted and coral covers at least 5% of substrate.
Fire	Likelihood of occurrence	Ignition source is present in habitat areas AND Source of tinder is dry and present in habitat areas AND Means to extinguish is not present or a plan is not in place
Projectile impact and explosion	Area of effect Presence of protected species or habitat	Takes of listed species or habitat modification are likely
Underwater shock wave	Charge size, depth, and distance	Impulse greater than 2 psf-ms* and overpressure greater than 50 psi affect marine resources of intrinsic importance
Explosion	Effective casualty radius AND dud rate	Occurs in critical or other important habitat

Notes: * Pounds per square foot per millisecond.

Protected species and habitat. The following summary of protected habitat and species on Tinian is limited to those conditions relevant to training activities. A more complete description of existing conditions is given in Chapter Three.

Three protected bird species (Tinian monarch, Mariana common moorhen, and Micronesian megapode) and the Mariana fruit bat (listed on the CNMI Endangered Species List) are known to occur on Tinian.[1] The island is believed to be free of BTS infestation. The Tinian monarch[2] nests in trees in limestone forest, secondary forest, and tangantangan. Mariana common moorhens nest near the water at Lake Hagoi. The Micronesian megapode utilizes native limestone forest along the clifflines of Tinian.[3] The Mariana fruit bat roosts in large trees surrounding Lake Hagoi and along the clifflines and forest plateau near Mount Lasso.

Coral reefs, beaches, and coastal strand vegetation are sensitive habitats on Tinian. Reefs provide important habitat for threatened and endangered sea turtles. The green sea turtle nests at virtually all beaches on Tinian, and the endangered hawksbill sea turtle is found in the nearshore waters.

[1] The island swiftlet may also be present, but it has not been sighted on Tinian since 1976.

[2] The USFWS has indicated that it plans to delist the Tinian monarch.

[3] It is not known whether a resident breeding population exists on Tinian (USFWS, April 1996, Wildlife Research Report).

The coral reef flat at Unai Babui is almost barren, with one percent or less living coral coverage at depths shallower than two meters.[4]

Overview of training impacts. This section evaluates potentially significant impacts on biota and impacts which would not be significant but have aroused public concern:

- Off-road vehicle travel and excavation: damage sensitive habitat and take ground-nesting endangered species (significant)
- Pyrotechnics and open fires: burn habitat, take endangered species (significant)
- Noise from firing weapons, helicopter hovering and landing, close air support (significant)
- Logistics shipping: import BTS in cargo (significant)
- Amphibious vehicles: crush or break coral on reefs (significant), compress sand over turtle nests (significant), generate turbidity and salt spray (nonsignificant, depending on extent)
- Clearing vegetation to construct firing range, mortar range, and shooting house (nonsignificant)

4.2.1.1 Field Maneuvers

Existing conditions. All of the EMUA is used for field maneuvers. Endangered bird species nest in trees, on the ground, and in wetlands around Lake Hagoi. Endangered sea turtles nest on most Tinian beaches. Strand vegetation is present on several beaches in the EMUA.

Potentially significant impacts.

- Off-road travel by wheeled or tracked vehicles could damage tangantangan trees (Tinian monarch habitat), destroy megapode nests or chicks, compact sand over green sea turtle nests and create ruts too deep for baby turtles to traverse (from vehicles exiting a landed LCAC on a beach), and damage strand vegetation on the beach.
- Use of signal flares and smoke could ignite fires, damaging tangantangan (monarch habitat) and endangered birds and their nests.
- Noise from firing weapons (with blanks), hovering and landing helicopters or Harriers, and low-flying close air support could agitate endangered birds and bats to the point that they fail to reproduce successfully (a take).

Proposed mitigation. Mitigation of these significant impacts was established for the exercise Tandem Thrust 93[5] and consists of restricting training activities in certain areas (see Figure 2-7a):

[4] Personal communication with Steve Dollar, Marine Research Consultants, December 12, 1996, based on qualitative visual survey.

[5] Belt Collins & Associates (1993) *Environmental Assessment: Military Exercises, Island of Tinian, Commonwealth of the Northern Mariana Islands.*

- No noisy activities—helicopter hovering and landing, firing blanks, or low flying at high speed—are allowed in areas delineated NWD (no wildlife disturbance).
- The area around Lake Hagoi is a No Training (NT) area except for foot and vehicle travel along established roads.

The NWD and NT areas are delineated on all training maps, where they are represented as areas to be avoided for tactical reasons (for example, Lake Hagoi might be marked as "contaminated with radiation" and unsafe to enter). Trainees are penalized for improper activities in these areas. In addition, these areas will be defined in updated area training orders, and all troops training on Tinian will continue to be briefed regarding endangered species prior to arrival on the island.

4.2.1.2 Logistics Support Training: Brown Tree Snake Introduction

Materials for logistic support training arrive on Tinian at Tinian Harbor, West Tinian Airport, and North Field.

Existing conditions. There are bushes and other vegetation suitable for BTS concealment at both Tinian Harbor and North Field. Both Tinian Harbor and West Tinian Airport are commercial ports with several arrivals and departures each day. Despite this fairly heavy traffic, very few BTS searches are conducted of civilian cargo, and no routine canine detection programs are in place.

Potentially significant impacts. Introduction of a BTS population is the most significant impact that could result from training activities on Tinian. Import of BTS in military cargo, vehicles, or construction equipment shipped from Guam could result in establishing a BTS population on Tinian. This would have devastating long-term impacts on Tinian's native bird and bat population,[6] potentially extirpating these species.

Proposed mitigation. COMNAVMARIANAS will notify WS on Guam prior to exercises on Tinian. WS will establish infrastructure for human and canine inspections, snake-free staging areas, fencing, and traps on both islands. Designated military personnel will steamclean all heavy equipment and vehicles prior to their entering snake-free staging areas on Guam. All cargo, vehicles, and personal equipment will be inspected by snake detector dogs on Guam and re-inspected upon arrival on Tinian. No aircraft or material will be permitted to leave Guam for Tinian without an appropriate label indicating when it was fully inspected.[7] Detector dogs will also inspect accessible transport craft (ships, barges, aircraft) prior to departure from Guam. All training units will strictly comply with WS inspectors and protocols, which will be based on the 1996 BTS Plan but revised to include the most up-to-date technology and techniques. In all cases, WS personnel tailor all BTS controls to meet the demands of a particular exercise.

[6] USFWS (April 1996).

[7] Personal communication with Michael Pitzler, USDA Wildlife Services, June 1, 1998.

WS will establish quarantine procedures and perform a second inspection of all cargo arriving on Tinian, in coordination with CNMI FWS. Quarantine activities at ports of entry include erecting temporary barriers, spotlights for night searches, establishing sterile areas, and activating snake traps and canine inspections. All training personnel will be briefed on the BTS hazard prior to leaving Guam for Tinian. Any personnel sighting a BTS will be instructed to report immediately to WS officials. COMNAVMARIANAS will monitor compliance by coordinating with WS and base environmental personnel to keep abreast of successes and problems on at least a quarterly basis.

4.2.1.3 LCAC Landings

Existing conditions. Resources at Unai Chulu, Unai Dankulo, and Tachagna Beach are vulnerable to LCAC landings are coral reef, green sea turtle nests and hatchlings, and terrestrial vegetation.

- All three proposed beaches have coral present in shallow water.
- Green sea turtles may nest at all three beaches between late January and July/August. Hatchlings emerge from the nest 62 days later (between April and September/October).[9]
- Unai Chulu has some strand vegetation and a row of trees backing the beach; Unai Dankulo has some small trees; Tachagna Beach is backed by a wooded grassy area with a few picnic pavilions.

Potentially significant impacts.

- An LCAC will not disturb a coral reef if it is fully up on its air cushion while crossing the reef. LCACs do not usually come off-cushion and contact the ground until clear of the water's edge and fully over dry land.[10] However, if an LCAC is moving relatively slowly and is only partly up on cushion while in the water, it may create a surge wave capable of moving large (1 m diameter) rocks and breaking off coral heads. An LCAC fully on-cushion may create a wake and cause minor turbidity, but will not contact coral since only the rubber skirt of the craft contacts the water surface. (The actual hard bottom of the LCAC is suspended at least a meter above the water surface; a guide wire holds the bottom of the skirt in place.)
- Once on land, the weight of an LCAC compacts the sand and leaves a footprint 2 to 10 cm deep. Green sea turtle nests, buried approximately 1 m underneath the sand, are not likely to be damaged, but compaction of the sand may make exit from the nests difficult for hatchlings. Offloaded vehicles may crush turtle nests or leave deep tire track ruts that serve as physical barriers to hatchlings crossing the beach.

[8] Meeting Notes from June 19, 1997 in a meeting with Belt Collins, PACDIV and COMNAVMARIANAS.

[9] USFWS (May 30, 1996) *USFWS Wildlife Research Report Part III: Status and Distribution of Marine Turtles on the Island of Tinian*, CNMI--1994 and 1995. Prepared for Department of the Navy.

[10] If an LCAC were to come off-cushion while waterborne, the craft would have a draft of 0.76 m.

- LCAC fans blow salt spray and sand into the air, similar to but milder than conditions caused by typhoons.

Proposed mitigation.

- LCACs must operate fully on-cushion while over shallow reefs. All turns must be conducted on land. Landing beaches with a slope of >6° may be unsuitable since the craft tends to slide backwards into the water and could damage a shallow reef. Therefore, any landing beach will be surveyed by exercise personnel or SEALs no more than one week in advance of a planned landing, to ensure beach conditions allow a fully-on-cushion approach, landing and turn on the beach.

  In addition, Unai Chulu will be surveyed before and after each landing exercises or at least two times per year, with Unai Lamlam surveyed as a control site. (Unai Babui will also be surveyed, related to AAV landings.) Navy-contracted surveyors will record percent coral cover, turbidity, fish assemblage, sedimentation rates, and topography of each site. CNMI agency representatives will be notified at least 30 days in advance of the survey and will be welcome to accompany survey teams. Survey protocols will be proposed by COMNAVMARIANAS and agreed to by CNMI DFW prior to the first survey.
- Beaches will be surveyed by a Navy biologist for possible sea turtle nests no more than 6 hours prior to a landing. Areas free of nests will be flagged, and vehicles will be directed to remain within such areas.[12] The Navy biologist will monitor beaches during any nocturnal landings. If turtles are observed or known to be in the area, training will be discontinued until all nests have been located and turtles have left the area.
- Salt and sand spray from LCACs will not create significant impacts. No mitigation is required.

4.2.1.4 AAV Landings

Existing conditions. The beach at Unai Babui is approximately 70 m wide.[13] The shoreline is sandy with some outcroppings of limestone at the water's edge on both the northern and southern ends of the beach (see Figure 2-7c).[14] Further up from the shoreline is strand vegetation, dense brush 3 m tall, and scattered trees 3 to 6 m tall. Two roads lead from the beach to an unimproved dirt road lined with tangantangan. Turtles are known to nest at Unai Babui.

[12] Actual nests will not be flagged, as this may direct poachers to nests.

[13] LTJG Smith, AOIC, SEAL Team ONE BRAVO Platoon (April 14, 1994) Memo to Commander, Naval Special Warfare Unit ONE regarding Post-Operations Report For Tinian Island Training Conducted From 20-25 March 1994. Appendix D in Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.*

[14] Additional limestone outcroppings may be exposed by major storms eroding sand from the beach.

The waters at Unai Babui are less than 2 m deep for a distance out about 70 m from the water line. Visual diving surveys conducted in 1994 and 1996 (Appendix C) found only 1 percent or less live coral cover on this shallow reef flat, where wave action is fairly substantial (Figure 4-1).[15] The reef flat is dominated by algal mats and sediment. Past the reef flat, water depth gradually increases to a reef margin and then to a spur and groove platform.

The approach to Kammer Beach is sandy, and coral reef areas are avoidable. The area behind the beach has been developed for picnics and recreation. All other beaches proposed for AAV landings (Unai Chulu, Unai Lamlam, and Unai Dankulo) have higher percentages of living coral than Unai Babui, and all are likely green sea turtle nesting areas.[16] Figure 4-2 shows the high amount of coral cover at Unai Chulu.

Potentially significant impacts.

- The 23- to 27-metric ton, tracked AAV contacts the bottom in water less than about 1.8 m deep (see Appendix B-7), and would crush or compact coral that it contacts, reducing or eliminating a reef's natural functions and usefulness as a tourist attraction. The vehicle cannot contact coral in deeper areas.
- AAVs arriving on the beach would disturb the upper sand layer above possible green sea turtle nests, compacting sand and creating tracks that might be difficult for hatchlings to navigate. AAVs could damage strand vegetation, which is functional in preventing beach sand erosion. (Impacts would be the same for the proposed AAAV, due to be in the inventory in several years.)

Proposed mitigation. Due to the presence of relatively substantial live coral at shallow depths, AAV landings will be prohibited at Unai Chulu, Unai Lamlam, and Unai Dankulo.

- Impacts of AAV landings at Unai Babui will be minimized by restricting vehicles to an established approach lane (see Figure 2-7c) to minimize the area impacted, and by allowing landings only in single file and only during high tide.[17] The designated lane will be 15 to 22 m wide and 70 m long (i.e., the width of the reef at depths of less than 1.87 m), reducing the amount of live coral damaged to 35 m^2 or less.[18] This represents much less than 1 percent of Tinian's total coral reef flat. Prior to the first landing, any movable live coral will be hand-picked and carried to a portion of the reef outside the established lane. The lane will be surveyed, defined in training orders, and may be permanently marked with metal stakes installed above the water line.

[15] Discussions with CNMI Fish and Wildlife personnel indicate that the majority of the live coral is in narrow channels in the reef. Personal communication with Katharine Miller, CNMI Division of Fish and Wildlife, October 1997.

[16] Marine Research Consultants (September 26, 1994) *Preliminary Assessment of the Nearshore Marine Environments Off of Beaches On the Island of Tinian, CNMI: Potential Impacts From Amphibious Troop Landings, Tandem Thrust 95.* Appendix F in Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.*

[17] Established approach lane is at latitude 15°04'50.1"-N, longitude 145°37'17.1" E, with normal axis of beach at 112° M.

[18] Coral cover is 1 percent or less on the reef flat (approximately 60 m long) and 10 percent or less on the reef margin (approximately 10 m of which is at a depth of 1.8 m or less). Therefore, the area of potentially affected coral is: 22 m x 60m=1,320 m^2 multiplied by 1 percent, equaling 13.2 m^2 for the reef flat, plus 22 m x 10 m=220 m^2 multiplied by 10 percent, equaling 22 m^2 for the reef margin, for a total of 35.2 m^2 of potentially affected live coral.

Effects of AAV landings will be monitored by Navy-contracted pre- and postmission reef surveys (with a minimum of two surveys per year) of Unai Babui, with Unai Lamlam as a control site. (Unai Chulu will also be surveyed, as mitigation for impacts of LCAC landings.) Surveyors will record percent coral cover, turbidity, fish assemblage, sedimentation rates, and topography of each site, in accordance with a protocol to be agreed upon between COMNAVMARIANAS and CNMI Division of Fish and Wildlife.

- Prior to AAV landings, beaches will be surveyed for the presence of sea turtle nests. Beaches will be flagged to restrict vehicles from areas suspected of containing nests. No engineered modifications of the beach, such as regrading, will be permitted prior to landings. After exercises are completed, beaches will be restored to their approximate original topography.
- Exit lanes from beaches to connecting roadways will be identified to eliminate the trampling of sensitive strand vegetation.

4.2.1.5 Shooting and Breaching Houses

The proposed shooting and/or breaching houses would be constructed near North Field Runway #1, either in a revetment area that is mostly paved or in a large, grassy field located just south of Runway #1 (see Figure 2-1a).

Existing conditions. These locations are already cleared and lack large stands of tangantangan, which provide habitat for the threatened Tinian monarch. The monarch has been observed to nest in tangantangan in the months of May, August through October, and December.[19]

Potentially significant impacts. Construction would require only minimal clearing of tangantangan (just a fraction of a hectare). While this activity has the potential to affect nesting monarchs or their eggs, at a density of 88.5 monarchs per hectare, only a few individuals, representing less than 0.0002 percent of the population, would potentially be affected by takes or displacement. This is based on the current estimated population of 55,721 monarchs on Tinian.[20]

Clearing is not anticipated to result in cumulative impacts with the VOA site development by the U.S. Information Agency. Less than one percent of the total monarch population will be affected by the VOA project, and the U.S. Information Agency will mitigate removal of monarch habitat by replanting approximately 0.2 km^2 of tangantangan forest.[21]

Proposed mitigation. No clearing will be permitted during the heaviest Tinian monarch nesting season (May through December).

[19] USFWS (April 1996).

[20] Michael Lusk, Steve Hess, Michelle Reynolds, and Scott Johnson (September 1997) *Population Status of the Tinian Monarch (Monarcha takatsukasae) from the Island of Tinian, CNMI.*

[21] United States Information Agency, Internal Broadcasting Bureau, Voice of America, *Final Environmental Assessment and Finding of No Significant Impact for the Voice of America Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands,* August 1995.

4.2.1.6 Small Arms Range

Existing conditions. The proposed range, approximately 450-m-long and 200-m-wide, would be developed in an area vegetated with tangantangan and in grassy areas where the vegetation was previously burned. Medicinal plants, which occur throughout the island, may be present. While Unai Chiget, a known green sea turtle seagrass feeding area, is nearby, no turtle nesting beaches or seagrass feeding areas occur within the proposed SDZ (see Figure 2-1b).

Potentially significant impacts. Potential impacts from the live-fire range are clearing (during construction), fire hazards, and projectile impacts.

- The majority of the site will be cleared of tangantangan, with small patches of trees (approximately 50 trees/ha) left standing if they do not interfere with visibility and fields of fire. Clearing 75 to 80 percent of the site would result in a loss of up to 7 ha of tangantangan habitat. The Tinian monarch population could be impacted by direct takes or habitat loss.
- Ammunition would consist only of small arms bullets (lead with a copper jacket). Tracer rounds could start fires. Under windy, drought conditions, fires could spread rapidly through the tangantangan brush growing between the paved runway areas.
- Targets would be located a maximum of 200 to 300 m from firing points. Each target would have an individual sand backstop or bullet trap designed to stop the majority of the projectiles. A fraction of the projectiles may miss the backstops and continue on into the ocean. The proportion of bullets reaching the ocean will not pose a significant risk to green sea turtles, which are not common in the immediate area of the SDZ.

  No significant impacts on green sea turtles would result from the small number of lead bullets landing in the ocean. The bullets are similar in size and composition to standard fishing sinkers. Turtles are not expected to eat the bullets (which do not look like normal turtle foods). Lead pellets do not readily dissolve in seawater, but develop a coating of salt compound which render the pellet chemically inert.

Proposed mitigation.

- Proposed mitigation is to replant approximately 4 ha of tangantangan (i.e., 60 percent of the amount of removed habitat) in an alternative location, if monarchs are a protected species at the time the range construction.
- No tracer rounds will be permitted on the range, and training will not occur during drought conditions with high winds. The potential fire hazard from use of the proposed firing range will also be mitigated by strict adherence to a fire prevention and response plan, which will be developed by COMNAVMARIANAS and modeled on the Tandem Thrust 95 Plan (enclosed as Appendix F). Preventive measures outlined in the plan will include having firefighting equipment such as water, shovels, and vehicle fire extinguishers readily available during range use.
- No significant impacts to sea turtles are expected, and no mitigation is proposed.

4.2.1.7 Mortar Range

Existing conditions. The mortar range—which is not included in the Preferred Alternative—would be in an area currently vegetated by tangantangan (see Figures 2-1a and 2-1b).

Potentially significant impacts. During construction, the range would be cleared of all tangantangan in an area approximately 1,000 m by 700 m, removing up to 35 ha of monarch habitat. Remaining plants, including medicinal plants, would be periodically cleared by herbicide spray; this will facilitate the identification of UXO.

Mortar rounds are explosive and could ignite fires. Fires on the range itself would not impact monarch habitat, since tangantangan would be previously cleared. However, fires could spread to nearby tangantangan habitat under windy conditions.

Proposed mitigation. If the mortar range were constructed, up to 21 ha of tangantangan (i.e., 60 percent of the amount removed) would be replanted at another location in the EMUA if monarchs are a protected species at the time the range construction. The potential fire hazard from use of the proposed mortar range would be mitigated by strict adherence to the fire prevention and response plan used in Tandem Thrust 95 (see Appendix F).

4.2.2 Cultural Resources on Tinian

Significance criteria. Ongoing and proposed training activities have been evaluated to determine whether potential impacts to historically insignificant cultural resources are significant or nonsignificant in the NEPA sense. The general evaluation criteria are:

- Are there cultural resources in the area where training activities will take place?
- Is there potential for the activity to have an effect that is not considered harmful to a cultural resource?
- Is there potential for the activity to have a harmful effect on a cultural resource?

If the answers to the first and second questions are yes, the training activity would cause a nonsignificant impact. If the answers to the first and third questions are yes, the potential impacts are considered significant.

To determine the likelihood of diminishing the integrity of historically significant cultural resources, a more detailed evaluation of training activities has been performed. Historically significant resources can be affected by ground-disturbing training activities, ricochets, underwater shock waves, or vandalism. The evaluation criteria used for the detailed analysis are listed in Table 4-2.

Tinian has numerous cultural resources, including ancient to recent Chamorro sites and World War II historic sites. The potential to affect sites protected under the National Historic Preservation Act (NHPA) is the basic significance criterion.

Table 4-2 Evaluation Criteria for Potential Impacts on Cultural Resources

Resource	Effect Of Training Activities	Significant If
Historically "significant" resources and National Historic Landmarks	Ground disturbance/damage to resources	Mechanical vegetation clearing activities are planned.
		Vehicles used off established roads.
		Subsurface excavation activities are planned.
		Large numbers of personnel are present.
	Direct impact of projectile/ ricochets	Live fire is used and resources are in line of fire.
	Vandalism (includes removal, defacement, and movement of resources	Training activities require movement of resources.
		Large numbers of personnel are present.

4.2.2.1 Programmatic Impacts

This section analyzes potentially significant non-site-specific (programmatic) impacts of ground-based training and impacts of certain site-specific training activities on particular resources listed in the National Register of Historic Places. Impacts on three training locations of concern: Unai Chulu, Unai Babui, and the former Japanese Naval Air Command Post are addressed in the following two sections.

Information in this section is based on a review of existing survey reports, overview survey reports, draft and final cultural resource management plans, discussion with archaeological contractors conducting surveys in proposed training areas, and data gathered during several site visits in 1996. The review was performed by International Archaeological Research Institute, Inc. (IARII) in December 1996 (Appendix G). The IARII report identifies sites, determines historical significance, and proposes mitigative actions. Archaeological and historic resources on Tinian were evaluated for historical significance in terms of their ability to meet the criteria of eligibility for nomination to the National Register (NR) of Historic Places under the NHPA.[22]

Potentially significant programmatic impacts. Impacts of various ongoing and proposed ground-based training activities include both nonsignificant and potentially significant impacts.

[22] Historical "significance" should not be confused with significance of a potential impact. To be considered eligible for nomination to the NR under the NHPA and referred to as a historically "significant" resource, a resource must possess integrity and meet at least one of the four following criteria of historic value:

A: The resource is associated with events that have made a significant contribution to the broad patterns of our history.

B: The resource is associated with the lives of persons significant in our past.

C: The resource embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high-artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D: The resource has yielded, or may be likely to yield, information important in prehistory or history.

- Nonsignificant impacts include minor ground disturbance (e.g., vehicle tracks) in culturally significant areas without damage to artifacts or architectural features.
- Potentially significant impacts include movement, removal, or defacement of important artifacts or structural features, resulting in loss of archaeological or historic data or inherently important features.
- The potential cumulative impact is the loss of a major portion of the historic and/or archaeological record and the resulting loss of information from repeated nonsignificant impacts (e.g., small disturbances), or the loss of an artifact with intrinsic importance within its historic context. This could result from repetitive training or from cumulative impacts with tourism. Repetitive impacts of ongoing training on Tinian have been addressed in detail in the past[23] and continue to be mitigated by limiting ground-disturbing activities and by complying with a recently developed *Prefinal Tinian Historic Site Protection Plan for the Military Lease Area.*[24]

Proposed mitigation for programmatic impacts. Mitigation of many potential impacts to cultural resources consists primarily of prohibiting certain training activities in certain locations. These measures include identifying NT areas and NCRD areas, where excavation and off-road vehicle travel are prohibited (see Figures 2-7 through 2-10).

Additional mitigation measures will be incorporated in the next revision of COMNAVMARIANAS INST 5440.1C, the order governing training on Navy lands in the Marianas:

- No digging will be permitted within 1 m of any historic structure with concrete walls or in any cave.
- All exercise personnel will be briefed on the significance of archaeological resources and historic structures, including certain areas where activities are limited and areas are off limits. The briefing will include a description of cultural resource indicator (e.g., charcoal-stained soil, pottery fragments, bones). Training personnel will be instructed to stop any digging if such materials are found and to immediately notify the COMNAVMARIANAS Cultural Resources Manager to determine whether digging may be resumed.
- Selected sites within NCRD areas will be flagged or otherwise visually identifiable prior to any ground-based exercise. Permanent signs may be installed at boundaries to some sites.
- Specific sites will be monitored by Navy archaeologists during and immediately after an exercise.

[23] Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.*

[24] International Archaeological Research Institute, Inc. (December 1996) *Prefinal Tinian Historic Site Protection Plan for the Military Lease Area.*

Areas currently identified as LR may become accessible to vehicles after completion of data recovery or additional surveys.

4.2.2.2 Amphibious Landings at Unai Chulu and Unai Babui

Unai Chulu is currently used for LCAC landings and swimmer insertions/extractions, while Unai Babui is used only for swimmer insertions/extractions. [Note that while LCACs only generate wind-blown ground disturbance, they offload wheeled and tracked vehicles which then exit the beach to inland areas.] The training activities which could potentially impact cultural resources are ongoing LCAC landings at Unai Chulu and proposed AAV landings at Unai Babui.

Existing cultural resources. There are several intact prehistoric sites and relatively unique and significant historic sites at both Unai Chulu and Unai Babui (see Appendix G). A prehistoric complex at Unai Chulu contains latte remains, burials, and one of the earliest habitation sites in the Marianas. This site was damaged several years ago by bulldozing for a "tourist access road;" it is presently overgrown by tall grasses which may be hiding additional resources. Unai Babui has several intact prehistoric deposits and numerous human burials. During World War II, U.S. troops landed large numbers of amphibious vehicles at both Unai Chulu and Unai Babui to begin the American invasion of Tinian (see photographs on cover sheet of Chapter Two).

Potentially significant impacts. Ongoing vehicle offloading from LCACs at Unai Chulu and proposed AAV landings at Unai Babui have the potential to affect intact historic sites, if military personnel or vehicles wander off established roads while departing the beaches. In particular, archaeological resources at Unai Chulu are obscured from view by tall grass and are vulnerable to unintentional ground disturbance.

Unai Chulu is also a tourist destination; tourist vehicles park on the rear of the beach while visitors picnic or stroll in the area. As cultural resources are not protected, there is a possibility that tourists could vandalize large resources (e.g., chip off a "memento" from the pillbox at the beach entrance) or remove small artifacts. Tourist numbers on Tinian are projected to increase as a result of casino construction in San Jose. Potential damage to resources from increased tourist visits in the future would generate a cumulative impact.

Proposed mitigation.

- Potential damage to the Unai Chulu site will be mitigated by marking most of the area NCRD, restricting vehicles to designated paths and established roads in the vicinity of Unai Chulu (see Figure 2-7b).
- Potential damage to resources at Unai Babui will be mitigated by marking the area NCRD restricting vehicles to unvegetated areas and existing roadways. Personnel on foot may train in vegetated areas.

4.2.2.3 TRUE Training at Former Japanese Naval Air Command Post

Ongoing training at this location involves personnel shooting at bullet traps on the outside of the building or entering a particular room of the building from the surrounding woods and shooting at bullet traps. All bullet traps are portable devices removed following exercises.

Existing cultural resources. The former Japanese Naval Air Command Post, located at Ushi Airfield, was used during World War II and was a major target for American air and naval bombardment before the invasion of Tinian.[25] It is considered part of the North Field National Historic Landmark and is a popular tourist attraction. It is a two-story concrete building with semi-intact walls and floors; bomb damage and bullet holes exist throughout the building (see photograph on cover sheet of Chapter Three).

Potentially significant impacts. This training activity has the potential to damage the building, which is considered a significant historic resource, if bullets should directly hit the walls. The likelihood of bullets impacting the wall is small, given the short range at which firing will occur. Therefore, no significant impact to the building's structure from bullets is expected. There is also potential for cumulative impacts due to the repetitive nature of the training activity and to increasing numbers of tourist visiting.

Proposed mitigation. Mitigation will consist of photographing the building walls before and after exercises to determine whether any damage has occurred. The photographs will be evaluated by a Navy archaeologist, who will then allow or disallow training exercises to continue. The training unit will clean up any litter within the vicinity of the command post after exercises are completed, including litter left by civilians.

4.2.3 Wastewater Disposal on Tinian

This section analyzes the impacts of disposing domestic wastewater generated by ongoing training on Tinian. This is a significant issue because improper wastewater disposal can create public health impacts from contaminated drinking water or surfacing effluent. Tinian has no public or private wastewater treatment plant, but the Municipality owns relatively large septic systems at the Field House and at the former administration/school building, both of which have been used by training organizations in the past. The following sections focus on the impacts of disposing wastewater to existing or future municipal wastewater disposal facilities, including cumulative impacts resulting from activation of the VOA facility and one or more casinos and hotels.

Proposed action. This DEIS proposes continuing use of municipal facilities by small training units as well as continuing use of portable toilets (PTs) by large training groups. All alternatives except No Land Use propose continued disposal of PT waste into the Municipality's two existing

[25] Don A. Farrell (1992) *Tinian.*

septic systems, although the Preferred Alternative proposes eventual diversion of some small unit and all PT wastewater to a military septic system at the proposed logistics support base camp.

Overview of training impacts. This analysis focuses on impacts of military wastewater on wastewater disposal systems.[26] The analysis is divided into small-scale exercises (defined here as not more than 50 persons) and large-scale exercises. Because it is assumed that the septic system will be properly designed, sited, and permitted, this section does not focus on impacts of the proposed septic system on groundwater in the EMUA.

Impacts on wastewater systems would result from overloading or from affecting a system's ability to break down wastes.

- If a septic system is overloaded on a single occasion, wastewater or septic tank effluent may surface, causing potential public health hazards in addition to nuisance odors. No long-term damage to the system is likely to result.
- Chronic overloading has the potential to affect the long-term functioning of the system. It can impair biological activity, reducing the frequent maintenance to remove and dispose sludge, increasing costs to the system owner. Increased accumulation of solids would eventually deteriorate the soil absorption system, shortening the systems functional life.
- A septic systems microorganisms may be damaged or destroyed if any substance lethal to them is added to the system with wastewater. Tank microorganisms are naturally occurring; if they are completely destroyed, they will reappear after approximately a month, provided that the lethal substance is not persistent in the tank. During the time the microorganisms are not fully functioning, wastewater will not be fully clarified and solids will not be broken down within the tank.

Evaluation criteria. Potential impacts of military wastewater disposal are evaluated using the criteria presented in Table 4-3.

Table 4-3 Evaluation Criteria for Potential Impacts of Wastewater Disposal

WASTEWATER TREATMENT SYSTEM	PARAMETERS	SIGNIFICANT IF
Existing municipal septic systems	Capacity	Addition of military wastewater* would cause one or more overflow or surfacing events
		Addition of military wastewater* would increase maintenance requirements by 10%
	Toxicity	Addition of PT wastewater would damage/destroy tank microorganisms
Future municipal wastewater treatment plant (if constructed)	Capacity	Addition of military wastewater* would cause one or more overflow of surfacing events
	Toxicity	Addition of military wastewater* would increase maintenance requirements by 10%

[26] The impacts of improper wastewater disposal practices, such as discharge of untreated wastewater over land or into coastal waters, are not addressed as no such practices are proposed.

Table 4-3 *(continued)*:

WASTEWATER TREATMENT SYSTEM	PARAMETERS	SIGNIFICANT IF
Future DoD septic system	Impacts on groundwater	Contaminants could leach to drinking water source
Field disposal	Impacts on groundwater	Contaminants could leach to drinking water source

NOTE: The combination of PT wastewater and direct additions by military use of showers and toilets at Field House.

4.2.3.1 Existing Wastewater Disposal Facilities on Tinian

The only wastewater disposal systems currently in use on Tinian are individual wastewater systems (IWSs). No collection system for wastewater from multiple sources exists. The IWSs mostly consist of either cesspools or septic tank systems with leaching fields or seepage pits (Figure 4-3). The newly constructed Tinian Dynasty Casino has a package treatment plant.

- **Cesspools** are subsurface pits into which wastewater is discharged directly.
- **Septic tank systems** consist of watertight anaerobic treatment tanks with discharge to soil absorption systems, such as absorption trenches or beds, or seepage pits. Naturally occurring microorganisms in the tank decompose waste, clarifying liquids and facilitating settling and volume reduction of solids.
- **Absorption trenches and beds** are relatively shallow excavations that are back filled with drain rock and contain drain pipes.
- **Seepage pits** are physically identical to cesspools, but they are used for disposal of septic tank effluent rather than raw sewage.

Two of Tinian's larger septic systems, owned by the Municipality of Tinian and Aguijan, are at the Field House and at the former administration/school building.

- The Field House septic system has a capacity of approximately 8.6 cubic meters per day (m^3/d). The septic tank volume is 8.64 m^3/d, and the absorption field area is approximately 170 m^2.
- The capacity of the septic system at the former administration/school building is not known. The septic system served approximately 350 daytime staff and students during the 1970s.[27] Based on a generation rate of 0.05 m^3/d per student or staff member,[28] this equates to a design flow of approximately 18 m^3/d.[29]

[27] M&E Pacific, Inc. (June 1979) *Supplement B, Facilities Plan for the Island of Tinian, Mariana Islands.* Prepared for Department of Public Works, Government of the Mariana Islands.

[28] Hawaii Administrative Rules, 11-62, Table I.

[29] Note that available records do not contain specific information on the actual design capacity, septic tank and leach field sizes, and the condition of the existing system. The system was constructed before the existing IWS permitting program was established by the CNMI Department of Public Works, Division of Environmental Quality (DEQ).

There are no existing wastewater disposal facilities for military or tourist use in the EMUA or LBA. Past military field sanitation practices consisted of either using portable toilets (PTs) temporarily installed along Eighth Avenue and in the EMUA, or by individual dig-and-bury (cat holes). Wastewater from the PTs was disposed into municipal septic tanks.

4.2.3.2 Wastewater Disposal for Small-Scale Exercises

MILITARY USE OF EXISTING FACILITIES

Any military personnel housed in facilities with restrooms and showers will generate approximately 0.1 m^3 of wastewater per person per day.

Potential impacts. Military personnel may train in the vicinity of San Jose Village and West Tinian Airport. They will use sanitary facilities at the Field House, the airport, and other public places. Loads upon public facilities will be increased; however, due to the small numbers of personnel and the short duration of small-scale exercises, the additional loads will be within the operating capacity of properly functioning systems. If 50 people are housed at the Field House, they will generate a maximum of about 5 m^3/day of wastewater, which will not overload the facility's septic system (capacity of approximately 8.6 m^3/d). Impacts will not be significant.

Proposed mitigation. If public functions at the Field House preclude use of the sanitary facilities by military personnel, PTs will be used at the site; PT waste will be disposed into the Field House septic system after public functions have finished. No other mitigation is required.

FIELD SANITATION

Field sanitation practices will be employed during field exercises in areas where no sanitary facilities are available.

Potential impacts. Common field sanitation practices, such as temporary pit toilets and small individual excavations (commonly referred to as "cat holes"), are not easily practiced on Tinian. Difficulties in controlling such procedures are exacerbated by the predominance of shallow soils over limestone bedrock and by the occurrence of compacted granular surface soils at many locations. Resulting shallow burial of human wastes could result in health hazards for future users of the sites, which would potentially be a significant impact over time, if practiced by a large number of individuals.

An alternative field-sanitation practice is use of diesel-fired "burn cans" as toilets, and subsequent field burial of residual ash.[30] Burn cans would generate minimal emissions, would be more easily controlled, and would not leave potentially contaminating residues which could be a nuisance and a hazard for future users of the site.

[30] No diesel residue remains in the ash.

Mitigation. Proper management of field sanitation will adequately mitigate the potential for significant impacts. The U.S. EPA has indicated that they do not anticipate adverse air quality impacts from use of burn cans for small-scale training exercises where troops are concentrated in camps. Burn cans are, therefore, the preferred method of disposal for sanitary wastes from small-scale field exercises where troops are concentrated in camps. Burn cans will be properly sited and supervised to minimize potential nuisance from smoke emissions and to prevent brush fires (which could have significant impacts on endangered species, as indicated in Section 4.1). Dig-and-bury techniques on Tinian are only appropriate for very small units.

4.2.3.3 Wastewater Disposal for Large-Scale Exercises

POTENTIAL IMPACTS

Proper treatment and disposal of wastewater from large field exercises, for which no permanent sanitary facilities are available, will minimize the potential for significant public health hazards and pollution that can occur if sanitary waste disposal is not handled properly. The practice of contracting a number of PTs, as has been done for past Tandem Thrust exercises, significantly reduces potential health hazards. Assuming that an adequate number of PTs is provided at suitable locations, the only potential impact is overloading of municipal septic systems.

Approximately 30 PTs were used for about 1,500 people during Tandem Thrust 95, according to the *Tandem Thrust 95 Solid Waste and Sludge Management Plan, Draft Report* by Barrett Consulting Group, Inc. The plan indicates that the wastewater generation rate from the PTs averaged 0.8 to 1.5 m^3/d. This total daily volume is no more than half of the design rate of an average single family house.[31] If this average generation rate were produced for approximately 10 days, a total of no more than 15 m^3 would be generated. When disposed in a municipal septic system, this would increase sludge accumulation in the tank(s) and would increase the hydraulic loading and possibly the solids loading to the soil absorption system(s). The increased solids loading to the existing septic system(s) may require more frequent removal and disposal of the septic tank sludge.

- The septic system at the Field House, with a capacity of approximately 8.6 m^3/d, will be able to accept 1.5 m^3/d of additional wastewater if base flows from other sources do not exceed approximately 7.1 m^3/d.[32]
- Because the actual size and condition of the septic tank system at the former administration/school building is not known, it is not possible to predict the specific impact of the discharge of PT wastes from large-scale exercises.

PT wastes are highly concentrated in comparison with typical domestic wastewater. If disposed of improperly, the PT wastes could be a public health threat or could cause pollution of stormwater runoff, coastal waters, or groundwater. If deodorizing solutions in the PTs contain

[31] Hawaii Administrative Rules, Chapters 11-62, "Wastewater Systems."

[32] For Tandem Thrust exercises, up to 50 military personnel may occupy the field house for several weeks. As indicated in Section 4.1.3.2, these personnel are expected to generate a total maximum of about 5 m^3/day [0.1 m^3 per person].

disinfectants (biocides), emptying PT waste into a municipal septic system could damage or destroy needed septic system microorganisms.

For field exercises in locations that are not served by PTs, the potential impacts would be similar to those for small scale exercises.

PROPOSED MITIGATION

Portable toilets for temporary facilities. Portable, self-contained toilets will continue to be used for all large-scale exercises on Tinian. The use of PTs will adequately mitigate the potential for health hazards or pollution that could otherwise result from inadequate sanitation facilities. PTs typically hold up to 0.23 m^3 but are often pumped out well before they are filled to capacity. Contracts for PT services will specify that no disinfectants (biocides) may be used in the toilets. Nondisinfecting deodorizing solutions, employing bacteria and/or enzymes, are available.[33] The PT service will be provided by contract with local suppliers whenever possible.

Wastewater disposal at existing municipal septic systems. With permission of the Municipality and proper coordination with other events at the Field House, it will be possible to dispose of PT wastes in the septic system at the Field House. If other functions at the Field House during large-scale exercises preclude the use of the Field House septic system for disposal of PT wastes, PT wastes will not be disposed until use of the Field House decreases or, with permission of the Municipality, will be disposed in the septic system at the former administration/school building. Both of these options are considered to be short-term measures until a septic system for military use is constructed at the proposed base camp.

Septic tank system at base camp. Potential impacts of wastewater generated at the Field House and from disposal of PT wastes will be mitigated in the long term by construction of a septic tank system at the proposed logistics support base camp in the EMUA. The facility, which will include a septic tank and leach field, will be secured to prevent unauthorized use. This mitigation will alleviate both municipal and DEQ concerns regarding capacity and sludge accumulation issues at the Field House and other existing municipal septic tank systems. The septic tank system will be annually inspected to determine the volume of sludge accumulation. When the accumulated sludge reaches a specified level, the tank will be pumped out. If the leach field is found to have failed, it will be reconstructed or replaced prior to the next larger-scale exercise.

Disposal of the septage is normally to a wastewater treatment plant if one is available. In the absence of treatment facilities, as is the case on Tinian, septage will be discharged to a properly designed sludge-drying bed for drying and further stabilization. The dry sludge can then be landfilled or used as a soil amendment under controlled conditions.

Composting toilets for treatment. Composting toilets are not the best method of domestic military waste treatment. Although they provide more complete biodegradation of organic wastes, several characteristics make them undesirable for military use on Tinian:

[33] Personal communication with Fred Newmark, J & J Chemical Company, May 1996.

- They require more maintenance than septic tank systems.
    - Many models require electrical power to enhance evaporation and ventilation for both moisture control and odor control.
    - They generally require the addition of a "bulking agent" to absorb moisture and facilitate aerobic conditions.
    - Moisture buildup can be a problem, especially in nonelectrical units.
    - Control of vectors would be more difficult than with PTs and septic tank systems.
    - They are more sensitive to shock loading than septic tanks.
    - Although concentrated, PT wastes contain excess liquid which make them unsuitable for discharge to composting toilets.
    - They do not represent final disposal, as the composted wastes must be disposed of as a soil amendment or landfilled.
    - They are generally less portable and more expensive than PTs.

4.2.3.4 Cumulative Effects with Casino Development and VOA

POTENTIAL IMPACTS WITH CASINO DEVELOPMENT

Casino resort development on Tinian could impact wastewater management on the island significantly. However, because wastewater flows generated by military training activities would be a very small percentage of flows generated by a large casino development, the impact of the military contribution of wastewater would not be significant.

If casino development does not involve the construction of a municipal wastewater collection and treatment system, the casino developers would need to build their own self-contained existing wastewater treatment and disposal systems. (The first casino to be built has its own package plant.) In this case, the only cumulative impact on wastewater disposal systems in San Jose Village and other parts of the island would be due to the increased demand by larger numbers of tourists. Assuming any new individual wastewater systems around the island were sized adequately to accept wastewater flows from additional tourist activity, the wastewater contributions from military training activities would not be expected to cause system capacities to be exceeded or system maintenance requirements to increase by more than 10 percent except at the Field House. Thus, the cumulative impact of wastewater generated by military training activities would not be significant. No mitigation would be required.

In the long term, the population and economic growth resulting from large-scale casino development would probably require development of a municipal wastewater collection and treatment system designed to serve a population of 20,000 or more residents and tourists.[34] A

[34] Dames & Moore, Juan C. Tenorio & Associates, and Austin Hansen International (March 1994) *Island of Tinian Master Plan Strategy Study.*

typical per capita generation rate for design of municipal wastewater collection and treatment systems is 0.4 m^3/d per person, which suggests a minimum treatment plant capacity of approximately 8,000 m^3/d. The wastewater flows generated by the proposed military training activities (approximately 5 m^3/d at the Field House plus 1.5 m^3/d of concentrated wastes from PTs during a large-scale exercise) would represent less than one percent of the wastewater treatment plant design flow. This small percentage would not be expected to cause system capacities or increase system maintenance requirements by more than 10 percent, indicating that the impact of the military contribution would not be significant. Again, no mitigation would be required.

POTENTIAL IMPACTS WITH VOA

The cumulative impact of wastewater treatment and disposal from military training activities and the VOA development will not be significant. The VOA proposes to build and operate its own IWS on the VOA site. Preliminary estimates indicate that the VOA station will generate approximately 3 m^3/d of wastewater.[35] There will be no cumulative impact upon wastewater facilities because wastewater generated by military training activities will not be discharged to the VOA facility. Also, because the VOA wastewater generation rate approximately equals the design rate for a single-family house, the cumulative impact upon groundwater of wastewater disposal through leach fields from military exercises and the VOA station would not be significant.

PROPOSED MITIGATION

If a municipal wastewater treatment plant is built as a result of future casino resort development, or for any other reason, an effort will be made to secure an agreement with the Municipality to dispose of PT wastes to the municipal treatment plant.

If the proposed base camp and associated septic system are built on VOA property, the military septic system will be sited at least the minimal distance from the VOA system required by CNMI regulations and/or permits.

4.2.4 Disposal Of Solid And Hazardous Waste Generated On Tinian

This section analyzes the cumulative impacts of waste disposal from continued training on Tinian. The issue is significant for two reasons: (1) there are no approved on-island waste disposal facilities and (2) transporting waste off-island for disposal is expensive and somewhat complicated, due to federal and local regulatory requirements.

Training activities routinely generate varying amounts of solid waste (SW) (primarily cardboard and paper) and very small amounts of used oil; some ongoing training activities generate used

[35] U.S. Information Agency, Voice of America (August 1995) *Public Review Copy: Final Environmental Assessment and Finding of No Significant Impact for the Voice of America Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands.*

lithium batteries, which require transport as hazardous materials, if fully expended.[36] No hazardous waste (HW) is routinely generated by military units training on Tinian. On Tinian, there is no existing military infrastructure for waste disposal.

The sections below are developed from information provided in a study of waste disposal practices and options generated after the 1995 Tandem Thrust (TT 95) exercise.[37] [Note that all measurements quoted were originally provided in English units and have been converted to metric units for this document.]

4.2.4.1 Existing Conditions

SW and HW generated on Tinian. Observations of SW disposal practices during TT95 indicated that approximately 107 m^3 of SW was generated.[38] A visual estimate of waste components indicated that at least 90 percent of the waste consisted of traypack meals and associated paper and cardboard packaging and plates. The remaining 10 percent consisted primarily of plastic eating utensils and aluminum or glass beverage containers. SW was transported to Guam by a contractor (Guahan Waste Control, Inc.) and disposed at the PWC landfill at COMNAVMARIANAS Waterfront Annex, after steam sterilization and fumigation.

SW generated during relatively small exercises, e.g., National Guard and Army Reserve units training on Tinian, has been backhauled to Guam by the training unit and disposed at the PWC landfill. Waste generated by other organizations training on Tinian has been backhauled to the originating unit's home location and disposed with that location's SW.

Assuming that the total SW generated by National Guard and Army Reserve units annually approximately equals the volume of TT95 waste, and that TT exercises will continue to occur every other year, the volume of waste backhauled annually to Guam from Tinian would range from about 110 m^3 to 220 m^3. No HW is routinely generated on Tinian. Small amounts of used oil resulting from unexpected vehicle repair or small releases is transported as SW. Once received by PWC or DRMO on Guam, the oil can be tested for hazardous characteristics to determine whether it should be classified as HW. All HW is managed and stored at PWC or AAFB temporary storage areas operated in compliance with RCRA regulations. There is a potential for additional used oil to be generated if vehicles are permanently stationed at the proposed base support camp. Regular vehicle maintenance would generate used oil with the potential to be HW.

Past exercises have generated expended lithium batteries, which are used in communications equipment and are hazardous materials (HM) by virtue of their potential to rupture, causing an explosion and/or fire. Used lithium batteries can be recycled and are considered HM rather than

[36] Expended lithium batteries are recyclable materials, which are returned to the U.S. mainland for recycling. If not recycled, they must be classified as HW.

[37] Earth Tech, Inc. (1996) *Tandem Thrust 95 Solid Waste and Sludge Management Plan.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[38] Earth Tech, Inc. (September 1996).

HW. They may be transported from a simulated combat area without special packaging; once reaching a nontactical airport, they must be transported in accordance with DOT and DoD regulations regarding HM.[39]

SW facilities. Tinian does not have either military or civilian facilities available for disposal of SW or HW generated by training personnel. Tinian's municipal landfill is an open dump, which is not in compliance with federal solid waste regulations.[40] The dump is located downwind of San Jose, near the former leprosarium north of town. There is no public or private waste-hauling service; residents bring their own trash to the dump. There are no landfills on Saipan or elsewhere in the CNMI in compliance with federal regulations. As a result, the nearest landfills available for disposing SW generated by training are those on Guam.

A recent SW study evaluated five SW disposal options for Tinian: constructing a landfill, recycling, composting and co-composting, mobile incineration, and export off-island.[41] The study concluded that export was the only feasible and cost-effective disposal method and recommended backhauling all waste to Guam, as there are no RCRA-approved disposal facilities in the CNMI.[42] Therefore, the resources impacted would be ocean transportation and military disposal facilities on Guam.

Guam has two military landfills and one civilian landfill:

- The Navy Public Works Center (PWC) operates a 37.6-hectare landfill in the southern portion of the COMNAVMARIANAS Waterfront Annex. The landfill is currently being studied to determine its capacity and annual fill rate. The currently established maximum landfill height is about 9 m above mean sea level (MSL)[43] and the annual volume of SW entering the landfill is estimated to be between 60,000 m^3 and 115,000 m^3. The remaining service life is estimated to be between 14 and 17 years, respectively. However, a proposed vertical expansion to 14.63 m MSL (48 ft MSL) would extend the life span to between 22 and 41 years.[44]

- AAFB has a landfill that is nearing capacity and is not able to accept non-Air Force waste.

[39] Joint publication AFJMAN 24-204/TM 38-250/NAV SUP PUB 505/MCO P4030.19F/DLAM 4145.3 (25 November 1994) *Preparing Hazardous Materials for Military Air Shipments.* Chapter 3 Tactical Contingency or Emergency Airlift, Section 3-8 "Lithium Batteries" specifies that used lithium batteries may be transported installed in electronic equipment if installed in a battery box or compartment, without additional packaging. Used lithium batteries not installed in equipment may be airlifted from a forward area (i.e., close proximity to combat or simulated area) provided each battery is wrapped in nonconductive material to prevent short-circuit. However, at the first en route airport before further airlift, batteries must be properly packaged (i.e., individually wrapped in nonconductive material) and placed in an outer container.

[40] 40 CFR Part 257 *EPA Regulations on Criteria for Classification of Solid Waste Disposal Facilities and Practices*, and Part 258, *EPA Criteria for Municipal Solid Waste Landfills.*

[41] Earth Tech, Inc. (September 1996).

[42] Disposal at a non-RCRA-approved facility has the potential for significant long-term impacts on groundwater quality and public health. Therefore, such disposal is not an option for units training on Tinian.

[43] Actually, 30 feet MSL.

[44] Personal communication with Michael Miyahira, GMP Associates, Inc., May 9, 1996.

- The only civilian waste disposal facility on Guam, Ordot Landfill, is an open dump out of capacity and out of compliance with RCRA regulations. Under a consent order signed with U.S. EPA, GovGuam was required to close Ordot in 1997; due to a lack of funding and the difficulty of gaining approval for a new site, this has not occurred. The situation as of May 1998 is unresolved.

SW delivered to Guam from aircraft and ships arriving from all sites outside the continental U.S. and Canada must be steam-sterilized prior to disposal in landfills on Guam.[45] PWC maintains pier side dumpsters in Apra Harbor and the Guam Commercial Port with approved sterilization capability.

HW facilities. There are no RCRA-approved HW treatment, storage and disposal facilities (TSDFs) on any island in the CNMI or Guam. HW and used oil generated by military organizations in the Marianas are managed and disposed by the Defense Reutilization and Marketing Office (DRMO), which transports HW from PWC and AAFB on Guam to the continental U.S. for disposal at a licensed facility.

Any HW generated on ships and at locations off Guam must be approved by GEPA prior to offloading on Guam.[46]

Significance criteria. Waste disposal activities resulting from ongoing training were evaluated to determine whether they would have a potentially significant impact on the environment. The criteria used are presented in Table 4-4.

[45] U.S. Department of Agriculture, Animal and Plant Health Service (3 May 1995) *Compliance Agreement for the Handling and Disposal of Foreign Garbage by the U.S. Navy Public Works Center, Apra Harbor, Naval Station, Guam.*

[46] Such waste is considered an import by GovGuam and must conform to Guam EPA regulations. A generator must be identified, must have or obtain a generator identification number from the U.S. EPA, and must initiate an import request involving a 60-day approval period.

Table 4-4 Evaluation Criteria for Potential Impacts of Solid and Hazardous Wastes Generated on Tinian

CRITERION	PARAMETER	SIGNIFICANT IF
SW transportation	Presence	No commercial or military vessels available to transport SW containers between Guam and CNMI
	Means of controlling pest/disease import	No protocols and associated infrastructure established
	Import from CNMI to Guam	Prohibited by law
SW disposal facility	Presence	No RCRA-compliant facilities available within Guam/CNMI region (per 40 CFR 257 and 258)
	Landfill service life	SW from Tinian would shorten service life by 5% or more
HW and HM transportation	Presence	No DOT-compliant commercial or military aircraft or vessels available (per 49 CFR 257 and 258)
	Import from CNMI to Guam or continental U.S.	Prohibited by law
Permitted HW TSDF	Presence	No RCRA-permitted facilities available within Marianas (per 40 CFR 171-173)
HW Storage	Presence	No temporary (<90 day) storage facility or permitted HW TSDF in Guam or CNMI (per 40 CFR 261 and 262)
HW, HM, used oil handling and storage	Means of preventing and controlling spills	No SOPs and associated infrastructure are established or present

4.2.4.2 Potentially Significant Impacts of Solid Waste Disposal

Transportation availability and controls. No significant transportation impacts are expected as there are commercial transporters in Guam and the CNMI interested in having the business. In addition, DoD ships are capable of transporting SW.

Empty SW dumpsters will be inspected for brown tree snakes in accordance with the *BTS Control/Interdiction Plan* discussed in Section 4.1. No BTS controls would be necessary to ship SW from Tinian to Guam. SW shipments from Tinian to Guam will continue to be inspected by the Department of Agriculture, including fumigation and visual inspection for other pests.[47]

Transporting SW from CNMI to Territory of Guam. SW shipments from the CNMI to Guam are considered imports by GovGuam, which has indicated it prefers not to approve SW imports into the territory, even for disposal at a DoD-owned and -operated facility. However, GovGuam has not attempted to prohibit such imports and has established a protocol for handling such waste. Therefore, although occasionally backhauling SW to Guam may generate increased friction between GovGuam and the Navy, it is not expected to have a significant impact on solid waste disposal resources.

[47] Fumigation and inspection are required by the Compliance Agreement between the U.S. Department of Agriculture and the Navy Public Works Center dated May 3, 1995.

Licensed disposal facilities. No significant impact is expected from lack of a licensed SW landfill with adequate capacity.

The PWC SW landfill is located within the Marianas, is available to receive SW from military activities in and around that area, and is in compliance with RCRA regulations. It has the capacity to accept additional SW without decreasing its service life by 5 percent or more. An estimate of 500 m^3 of SW per year was assumed to be generated by exercises on Tinian. The estimate is conservatively high, so about half that amount is more likely. This represents less than 1 percent of the waste annually accepted by PWC landfill.[48]

This means that the backhauled Tinian SW would potentially shorten the service life of the PWC landfill by a maximum of 21 days in seven years, its minimum anticipated service life.[49] This reduction of less than 1 percent in the landfill service life does not meet the volume criterion for significant impact to the landfill capacity.

There would be no impact on the civilian landfill situation. PWC is not a potential repository for civilian SW; therefore, disposal of Tinian's military-generated SW at the PWC landfill would not affect the island-wide capacity for civilian-generated SW disposal.

4.2.4.3 Proposed Mitigation of SW Impacts

The impact on GovGuam-Navy relations from backhauling solid waste from Tinian cannot be entirely mitigated without providing for SW disposal on Tinian, which would be extremely costly and difficult to control, in the absence of any staffed DoD base on Tinian. The Navy will continue to work closely with GovGuam to allay concerns regarding imported SW.

The funding and logistical impacts on training organizations may be mitigated by implementing waste minimization measures, in accordance with current Navy policy.

4.2.4.4 Potentially Significant Impacts of Used Oil and HW Disposal

Transportation. All HW and HM will be transported by DoD aircraft or watercraft in accordance with RCRA, U.S. Department of Transportation (DOT), and GEPA regulations regarding HW transport, handling, and storage. Commercial HW shipping companies may also

[48] 500 m^3/60,000 m^3 = 0.008 = 0.8% < 1%
Where 500 m^3 = volume generated annually on Tinian
and 60,000 m^3 = lowest estimate of annual volume entering PWC landfill at the present time.
500 m^3 /115,000 m^3 = 0.004 = 0.4%<1%
Where 115,000 m^3 = highest estimate of annual volume entering PWC landfill at the present time.

[49] 0.8% x 2555 days = 20.4 days
Where 2555 days = 7 years, the minimum estimated service life.
0.8% x 5110 days = 40.9 days
Where 5110 days = 14 years (maximum estimated service life without proposed expansion)

be contracted to ship HW from Tinian to Guam or Saipan for transshipment to the continental U.S.

Permitted disposal facilities. HW and HM (i.e., expended lithium batteries) will be transported either to Guam or directly to the continental U.S. by the generating units. HW transported to Guam will be managed and temporarily stored by PWC or by DRMO, prior to shipping to the continental U.S. for disposal at a licensed TSDF.

Spill prevention measures. No significant impact from an unexpected release is expected on Tinian, as all units operating on Tinian must be in compliance with military orders regarding spill prevention and response.[50] Storage and handling of HW, HM, and used oil are managed in accordance with federal regulations and associated military instructions.[51]

4.2.4.5 Proposed Mitigation of Used Oil and Hazardous Waste Impacts

To reduce the amount of used oil generated on Tinian, no scheduled vehicle maintenance will be permitted during exercises on Tinian. All vehicle refueling will occur on paved/impervious surfaces or with spill containment equipment in place. Used oil backhauled to Guam will be periodically tested for HW characteristics.[52] If the used oil is determined to be HW by the toxicity characteristic, future shipments of used oil from Tinian to Guam will be managed in accordance with federal and Guam regulations regarding HW shipping and import.

Any release of petroleum, oil or lubricant during a training exercise on Tinian will be contained and absorbed with clay particles (cat litter), in accordance with existing SOPs. The resulting waste will be placed in a secure container and backhauled with the generating unit for disposal at its home location.

4.2.5 Range Safety on Tinian

This section addresses potential public access conflicts and public safety measures in place for proposed weapons training.

Significance criteria. All potential impacts of live-fire training are significant, if they affect human safety. Military training SOPs and area-specific constraints have long been in place to prevent accidents associated with this training. The SOPs are established on safety criteria and related operational/training procedures published by responsible government agencies and tailored for specific ranges and airfields. Significance criteria are included in Table 4-5.

[50] U.S. Department of the Navy, Commander, Naval Forces, Marianas (16 February 1993) COMNAVMARIANAS Instruction 5090.2 *Oil and Hazardous Substance (OHS)* Pollution Contingency Plan.

[51] E.g., RCRA solid waste regulations at 40 CFR Parts 240 and 250, RCRA hazardous waste regulations at 40 CFR Parts 260 and 270, OPNAVINST 5090.1B *Environmental and Natural Resources Protection Manual,* COMNAVMARIANAS INST 5090.2 *Oil and Hazardous Substance (OHS) Pollution Contingency Plan*, and various site-specific OHS (oil and hazardous substances) Spill Contingency Plans.

[52] See 40 CFR 261.20-261.24, *Characteristics of Hazardous Waste.*

Table 4-5 Evaluation Criteria for Potentially Significant Effects of Live-Fire Training

ACTIVITY SIDE EFFECT	PARAMETER	SIGNIFICANT IF
Personnel safety	Risk of injury to personnel in range area, surface danger zones, nearby roads and trails, and adjacent waters	Lack of range SOP, range and SDZ safety observers, communications, and positive range control to keep all unauthorized personnel clear of the ranges
		Lack of ability to inspect a range (range sweep) for UXO prior to using a range for training, and prior to departing a range after training
		Lack of standard public notifications (NOTMAR, maps, press releases, etc.)
		Lack of roadblocks and sentries to stop vehicular traffic through the range area
	Risk of injury by UXO	Lack of means to clear UXO caused by training activities
Aviation safety	Risk of damage to aircraft by aloft munitions	Lack of NOTAM publication and direct communication with FAA to coordinate mortar training and commercial/military flight activity
Damage to roads	Risk of mortar round impacts on public thoroughfares	Lack of immediate road repair capability

4.2.5.1 Existing Conditions at Existing and Proposed Range Areas

The proposed sites for new small arms and mortar ranges on Tinian (see Figure 2-1b) are adjacent to a former range, the use of which has been suspended. The former range was oriented north to south along the island's east coast and was used for live-fire training with rifles, crew-served light machine guns, 60mm mortars, and 40mm grenades. The range's impact area now contains UXO from mortar and grenade training. The UXO density and characterization have not been formally investigated. Portions of the former impact area contain native plants sometimes gathered by local residents for ethnobotanic uses.

The proposed small arms fire-and-maneuver range would be oriented west to east, with a surface danger zone (SDZ) across the old range and into the sea. The proposed 60mm mortar range (which is not part of the Preferred Alternative) would be oriented north to south, parallel to and immediately west of the former range. The SDZ for each range is configured to include margins of safety on both flanks and beyond, to compensate for aiming errors and ricochets with the designated weapons for each range. The SDZ is an area that must be kept clear of all personnel during range use.

A specific site for a shooting house has not been selected beyond designating North Field as a logical location. The shooting house would have a 50 m radial SDZ, and would need to be in proximity to an airfield or helicopter LZ. Numerous suitably sized areas with minimum vegetation exist near the North Field runways.

TRUE training is conducted at the former Japanese Naval Air Command Post, a two-story building which sustained substantial bomb damage during World War II. Temporary bullet traps are mounted outside and inside the building. Exercises are held primarily at night.

Prior to the introduction of any live-fire training to Tinian, ranges would be designed and certified by the Naval Facilities Engineering Command. In addition, air space Restricted Areas and SDZs would be established, if needed. These restrictions would be processed with the FAA and USCG.

As a means to ensure that NOTAM and NOTMAR coverage includes CNMI, early notification would be provided to the CNMI Emergency Management Office for marine band broadcasting simultaneously with USCG NOTMAR broadcasting from Guam.

4.2.5.2 Potentially Significant Impacts

Fire-and-maneuver range. The proposed small arms fire-and-maneuver range would have an SDZ extending over navigable waters and a public road, creating potential hazards to boaters as well as to tourists visiting historic trails and sites in the EMUA.

No impacts on water quality would result from projectiles (bullets) landing in the ocean. Lead and associated trace metals acquire a coating of hard-water minerals which prevent release of free lead or other metals into the water and prevents lead exposure to marine organisms, except those that swallow whole pellets.[53]

Shooting house. It would be possible for civilian visitors to leave a historic trail and, by using the many former taxiways and parking aprons, inadvertently enter the shooting house area while urban training was being conducted. Safety impacts are unlikely, given shooting house design.

TRUE training. It is possible for civilians to encroach on the training area, generating safety hazards.

Mortar range. The 60mm mortar has the potential for causing dud (UXO) contamination in the range impact area. Although the impact area can be swept, fenced, and posted with warning signs, such measures cannot guarantee that the mortar impact area would not be entered. The limestone terrain and heavy underbrush in the proposed impact area would make post-training dud clearing by EOD personnel extremely risky. UXO would accumulate in the designated impact areas, constraining future land use. Fire from the mortar range could damage the public roadway running north-south along the island's east coast.

Potential impacts of mortars on aviation safety are discussed in Section 4.2.4.

4.2.5.3 Proposed Mitigation

Live fire training is inherently dangerous and has resulted in volumes of rules and regulations which must be followed by those conducting, and by those participating in, firing and demolition

[53] Memorandum from Leslie Au, Hawaii Dept of Health toxicologist, February 2, 1998 regarding "Assessment of Possible Health Risk from Lead Shotgun Pellets." Also see Long, DT and Angino, EE (1977) Chemical speciation of Cd, Cu, Pb and Zn in mixed freshwater, seawater, and brine solutions. Geochim et Cosmo Acta: 41: 1183-1191.

range training. Approvals, regulations, notifications, and warning measures are standardized (see Section 1.5.3.2).

General. Multiple temporary roadblocks would be established during training activities, due to the number of former runways, taxiways, and roadways that allow safe access to the proposed range areas. Depending on the nature of a particular exercise, alternate civilian routes might be established within the EMUA to provide safe access to tourist attractions during training events. Conflicting airspace would be avoided by providing advance warning of Tinian operations to commercial air carriers through FAA and EMO. The Tinian Mayor's Office and Marianas Visitor Bureau would be informed at least one week in advance if access to tourist destinations must be closed due to range use. A water observation sentry post would be established for use of the fire and maneuver range overlooking the SDZ.

Mortar range. This range is not included in the Preferred Alternative. If it were implemented, the impact area for the mortar range would be swept by EOD teams after every training session. Pre-use clearing and maintenance with nonpersistent herbicides such as Roundup would facilitate such routine dud sweeps. In addition, the impact area would be fenced off and warning signs would be posted at regular intervals along the fence. Because the proposed impact area includes a portion of a public roadway, either the roadway would be diverted around the impact area or the impact area would be modified to exclude the road. In either case, the public roadway would be carefully swept by the EOD team following every training session. If the roadway were damaged, the Navy would repair the road within one week. Warning signs and fences, however, would not guarantee that the mortar impact area would not be entered. Therefore, potential hazards to civilians and military personnel within the impact area could not be entirely eliminated.

Communication with the FAA on Saipan would be required for notification of aircraft in the vicinity of the range. The maximum height of a mortar projectile far exceeds the altitude of approaching and departing aircraft. Visual observation of air activity and communication between observers and the range safety officer would be mandatory. If communication failed, range training would immediately cease.

Fire-and-maneuver range. To counter the potential for injury to civilians, the Range Safety Officer (RSO) would have absolute control of the SDZ. The RSO would employ visual warning markers on shore (large red flags and/or flashing red/white strobe lights), safety observers for boating activity, and roadblocks and sentries to stop traffic from entering the range area. The SDZ would be shown on local navigation charts. NOTMARs would be published and broadcast prior to and during scheduled training. Radio communication would be established and maintained among the RSO, the firing line, and range safety observers. Boats entering the SDZ would cause firing to cease until they were clear of areas of potential impact. Berms and bullet traps would be placed behind each target, thus limiting the number of rounds that may impact the water area.

4.2.6 Aviation Safety on Tinian

Significance criteria. All potential impacts of aviation training are significant, if they affect human safety. Military training SOPs and area-specific constraints have long been in place to prevent accidents associated with aviation. The SOPs are established on safety criteria and related operational/training procedures published by responsible government agencies and tailored for specific airfields. All airfields have designated accident potential zones, clear zones, and safety buffers imposing safety restrictions on adjacent land use. Site-specific criteria were used to evaluate impacts at existing and proposed airfields, LZs, and DZs (Table 4-6).

Table 4-6 Evaluation Criteria for Potential Aviation

ACTIVITY SIDE EFFECTS	PARAMETER	SIGNIFICANT IF
Personnel safety at airfields	Interference with civilian aircraft activities	Communication with FAA is non-existent AND Absence of established public notification (NOTAM) and area clearance protocol AND Military and/or civilian flights do not follow established flight tracks
	Hazards to civilians on ground	Civilians have access to airfield during military air operations
Shared airspace	Damage to civilian aircraft	Lack of NOTAM publication and FAA notification in advance AND Lack of "no-fly zone" for area above mortar range
Activated landing zones and drop zones in airfield operating areas	Interference with/interference by civilian aircraft	Civilian aircraft overfly these training areas AND Absence of established public notification (NOTAM) and area clearance protocol

4.2.6.1 Existing Conditions

There are two airfields on Tinian and one on Saipan, all of which contribute air traffic to the vicinity of the EMUA. The civilian airfields—Saipan International Airport and West Tinian Airport—are located several miles north and south, respectively, of the EMUA. North Field is a World War II airfield in the EMUA used only by military aircraft but overflown by civilian aircraft.

West Tinian Airport is a VFR (visual flight rules) facility with a navigational light system but no control tower. It handles scheduled interisland flights from Rota and Saipan, charter flights from Guam, and military aircraft during training. Freedom Air and Marianas Air fly approximately 40 flights each day using small aircraft (5-6 seaters) from 6:15 am to as late as midnight.[54] Under prevailing tradewind and calm conditions, aircraft approach and depart on an ENE heading along

[54] Personal communication with Ed Villagomez, FAA Saipan, June 30, 1998.

an informally defined track which intersects the southeastern portion of the EMUA at an altitude of about 500 m, passing over North Field and the proposed mortar and small arms ranges (Figure 4-4). Aviation activities at West Tinian Airport and North Field are overseen by the FAA Air Traffic Control at the Saipan International Airport Tower.

The VOA site northeast of West Field has an antenna array. The array's location and height are clear of flight tracks approaching West Tinian Airport and are not of potential significance to aviation operations.

Saipan International serves international carriers (e.g., DC-10 and C-747 aircraft). The Saipan terminal is equipped with an airport terminal information system (ATIS) on which aviation information, including NOTAMS, is posted on repetitive UHF broadcasts. The west to east approach track is on the same approximate heading and about 3 miles northeast of the North Field approach and departure (used only by the military). Flights approaching Saipan International pass over North Field Runway #1 at an altitude of about 650 m to 800 m.

4.2.6.2 Potentially Significant Impacts

Use of North Field and West Tinian Airport for training has the potential to interfere with civilian air traffic. Relevant training activities are:

- West Tinian Airport: air traffic transporting troops and equipment, use of parking aprons, parachute jumps due east of the airport
- North Field: low-altitude fixed-wing cargo drops and paradrops, fixed-wing and rotary-wing landings and takeoffs, NVG training
- EMUA airspace: mortar range firing (not included in Preferred Alternative)

West Tinian Airport. Significant impacts are possible in connection with civilian flights in and out of West Tinian Airport, which may not follow established flight tracks and frequently overfly the North Field area. Aviation training may occur throughout the day and night, concurrent with civilian flight operations. If Tinian's casinos bring increased numbers of tourist flights in the future, potential hazards or conflicts with training activities would increase. Significant impacts to parachutists are also possible at the DZ east of West Tinian Airport, as the airport has no control tower.

North Field. Significant impacts to civilians in the EMUA are also possible. Tinian has an established historic trail with 14 points of interest in the LBA and EMUA, including points within North Field (see Figure 3-6). The EMUA has a large number of intersecting roadways, former runways, and taxiways that allow tourists broad access to North Field. Persons who inadvertently intrude onto aviation operating surfaces during aviation operations could cause or suffer from aviation hazards.

Mortar range airspace. Significant impacts to civilian aircraft are possible from mortar fire, since the proposed range would lie near the approach path to Saipan International and routes used

by aircraft approaching West Tinian Airport. The height of a mortar round would exceed the altitude of aircraft in this area.

4.2.6.3 Proposed Mitigation

Road blocks, security posts, and area inspections will be implemented to prevent civilian encroachment into aviation training areas.

Any type of military activity (flight operations and weapons training) within or near commercial airspaces or the VOA site will be coordinated with the FAA, CNMI EMO, and Tinian Mayor's Office with sufficient lead time to perform public notification. Through a NOTAM published 72 hours in advance of any such activity, both military and civilian aircraft will be informed of the time frames for planned aviation activities within shared or restricted airspace. A zone of restricted airspace between Tinian and Saipan may be established and activated for scheduled training via the NOTAM process.[55] A no-fly area could be designated above the proposed mortar range. During training activities at both North Field Runway #1 and West Tinian Airport, communication will be maintained between the military (USAF CCT/ALCE [Airlift Control Element] or USMC Arrival/Departure Airfield Control Group) and the Saipan Air Control Tower.

4.2.7 Socioeconomic Impacts on Tinian

Tinian is the only populated island in the Marianas which has not experienced dramatic economic development over the past ten years. Residents of the island have identified the presence of the MLA, which covers approximately two-thirds of the island, as the possible cause of this disparity. The MLA was leased to the U.S. Department of Defense as part of the CNMI's responsibilities under the 1976 Covenant establishing the Commonwealth. The Covenant provided all CNMI residents with full U.S. citizenship and provided the Commonwealth with substantial extended financial support from the U.S. Although access to the MLA is generally unrestricted, its land area may not be privately owned or developed. This has resulted in less land available for homesteading and a perceived shortage of land available for tourism-related development.

To determine socioeconomic conditions on Tinian, the firm of Ernst & Young reviewed available government records and interviewed individuals on Tinian and Saipan. Their report is summarized below and included in total as Appendix H.

4.2.7.1 Existing Conditions

This section identifies both the current situation on Tinian and the conditions which might result if proposed casinos are constructed and operated successfully.

[55] Federal Aviation Administration, U.S. Department of Transportation (September 16, 1993) *7400.2D Procedures for Handling Airspace Matters.*

Demographics. The published population of Tinian was 2,118 in 1990 (U.S. Census) and 2,553 in 1992, with an estimated 1995 year-end population of 3,718, based on records of airport activity between January 1992 and December 1995. Interviews with residents indicated that the majority of this increase is due to arrival of alien contract workers, matching a trend throughout the CNMI.

Population density was calculated on the basis of the extrapolated 1995 population and the land area available for use by the local population, i.e., the area outside the MLA (approximately 13.0 square miles). This provided a population density of approximately 285 persons per square mile (in comparison to 60 persons per square mile, if the entire island area of 39 square miles were available). By contrast, Saipan's density is approximately 1,062 persons per square mile.

Economy. In 1990, the mean annual family income on Tinian was $33,651,[56] which is relatively affluent compared to other CNMI residents and to the rest of Micronesia. Although no statistical information is available, it is widely agreed that most of the resident labor force, approximately 75 percent, is employed by the local government. This proportion may drop as the new casino(s) start operations.

Tinian does not currently have any significant industry, natural resources, or exports. Tourism has increased in recent years and is anticipated to expand dramatically if major casinos are successful on the island (see below). Available information indicates that an average of 1,200 to 2,000 tourists per month (roughly 60 per day) visit Tinian, mostly on day-trips from Saipan. These are primarily Japanese and Korean visitors, with occasional groups of war veterans, eco-tourists, hikers, and cyclers. Tourists arrive by air or by the new ferry service from Saipan. Most day-trip tours are scheduled months in advance and include a half day at a beach in San Jose, lunch, and a tour of World War II sites in the EMUA. Future tours may be aimed more at casinos and less at attractions in the EMUA. Tourists wishing to spend the night may be accommodated in 30 rooms at two small motels; two companies offer a small number of rental cars at the airport. The newly opened Tinian Dynasty Hotel & Casino will eventually have 400 guest rooms.

Commercial agriculture on Tinian consist of small-scale vegetable and fruit cultivation (marketed locally and also shipped to Saipan). Although there are no commercial fishing operations on Tinian, most families practice subsistence fishing (Figure 4-5). Commercial tuna fishing and transport ships sporadically dock in the harbor, providing substantial business for the local stevedore companies, nightclubs, and dockside fueling facility.

Commercial cattle grazing has dwindled from the Bar K's 10,000 head of cattle several years ago to a herd of 1,000 in 1995. The Bar K is equipped with a slaughterhouse and cold storage facility; it supplies beef to Saipan and Guam as an alternative to more expensive U.S. and Australian beef. Tinian also has three smaller family-owned ranches, and many families raise cattle or pigs for their own consumption.

[56] CNMI Department of Commerce and Labor (1993) *1993 Commonwealth of the Northern Mariana Islands Statistical Yearbook.*

Retail establishments on Tinian consist of six nightclubs; several convenience stores, hardware stores, and gas stations; several small restaurants and bakeries; and assorted other small businesses. There are also branches of the Bank of Guam and Bank of Saipan, two part-time insurance agents, one certified public accountant, and several manpower agencies supplying alien contract workers. Casino operations are discussed in the next section.

Air service is provided by Freedom Air and Pacific Island Aviation at the West Tinian Airport.[57] Most Tinian residents travel to Saipan at least once a month, averaging 265 passengers a day (96,725 passengers a year) in 1995. Substantial renovation of the airport is envisioned by the Commonwealth Ports Authority, if casinos are successful. A 300-passenger ferry service has recently been established between Saipan and Tinian, to service the first casino. A shuttle bus transports visitors and employees from San Jose harbor to the casinos. The shuttle operates approximately five times a day.

Casino industry. Tinian has worked for 10 years to develop a casino industry, overcoming differences between political parties and opposition from the Catholic church. Casinos are regulated by the Tinian Casino Gaming Control Commission (TCGCC), created in 1990.

The first casino to open was the Lone Star, which operated in a converted small office building from May through December 1995. The Lone Star's license was revoked in 1996. Two licenses have been awarded to Hong Kong companies (currently fully financed), and one has been awarded to a Taiwan-Saipan company which has not yet paid the full licensing fee. A memorandum of understanding has been signed for a luxury casino ship to be berthed in the harbor area. In addition, the governor has announced a floating casino/hotel, but no license application or fee has been filed.

The first resort, the Tinian Dynasty Casino and Hotel, is in San Jose, inland from Taga and Tachogna beaches. The casino itself has recently opened; when completed, this resort will include a hotel with over 400 rooms, entertainment theater, night club, restaurants, and fitness center, as well as an employee village for an estimated 800 employees. The next site planned for development is further south on the same road outside San Jose. Not all infrastructure requirements are currently in place or available (e.g., wastewater disposal).

The Commonwealth Ports Authority has planned expansion of the West Tinian Airport. The expanded airport would have a 2,438 m (8,000-foot) runway to accommodate 747 wide-body aircraft. An estimated 515,520 passengers per year have been projected to travel to Tinian once a 400-room hotel/casino is in operation (see Appendix H). As of June 1998, there have been no significant improvements to the airport. While the Commonwealth Ports Authority is attempting to float a bond issue for significant improvements to both the runway and the passenger terminal, there has been no progress. Flights of small passenger aircraft, ranging from six to thirty seat capacity, have increased slightly; however, there are no jet aircraft landings foreseen in the near future. While the runway can accommodate smaller passenger jets, such as the Boeing 727, there are no fuel storage facilities for jet fuel.

[57] Pacific Island Aviation terminated service in June 1998. Marianas Air initiated service between Saipan and Tinian.

Significance criteria. Impacts were evaluated for significance according to criteria presented in Table 4-7. These criteria essentially identify notification periods required in order to keep socioeconomic impacts from being significant.

Table 4-7 Evaluation Criteria for Potential Socioeconomic Impacts

RESOURCE	ACTIVITY	SIGNIFICANT IF
Tourism revenues	Close access to tourist destination	EMUA closed with less than 7 days prior notice OR EMUA closed for more than 10% of each year (36 days) OR EMUA closed for more than 5 days sequentially without one month's prior notice
	Military aircraft landing and parking at West Tinian Airport	Requires cancellation of civilian flights
Local authorities (Tinian Mayor's Office, Commonwealth Port Authority, Emergency Management Office [Saipan], FAA [Saipan])	Agency oversight and coordination	Notice not provided 7 days prior to exercise
Subsistence fishing	Close access to EMUA	No other fishing locations are available at the time

4.2.7.2 Potentially Significant Impacts

Both positive and adverse impacts on Tinian's economy are expected to result from the proposed action. Known impacts of the ongoing training activities include positive impacts, such as training planners visiting the island in advance of and during exercises, filling every hotel room, and patronizing local restaurants, hotels, and rental car agencies. Known adverse impacts of ongoing activities are inconvenience to local authorities caused by poor communication (see Appendix H), temporary loss of use of the municipal gym (Field House) during Tandem Thrust exercises, late payment to local contractors, and lost tourism revenue from closure of the EMUA.

Temporary restriction of public access to the EMUA has the potential to affect tourism in several ways. First, revenue may be lost to airlines, rental car companies, and tour guides on days when the EMUA is closed. This impact is expected to decrease if projected casino operations are realized, as tourists will be more likely to come to Tinian for casinos than for World War II sites and will likely stay for several nights instead of just several hours. Second, Tinian's reputation as a tourist attraction may suffer if many Asian tourists or tour companies have trips (scheduled months ahead) canceled with only one or two days' notice. Interviews with local businesses indicate the second impact is of greater concern, but again this impact may decrease in importance as the casino business grows.

Proposed firing range and shooting house in EMUA. The only newly proposed training activity likely to adversely affect the local economy is reconfiguring and reopening the firing range, which might result in additional restrictions on public access to the EMUA. Civilian access to all or portions of the EMUA would necessarily be denied during range use, possibly

increasing the number of days per year on which public access will be denied to EMUA tourist destinations. Closure of the EMUA would also temporarily prohibit access to some subsistence fishing locations. Use of the proposed shooting house for urban training is not expected to increase the number of days on which the EMUA would be closed to the public; shooting houses have very localized SDZs (approximately 50 m) and would not require general closure of the EMUA.

Proposed AAV landings at Unai Babui. Proposed AAV landings are not expected to impact the local economy. AAVs will be transported on military ships and will land and remain in the EMUA. They will not pose hazards to navigation and do not require closure of the EMUA. No mitigation is required.

Proposed landing craft and AAV use of San Jose Harbor. Use of the harbor will be coordinated so as to not interfere with any commercial craft activity. Landing exercises will be published in advance and could conceivably be a tourist attraction.

Construction of base support camp in EMUA. The proposed base support camp is not expected to adversely impact the local economy or government resources. Proposed construction projects have the potential to positively impact the local economy on a short-term basis, as construction workers or commercial transportation firms may be hired to assist with these projects. In addition, outside contractors would patronize local hotels and restaurants. No mitigation is required.

Cumulative impacts with casino development. There is a potential for military exercises to interfere with air and water traffic associated with the casinos. Military barges and landing craft periodically load and offload equipment and materiel in Tinian Harbor. Depending upon the location of any casino ships which may be permanently anchored in the harbor, some interference with civilian navigation may result when military craft are docked or entering/leaving the harbor. Similarly, the entry of numerous fixed- and rotary-wing military aircraft and use of the DZ east of West Tinian Airport for a Tandem Thrust exercise has the potential to interfere with the more intense civilian air traffic which would result from a successful casino industry.

4.2.7.3 Proposed Mitigation

The primary mitigation for impacts on tourism and on local authorities is to maintain advance communication with local authorities, specifically the Commonwealth Ports Authority, the Marianas Visitors Bureau (Tinian Field Office), the West Tinian Airport Manager, and the Mayor's Office. These officials will be notified of any planned closure of the EMUA and of any military use of the airport and/or harbor at least 30 days in advance of such activities. Units planning aviation exercises, aviation support, or use of the proposed firing range on Tinian will notify the FAA and USCG one week in advance, to allow publication of NOTMARs and NOTAMs 72 hours in advance of the activities. NOTMARs will also be provided to the CNMI Emergency Management Office for broadcasting on marine channels. (The proposed mortar range is not included in the Preferred Alternative; therefore, no mitigation is required.)

To minimize impacts on tourists, exercises will be scheduled to avoid the following annual tourist-intense events, to the extent possible:

Cliff Fishing Derby	3rd weekend in February
San Jose Fiesta	1st weekend in May
San Isidro Fiesta	4th weekend in May
Agri-Food Fair	1st weekend in June
MVB 10K Fun Run	4th Saturday in September

The EMUA will not be closed for a total of more than 36 days (10 percent) of any calendar year. In addition, exercise planners will attempt to limit EMUA closures or will arrange for partial access during exercises. (This has been accomplished successfully in past Tandem Thrust exercises.) If a casino ship is permitted for construction and anchoring in Tinian Harbor, COMNAVMARIANAS will initiate discussions with the Mayor's Office to coordinate military use of the harbor so as not to interfere with related civilian navigation.

To avoid late payments to local contractors, each exercise utilizing local contractors will have a designated finance officer to whom reimbursement billings may be submitted. COMNAVMARIANAS will provide the Mayor's Office with documentation on reimbursement procedures.

Many fishing locations exist outside the EMUA (see Figure 4-5). Therefore, the impact of occasional EMUA closures will not be significant. Public notice of EMUA closure will advise residents of the need to fish in alternate locations.

4.3 IMPACTS ON WATERFRONT ANNEX

4.3.1 Protected Species and Habitat at the Waterfront Annex

The endangered hawksbill sea turtle and threatened green sea turtle frequent Outer Apra Harbor. The harbor bottom and nearshore areas include degraded dredged areas and relatively pristine, well-developed coral reefs.

Overview of training impacts. This section addresses potentially significant impacts of continuing actions and all impacts of newly proposed training. Significance criteria are in Table 4-1. Nonsignificant impacts and proposed mitigation are specified in Table 2-11.

- Underwater shock waves from deepwater mine countermeasures (MCM) training may injure or kill fish, endangered marine species, or fracture coral within a certain radius of the detonation (significant).
- Amphibious vehicles may crush or break coral on reefs (significant), compress sand over turtle nests (significant), generate turbidity and salt spray (nonsignificant).
- Detonation of small, shallow water MCM charges will not injure civilians, endangered marine species, or fish (nonsignificant).

- Floating mine neutralization will not injure civilians, endangered marine species, or fish (nonsignificant).
- Riverine training will not disturb or otherwise harm endangered Mariana moorhens.

4.3.1.1 Deepwater MCM

Existing conditions at Apra Harbor site. Bottom composition at this 38-m-deep site consists of very fine calcareous silt with abundant patches of calcareous algae (*Halimeda*). No fish or corals were observed during an August 1996 site survey.[58] Figure 4-6 identifies known dive sites, which correspond to areas with well-developed coral habitat. Fish aggregate at wrecks and other underwater structures, which are shown as well. Turtles and marine mammals are known to be present in waters surrounding the proposed sites, but do not aggregate at certain points as do reef fish.

The use of 10 lb. charges at this site has been approved by Guam EPA and NMFS, as long as the established protocol is observed.[59] This protocol is incorporated in COMNAVMARIANAS INSTR 5090.7 of April 5, 1994, and includes requirements for notification, agency coordination, area surveillance and security, and post-operation reporting (Appendix I). The training has been observed by Guam EPA; to date, there is no record of any sea turtle kills resulting from detonating charges at this site

Existing conditions at Dadi Beach offshore site. This site is proposed for use of up to 20 lb. charges in waters ranging from 13 to 30 m deep. A marine survey of the site was conducted in September 1997 (Appendix C).[60] The substrate consists of an expanse of white sand, 10 to 15 percent of which is intersected by low limestone reefs. Giant sting rays and a colony of grass eels were observed once at the training site. Virtually no other epibenthic biota was observed on the expansive sand flats, which extend at least 150 m to the northwest and 200 m to the southeast within this depth range. No significant aggregations of fishes were observed or are known to exist in the area within the range of effect. Most of the limestone reef surface is covered with a short algal turf and several species of sea urchins. Biotic composition of the reef surfaces consists of low cover of small encrusting reef corals (primarily *Porites* spp.) that comprise less than 1 percent of the solid bottom cover. No marine mammals were seen during the survey, but spinner dolphins are reported to periodically frequent the general vicinity.

General effects of underwater demolitions. Underwater demolitions create damage through direct explosive effect (shattering) on substrate or other structures to which explosive material is attached. These explosives also create a pressure wave that acts like a shock wave, with peak overpressure and impulse; The strength of an impulse is a function of the pressure and the time

[58] Letter from Steve Dollar, Marine Research Consultants, August 16, 1996.

[59] Impacts of charges of up to 10 pounds have been studied by Guam EPA and are within the 100-foot fish kill radius compliance. (A list of fish species killed during four underwater mine detonations in Apra Harbor, between September 1995 and March 1996, is included as Appendix I). The use of these charges is ongoing. EOD training complies with current agreements. [Source: Personal communication with Mel Borja, Guam EPA, August 22, 1996.]

[60] The location of the proposed site is 13°24'25'N, 144°39'1'E.

of its duration. The amplitude of a shock wave traveling through water diminishes as the distance increases from its source. Impulse propagates irregularly because of wave reflection and, in general, increases with depth of the detonation and depth of the recipient organism.

The shock wave can affect marine life, humans in the water, and structures by subjecting them to extreme pressure gradients. The pressure acts primarily on voids (such as the swim bladder of a fish or the lungs of a mammal or reptile). Marine organisms without voids, such as crustaceans and mollusks, appear quite resistant to blast overpressure and are typically unaffected beyond distances of 15 to 25 m from the blast, depending on charge size. Fish lethality generally occurs with overpressures of 40 to 70 psi, depending on fish size (smaller fish being more susceptible). Criteria for human safety for swimmers are overpressure of 50 psi and impulse of 2 psi-ms (psi per meter per second).[61]

Explosions on the seabed cause cratering and disturb bottom sediments over an area estimated to be roughly twice the diameter of the crater.[62] A 20-pound charge exploded on mixed sand and clay in relatively deep water (greater than about 30 m) is estimated to result in a crater about three meters in diameter, with bottom disturbance over an area no more than 10 m wide. Not all training shots are on the bottom, as charge placement varies with the target simulation.

Potentially significant impacts. The proposed action is detonation of 10- and 20-lb charges at depths of 13 to 38 m.

- Detonations could harm or kill marine animals and human swimmers and divers within the "safe swimmer" radius
- Detonations will not impact coral, as there is no coral at either deepwater MCM site.

Table 4-8 provides the radius of effect of various size charges at depth on fish and human swimmers. Neither the 10- or 20-lb. charge would affect fish at the mapped aggregation points, although some fish are likely to be found within the area of effect as recorded in Appendix I (fish kill tabulations from prior exercises). Both marine mammals and reptiles could be affected at distances out to the "safe swimmer" radius, depending on depth. While human water activities conducted at the surface would be safe beyond 300 m from the detonation, divers would experience unsafe impulses out to approximately 2700 m, depending on depth.

Table 4-8 Underwater Demolition: Range of Effects

CHARGE	CHARGE DEPTH	EFFECT CRITERION	VALUE OF CRITERIA	RANGE OF EFFECT
1 lb	3 m	Fish 10 percent mortality	40 to 70 psi (depending on fish size)	103 m for 1 oz fish 55 m for 1 lb fish 27 m for 30 lb fish

[61] NAVSEA SW061-AA-MMA-010, Technical Manual "Use of Explosives in Underwater Salvage," January 1994.

[62] NAVSEA SW061-AA-MMA-010, Technical Manual "Use of Explosives in Underwater Salvage," January 1994.

Table 4-8 *(continued)*:

CHARGE	CHARGE DEPTH	EFFECT CRITERION	VALUE OF CRITERIA	RANGE OF EFFECT
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	(note 2)
10 lb	38 m	Fish 10 percent mortality	40 to 70 psi (depending on fish size)	200 m for 1 oz fish 129 m for 1 lb fish 79 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	272 m (@ surface) 2,174 m (@ 28 m deep)
20 lb	19 m	Fish 10% mortality	40 to 70 psi (depending on fish size)	261 m for 1 oz fish 169 m for 1 lb fish 106 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	247 m (@ surface) 1,691 m (@ 19 m deep)
20 lb	38 m	Fish 10% mortality	40-70 psi (depending on fish size)	283 m for 1 oz fish 182 m for 1 lb fish 111 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	343 m (surface) 2739 (@ 28 m deep)
		Small risk injury range for swimmer	Impulse and peak overpressure of 10 psi-ms	972 m (@ 28 m deep)

Notes:
1. NAVSEA SWO61-AA-MMA-010; Technical Manual; "Use of Explosives in Underwater Salvage"; January 1994.
2. N/A. Shallow water detonations are not covered in safety distance tables. Energy is lost to the atmosphere so reduced proportions of blast energy are propagated into underwater shock waves.

Proposed mitigation. Continue to follow protocols presently in existence for protection of marine animals and civilians. Survey surface, water column, and benthic substrate for a radius of 1,000 m around demolition sites for marine animals. If protected species are encountered during predetonation surveys, halt training activities until the animal(s) have left the location. Grass eels and giant sting rays camouflaged in the sand can be scared away from the site during visual surveys. Use proposed Dadi Beach site to relieve the pressure of monthly exercises on the Outer Apra Harbor deepwater MCM location, which is frequented more regularly by sea turtles. If the Dadi Beach location is approved for demolition of up to 20 lb. of explosives, reduce the limit within Apra Harbor to 10 lb Continue to notify dive shop operators and publish warnings when training exercises are to occur.

In addition, the Navy will conduct postexercise surveys to determine the number of fish kills as a result of the detonations. After two years, the results will be evaluated by the Navy, Guam EPA, and NMFS to determine whether the existing protocol should be modified.

4.3.1.2 Shallow Water MCM Training

Seven sites are proposed for this SEAL training: five in Outer Apra Harbor (Drydock Island, Polaris Point, Breakwater Beach, Spanish Steps, and Gabgab Beach) and one each offshore Tipalao Beach and Dadi Beach.

Existing conditions. Marine surveys performed for this DEIS found that coral growth in most sites is either marginal or widely spaced. Gabgab Beach and Dadi Beach have well-developed coral reefs in shallow inshore waters (see Appendix C). The portions of sites proposed for live charges, Breakwater Beach, Spanish Steps, and Tipalao Beach, do not have a high density of biota.

- **Breakwater Beach** has scattered small encrusting coral colonies on some of the breakwater boulders, but no coral or other macrobiota on the sandy bottom at the base of the boulder walls.
- **Spanish Steps** is near some shallow coral in a pool between Orote Point and a small offshore island.
- **Tipalao Beach** has essentially no macrobiota on either the reef flat or the hard, scoured substrate beyond the rubble flat. The beachrock bench in the Tipalao Beach intertidal zone is barren of macro-organisms other than short algal turfs. The sand zone, within which coral are virtually absent, extends to approximately 20 m offshore and does not exceed 1 m in depth. The only macrobiota in this area are scattered clumps of algae, primarily of the genera *Liagora* and *Sargassum*. Throughout Tipalao Bay benthic biota are extremely uncommon; living corals comprise less than 1 percent bottom cover and benthic macrofauna, such as sea urchins and starfish, are essentially absent. Reef fish were present but not abundant during the survey. It appears that the area is commonly subjected to the destructive force of storm waves.

Potentially significant impacts. No significant impacts will occur at training sites where blanks will be used. Reef could be slightly damaged by small blasts at sites where live ammunition (strings of up to 20 1-lb. charges of C-4) will be used. These impacts are not significant, since the live ammunition sites lack macrofauna and have less than 1 percent live coral coverage. Impacts on the small number of fish that occur in the area will not be significant.

Proposed mitigation. This training will not be permitted at Gabgab Beach.

4.3.1.3 Floating Mine Neutralization Outside Apra Harbor

Existing conditions. The proposed site is approximately 3.2 km north of Apra Harbor in waters over 600 m deep. The proposed shot will be a 10-lb. charge detonated within 3 m of the surface.

Potentially significant impacts. No significant impacts on biota are expected.

Proposed mitigation. The area will be visually surveyed before detonations for the presence of protected marine animals.

4.3.1.4 LCAC Landings

Existing conditions. Resources vulnerable to LCAC landings are coral reef, green sea turtle nests and hatchlings, and terrestrial vegetation.

- **Dadi Beach** has a shallow nearshore reef, with algae, small reef fish, starfish, and sea cucumbers. Corals in this zone are rare but present. Green sea turtles have not nested on Dadi Beach for at least 20 years.[63] Low, spreading mats of vegetation (beach morning glory and various grasses) cover some areas of sand. None of the plants in the area are threatened or endangered.[64]
- **Tipalao Beach** has essentially no macrobiota on either the reef flat or the hard, scoured substrate beyond the rubble flat. Green sea turtles are not known to nest on this beach. The beach sand is covered with boulders and is backed by a grassy lawn leading to a softball field.
- **Drydock Island** and **Polaris Point** beaches are both narrow sand beaches backed by cut grass. Bottom composition at both sites is composed of very fine-grained calcareous sediment (silt/mud). No corals or other benthic macrobiota occur on the sediment surface at these locations. The shoreline region of Polaris Point is lined with concrete riprap which supports coral colonies, large parts of which are dead due to the high levels of suspended sediment.
- **Toyland Beach** has no live coral, nor is it a known turtle nesting area.[65] Some bitterns roost in the mangrove immediately north of the proposed landing area. The shoreline is crushed coral with mown grass; offshore substrate is sand and rock.

Potentially significant impacts.

- An LCAC does not disturb coral reef if it is fully up on its air cushion while crossing the reef. LCACs do not usually come off-cushion and contact the ground until clear of the water's edge and fully over dry land.[66] However, if an LCAC is moving relatively slowly and is only partly up on cushion while in the water, it may create a surge wave capable of moving large (1 m^3 diameter) rocks and breaking off coral heads. An LCAC fully on cushion may create a wake and cause minor turbidity, but will not impact coral since only the rubber skirt of the craft contacts the water surface. (The actual hard bottom of the LCAC is suspended at least a meter above the water surface; a guide wire holds the bottom of the skirt in place.)
- Once on land, the weight of an LCAC compacts the sand and leaves a footprint 2 to 10 cm deep. Green sea turtle nests are not likely at the proposed LCAC landing spots; therefore, no impacts are expected. Any turtle eggs present, buried approximately 1 m underneath the sand, are not likely to be damaged, but compaction of the sand may make exit from the nests difficult for hatchlings. Offloaded vehicles may crush turtle nests or leave deep tire track ruts that serve as physical barriers to hatchlings crossing the beach.

[63] Personal communication with Gerry Davis, Guam DAWR, January 8, 1997.

[64] Helbert Hastert & Fee, Planners (March 1995) *Environmental Assessment for the Navy Lodge, Waterfront Annex, U.S. Naval Activities, Guam.* Prepared for Navy Exchange Service Command.

[65] Personal communication with Lesley Morton, COMNAVMARIANAS, April 23, 1998.

[66] If an LCAC were to come off cushion while waterborne, the craft has a draft of 0.76 m.

- LCAC fans blow salt spray and sand into the air, similar to but milder than conditions caused by typhoons.

Proposed mitigation.

- LCACs must operate fully on-cushion while over shallow reefs. All turns must be conducted on land. Landing beaches with a slope of >6° are unsuitable since the craft tends to slide backwards into the water and damage the reef. Therefore, any landing beach will be surveyed by exercise personnel or SEALs no more than one week in advance of a planned landing, to ensure beach conditions allow a fully-on-cushion landing and turn on the beach.
- The Navy will be notified by DAWR if turtles return to any of these beaches. Beaches will be surveyed by a Navy biologist for possible sea turtle nests no more than 24 hours prior to a landing. Areas free of nests will be flagged, and vehicles will be directed to remain within flagged areas.[67] If turtles are known to be in the area, no training may occur until all nests have been located and adult turtles have left the area.
- Salt and sand spray from LCACs will not create significant impacts. No mitigation is required.

4.3.1.5 AAV Landings

Existing conditions. Existing natural resources which could be impacted by AAVs are coral reef, green sea turtle nests, and sensitive habitat.

- **Tipalao Beach** has essentially no macrobiota on either the reef flat or the hard, scoured substrate beyond the rubble flat. Green sea turtles are not known to nest on this beach. The beach sand is covered with boulders and is backed by a grassy lawn leading to a softball field.
- **Drydock Island** does not support corals on the benthic sediment surface. No turtles were observed at this site during the September 1996 marine survey. The beach leads to a mowed grass lawn.
- **Toyland Beach** has no live coral, nor is it a known turtle nesting area.[68] Some bitterns roost in the mangrove immediately north of the proposed landing area. The shoreline is crushed coral with mown grass; offshore substrate is sand and rock
- The **fuel pier** shoreline consist of riprap and broken concrete. It accesses a poorly paved road bordering a wetland.

[67] Actual nests will not be flagged, as this may direct poachers to nests.

[68] Personal Communication with Lesley Morton, COMNAVMARIANAS, April 23, 1998.

Potentially significant impacts.

- The 23- to 27-metric ton, tracked AAV contacts the bottom in water less than about 1.8 m deep, and would crush or compact coral that it contacts, reducing or eliminating a reef's natural functions and usefulness as a tourist attraction. None of the proposed landing areas has live coral in water less than 2 m deep.
- AAVs arriving on a beach would disturb the upper sand layer above possible green sea turtle nests, compacting sand and creating tracks that might be difficult for hatchlings to navigate. AAVs could damage strand vegetation, which is functional in preventing beach sand erosion. (Impacts would be the same for the proposed AAAV, due to be in the inventory in several years.)

Proposed mitigation.

- Prior to AAV landings, beaches will be surveyed for the presence of sea turtle nests. Beaches will be flagged to restrict vehicles from areas suspected of containing nests, and vehicles will be directed to remain within flagged areas. No engineered modifications of the beach, such as regrading, will be permitted prior to landings. After exercises are completed, beaches will be restored to their approximate original topography.
- Exit lanes from beaches to connecting roadways will be identified to eliminate trampling sensitive strand vegetation.

4.3.1.6 LCU Landings

LCUs travel into shallow water and extend ramps onto the shore. Vehicles drive off the ramps to enter an action area.

Existing conditions. No proposed or existing LCU landing location in the Waterfront Annex has shallow reef. Drydock Island and Polaris Point have narrow beaches in which turtles could theoretically nest. The Sumay Cove Marina is a concrete ramp, Toyland Beach is crushed coral and grass with no turtle nesting areas, and the Japanese refueling pier area would be modified to provide a concrete or rubblestone slope on which LCUs could lower a ramp and offload vehicles. All sites access gravel or paved roadways.

Potentially significant impacts. An LCU may compress or dent shallow substrate. No significant impacts are expected.

Proposed mitigation. No mitigation is required.

4.3.1.7 River Insertion Training

Riverine training at the Atantano River mouth (see Figure 2-2a) consists of small clandestine groups traveling the river in raiding craft, walking or wading in certain areas of the associated marshland, and firing blanks. No vegetation clearing is planned.

Existing conditions. The training location is in brackish marsh areas at the mouth of the Atantano River. Mangrove swamps (a protected habitat) occur near the river mouth. Although the endangered Mariana moorhen could be present at the training site, it tends not to nest in brackish water that is under tidal influence.[69] Moorhens inhabit freshwater areas of the adjacent complex of marshes and ponds, referred to collectively as the Naval Station Marsh and known as one of the primary moorhen habitats on Guam.[70] They are also known to occur farther inland at the Shell Guam wetlands.

Potentially significant impacts. The mangrove swamps will not be significantly impacted by hiking activities; existing cleared areas on the bank between the mangrove swamp and the Marine Drive bridge allow hiking ashore without trampling mangrove roots. Any moorhens present during training might be disturbed by the presence of personnel or the sound of blank fire.

Proposed mitigation. Personnel will be informed about the endangered moorhens and instructed not to shoot near any birds observed or to disturb any nests that may be seen in the area. The mangrove swamps will be designated a No Training area (see Figure 2-8).

4.3.2 Cultural Resources in the Waterfront Annex

Information presented in this section is based on a review of existing documentation, consultations with archaeological contractors, and data gathered during several site visits in 1996 (Appendix J).

There is potential for certain site-specific training activities in the Waterfront Annex to adversely affect resources listed in the National Register of Historic Places. The two training areas of concern are Outer Apra Harbor and Dadi Beach, where deepwater MCM exercises using up to 20-lb charges and proposed LCAC landings, respectively, could potentially impact cultural resources.

4.3.2.1 Deepwater MCM Training in Outer Apra Harbor

Existing conditions. The Waterfront Annex contains numerous World War I and World War II naval structures. The deepwater MCM site in Outer Apra Harbor is in the vicinity of several submerged (sunken) vessels, including at least four of historical significance: the KITSUGAWA MARU, TOKAI MARU, NICHIYO MARU (WWII Japanese vessels), and the S.M.S. CORMORAN (see Figure 3-7). The TOKAI MARU and S.M.S. CORMORAN (WWI German vessel) are listed on both the National and Guam Historic Registers. The TOKAI MARU has several possibly armed depth charges in a room near its stern.

[69] No formal surveys have taken place in this area. (Personal communication with Bob Andersen and Bob Beck, Guam DAWR, December 10, 1996.)

[70] USFWS(September 1992) *Recovery Plan, Mariana Common Moorhen.*

The Apra Harbor MCM site is approximately 38 m deep and more than 1 km from the nearest known historically significant submerged ship. No impacts on the nearby submerged ships from past demolition exercises with 10- and 20-lb charges have been reported.

Potential impacts. Significance criteria are in Table 4-2. The effects of underwater explosives are described in Section 4.3.1.1 and Table 4-9. The detonation of charges at the deepwater demolition site in Outer Apra Harbor has the potential to impact submerged (sunken) ships by subjecting their structures to pressure gradients associated with the shock wave. Peak overpressures have been estimated to be 3.3 to 4.4 psi at the TOKAI MARU and 8.3 to 10.5 psi at the nearest sunken vessel. These peak pressures are all less than one atmosphere. It is not known exactly what effect these pressure waves would have on any particular structure or on the TOKAI MARU depth charges, although no impacts of past detonations have been reported. However, if a structure has no void (air) spaces, it is not particularly vulnerable to structural deformation and resultant damage.

Table 4-9 Underwater Demolition Effects on Submerged Resources

SUBMERGED RESOURCES	DISTANCE TO APRA HARBOR DEEPWATER MCM SITE	EFFECT
TOKAI MARU	1511 m	Minor peak overpressure
Nearest shipwrecks	630 m	Unsafe for swimmers; no fish effects
Dive site "bomber"	950 m	Unsafe for swimmers; no fish effects
Dive site "junk yard"	1825 m	Unsafe for swimmers, no fish effects
Middle ground	±950 m	Unsafe for swimmers, no fish effects

Deepwater MCM training in Outer Apra Harbor may generate a cumulative impact on sunken vessels from the repetitive structural stress. There is no way to determine whether or not cumulative stress is occurring. However, the low frequency of events and the low pressure exerted on the vessels' metal structures is likely not to be significant.

Proposed mitigation. When feasible, reduce the use of this location in favor of the Dadi Beach site, when feasible.

4.3.2.2 LCAC Landings at Dadi Beach

Existing conditions. Ten significant sites are located along the Dadi Beach coastline. These sites include prehistoric rock shelters, Japanese WWII defensive caves, Japanese bunkers, and the remains of Camp Bright, an American WWII camp.

Potential impacts. LCACs and offloaded wheeled or tracked vehicles have the potential to damage significant cultural resources upon exiting the beach area if they wander off established departure lanes, because numerous resources are located inside and in front of caves and rock shelters inland of the beach. Cumulative impacts may result from the repetitive nature of training activities and frequent visits by residents and tourists. Therefore, training activities have the potential to significantly impact cultural resources at Dadi Beach.

Proposed mitigation. Mitigation is avoiding the vicinity of the caves and rock shelters when exiting the beach.

4.3.3 Range Safety

The Waterfront Annex includes two small arms ranges, a shooting house, and several underwater demolition areas. Although there is little potential for harm to civilians due to routine implementation of range safety regulations, the issue of public safety is significant and the impacts are evaluated below. Significance criteria are in Table 4-5.

4.3.3.1 Existing Conditions

Small arms ranges. The small arms ranges are designed for personnel to fire east-to-west, away from populated areas of Orote Point (see figure 2-2a). The proposed fire-and-maneuver range will replace a small arms range which also had an over-water SDZ for many years. Hillsides up to 20 m (about 60 ft) high serve as backstops, capturing projectiles beyond the targets. The designated SDZs that extend out over the water southwest of Orote Point represent the theoretical ricochet and overshoot areas for projectiles which miss the 20 m high backstop (a rare but theoretically possible event). The ocean areas within the SDZs are accessible to civilian boaters and divers. Large warning signs are posted facing seaward to warn recreational and commercial water vessels to avoid the over-water SDZs.

The ranges are adjacent to historic trails open to civilians. When the ranges are in use, access roadways are blocked and marked to keep civilians away from range areas. Proposed range construction/modification at Orote Point would not alter this existing safety condition.

Shooting house. The existing Orote Point shooting house is located to the rear of the small arms ranges, along a former taxiway that connects to roads traveled by tourists on the historic trail. The safety zone (23 m diameter) is within a cleared, easily observed area.

Various shallow water MCM sites. The sites proposed for live ammunition are locations immediately offshore from Tipalao Beach and beaches near the mouth of Outer Apra Harbor, all in less than 3 m of water. Pre-exercise area surveys and continuous observation of these areas will ensure that no one strays within the demolition areas.

Deepwater MCM site, Outer Apra Harbor. The existing EODMU-5 deepwater MCM site is in Outer Apra Harbor at a depth of 38 m. Various sunken ships commonly used as civilian dive locations are within 2 km of the site in shallower waters (see Figure 4-6). Four depth charges dating to World War II are located on the sunken TOKAI MARU approximately 1,200 m from the site; it is not known whether the depth charges are armed (i.e., able to be exploded). The MCM site is an area of the harbor traversed by both civilian and military watercraft. NOTMARs are published 24 hours in advance of detonations through the USCG. An article is published in the *Pacific Daily News* one day prior to the event identifying the area that will be closed to boaters and divers for the duration of the exercise (about 4 hours). The USCG monitors the exercise safety zone, which is patrolled by EOD before and during the exercise (see Figure 4-6).

Proposed deepwater MCM site, offshore of Dadi Beach. This site is approximately 400 m offshore from Dadi Beach, in 33 to 35 m of water. The area is generally accessible to civilian boaters and divers. The nearest areas frequented by recreational divers are Haps Reef (2 km distant) and "Blue Hole" (3.5 km distant) (see Figure 4-6). The noninjury ranges for swimmers are provided in Table 4-8.

4.3.3.2 Potentially Significant Impacts

Small arms ranges. The SDZ for the proposed fire-and-maneuver range (site of a former small arms range) extends along the shore of Orote Point as far south as Tipalao Bay and includes several popular dive sites. The range is proposed for use approximately 10 days per month (see Table 1-1). The SDZ is wider than that of the former small arms range because personnel may fire at various angles on the range (instead of straight forward). As a result, approximately the same number of bullets will be fired as before, only the theoretical risk will be spread over a larger area. The cliff behind the range functions as a very effective backstop, but there is still a potential for significant impacts to civilian boaters, divers, and aircraft, if existing warnings are ignored. Civilian aircraft overflight of firing ranges is possible if aircraft disregard published warnings and no-fly zones. Regardless of warning signs, civilian boaters and divers can encroach the over-water SDZs. Therefore, there is potential for significant impacts at all of these locations if civilians ignore warnings.

No impacts are expected to civilians on the Orote Point historic trail, as access is prohibited during range use.

Shooting house. It is possible for civilian visitors to leave the historic trail and inadvertently enter the vicinity of the shooting house. However, no significant impacts are expected since the roadway toward the shooting house is barricaded and range observers are posted when training is conducted.

Shallow water MCM sites. No significant impacts are expected since pretraining inspections are conducted, and the areas remain under observation during training.

Deepwater MCM. Existing and proposed deepwater MCM training generates shock waves with the potential to affect civilian and military swimmers (see Section 4.3.1.1 and Table 4-8). Certain dive locations are less than the safe swimming distance from the existing and proposed sites (see Figure 4-5).

4.3.3.3 Proposed Mitigation

Small arms ranges. Routine range control measures and SOPs will be observed, including public notifications.

Shooting house. Routine range control measures and SOPs will be observed, including closing access to civilians prior to exercises.

Shallow water MCM. Prior to demolitions, training sites will be surveyed and cleared of civilian activity.

Deepwater MCM. Existing protocols for notification and coordination will be followed. Prior to deepwater MCM training at either site, the training site will be surveyed and cleared of civilian divers and watercraft. The site in use will be patrolled by EOD for the duration of the exercises (about 4 hours).

4.3.4 Aviation Safety

Existing conditions. One fixed-wing aircraft runway at Orote Point is only used for limited training operations in support of SEALs. Helicopter landings are conducted for training and for logistic support missions. The FAA is notified of these activities, and communications are established with the tower at the commercial airport. The Orote Point historic trail uses portions of the former airfield as roadways.

Potentially significant impacts. Significance criteria are in Table 4-6. No significant impacts on Guam civilian aviation are expected, owing to well-established communication and compliance with existing FAA and military regulations, and compliance with orders from air traffic control personnel. No significant impacts on civilian tourists are expected; potential impacts of aviation training will continue to be managed by military SOPs and area-specific constraints to prohibit civilian access to the Orote Point runway during aviation operations.

Proposed mitigation. No mitigation is required, beyond existing notification and security precautions.

4.3.5 Socioeconomic Impacts

Existing conditions. Portions of Apra Harbor are closed to subsurface activities (diving) for up to four hours at a time during deepwater demolitions by EODMU-5 (approximately once a month). The harbor is home to various commercial boating operations, including tour boats, dive boats, commercial submarines, fishing boats, and marinas (Appendix K). Numerous reefs and shipwrecks inside the harbor and southwest of Orote Point are popular dive sites; Atlantis Submarine and S.S. Neptune are commercial submarines which transport tourists to offshore reefs (see Figure 4-6). Recreational businesses operate 12 to 14 hours per day, seven days a week. Business is much better on weekends than weekdays.

Potential impacts of deepwater MCM. Significance criteria are in Table 4-7. Surface vessel traffic is prohibited within 300 m of the training site once a month, and large portions of the outer harbor are closed to subsurface activity, temporarily curtailing commercial boating and diving inside this area. (The ship channel remains open and most tour vessel activities are not affected.) Up to 15 of the 17 dive sites within Apra Harbor are thereby closed for one four-hour period per month, or about 1 percent of commercially useful hours. Closures are always on weekdays, when business is slower than on weekends. The two commercial submarine operators do not cease operations but must relocate operations from the Gabgab Reef to Jade Shoals during

MCM training. Multiple small boat and dive operators must avoid the area closed for MCM training and relocate temporarily. If operators did not relocate, the approximate dollar value of lost business opportunity (assuming 100 percent capacity filled with adults paying full fares) would be a maximum of $35,500 per event (i.e., once per month).

Use of the Dadi Beach site will have little socioeconomic effect; only three official dive sites are within the safe swimmer exclusion zone, and many alternative dive sites will be available for use. The Agat Bay Marina is not within the 300m surface traffic exclusion zone and would not be affected by monthly closures for four hours.

Mitigation. Use the Dadi location to reduce closure of Apra Harbor dive sites, weather permitting. When using Apra Harbor site, provide at least 30 days advance notice to commercial operators.

4.4 IMPACTS ON ORDNANCE ANNEX

4.4.1 Protected Species and Habitat at the Ordnance Annex

Protected faunal species in the Ordnance Annex include migratory shorebirds and waterbirds which use Fena Reservoir; the Mariana common moorhen (found at Fena Reservoir and at three small wetland areas to the east and northwest); the island swiftlet, located along the Talofofo River and in the Mahlac Cave and Fachi Cave (near the north end of Fena Reservoir); and a few individual Mariana fruit bats found in the limestone forest areas between Mount Almagosa and East Tower and also in the western part of the Annex. Three species of tree snail newly proposed for listing as federally endangered species are known to exist in the Ordnance Annex. Surveys for the snails have been initiated (June 1998).

In addition, two reptiles (the Pacific slender-toed gecko and the moth skink), two tree snails (the Pacific tree snail and the Mariana Islands fragile tree snail listed as endangered on Guam), and several rare and sensitive invertebrates were identified during USFWS faunal inventory surveys.[71] The skink occurs annexwide, the gecko occurs only on the southern portion of the annex, and the two tree snails are restricted to the riparian areas along the Bonya River (just northeast of Fena Reservoir). Several of the rare and sensitive species, including the Marianas eightspot butterfly and the Almagosa Cave isopod and amphipod, are in the *Merilliodendron* forest and subterranean karst system associated with Almagosa Pit.

Two botanical species listed as endangered on Guam are present: the tree fern (*Cyanthea lunulata*) and the ufa tree (*Heritiera longipetiolata*). The tree fern is found mostly along riverbanks in areas such as the Imong River, south of Fena Reservoir, and the ufa tree is found in

[71] USFWS (December 1996) *Faunal Survey for the Ordnance Annex, Naval Activities, Guam.* Prepared for Department of the Navy.

the *Merilliodendron* forest. A previously unknown tree species was also discovered recently in the Ordnance Annex. Other species of concern include several types of orchid.[72]

Overview of training impacts. Significance criteria are in Table 4-1. No significant impacts on protected species or habitats are expected from training in the Ordnance Annex. No newly proposed training will occur in the Fena Reservoir, the three small wetland areas, near the swiftlet caves, or along the Bonya River. Ongoing bivouacs may affect tree snails. Proposed training activities include construction and use of a sniper range and jungle trail range, construction and use of a breaching house, and creation of a paradrop zone, all of which occur in areas that are already disturbed. Simulated TRAP and CAS are proposed in the vicinity of existing LZs.

This section reviews impacts of the ranges, bivouacs, pyrotechnics, land navigation training, and air support to ground training activities. No significant impacts are anticipated.

4.4.1.1 Sniper Range and Jungle Trail

Existing conditions. The proposed sniper range location is on the west side of the Ordnance Annex; the firing points would be on a small hill, site of the former West Lookout Tower (Figure 4-6). The topography consists of hilltops, ridges, gentle to steep slopes, and a ravine that leads down into the lower elevations of the Ordnance Annex. According to a March 1996 flora survey (Appendix L), virtually all of the area is disturbed, most of it by periodic fires that ravage the hillsides, eliminating tree species and allowing the sword grass and mission grass to dominate.[73] No endangered birds or bats were found at the proposed sniper range during a May 1996 faunal survey (Appendix M), although the extreme end of the safety fan overlaps the southern end of Fena Reservoir, which is moorhen habitat. Wild carabao roam the annex but are not a protected species.

Potentially significant impacts. Vegetation clearing could harm important habitat, tracer rounds could ignite fires, and projectiles could theoretically harm protected species or carabao.

- No significant impacts to habitat will result from the emplacement of targets or from hand-clearing the jungle trail, because the area is already disturbed. Minimum range "construction" is required. The sniper range would employ a firing point that retains a natural setting and concealment for the sniper. Cardboard or plastic silhouette targets would be individually placed down range at varying distances about 300 to 900 m from firing points, in an area where no road access exists. Targets would be mounted on plastic stakes, which would be hand-carried and hammered into position. Installation of the jungle trail would involve limited hand-clearing to delineate a path.

[72] Orchids of concern include *Eria rostriflora, Coelogyne guamensis, Rhynchophretia micrantha,* and an unnamed *Bulbophyllum* sp. [Source: M&E Pacific, Inc. (March 1997) *Draft Flora Report for the Ordnance Annex, Guam*].

[73] The majority of these fires are thought to have been deliberately set by deer poachers to increase deer habitat. (Personal communication with Gary Wiles, Guam DAWR, May 16, 1996.)

- If used, tracer rounds could ignite brush fires, but are not since they would indicate the sniper's location.
- Wild carabao have a small potential of being hit by a sniper projectile, but the potential for injury to an animal is remote. Personnel using the range and trail would be expert snipers maintaining existing skills (not beginners); therefore, marksmanship is expected to be consistently excellent. Snipers are trained individually or in small groups, employing single shots at the targets. Since the sniper rifles are scoped, the snipers are training to notice and avoid movement. Targets will be located on forward slopes, with hillsides acting as target backstops.
- Moorhens within the SDZ at Fena Reservoir would be protected by the terrain from projectile impacts. (The SDZ is delineated without consideration for hills that would prevent projectiles from reaching the reservoir.) As described above, range users will be experts who will very seldom miss targets.

Proposed mitigation. No significant impacts to habitat or protected species will result from clearing the range or direct projectile impact, and no mitigation is proposed. The potential for a field fire will be mitigated by ensuring no use of tracer rounds, curtailing range training during drought conditions, and strict adherence to a fire prevention and response plan which will be finalized for the Ordnance Annex, based on the fire plan for Tinian (see Appendix F). A helicopter with water-hauling capabilities will be on call during training sessions at the sniper range; nearby Fena Reservoir is the immediate water source.

4.4.1.2 Breaching House

An area 30 m by 30 m would be cleared for construction of the proposed 14 m by 14 m breaching house.

Existing conditions. The area proposed for the breaching house is entirely disturbed (there is no sensitive vegetation) and is dominated by swordgrass savanna.

Potentially significant impacts. No significant impacts to vegetation are expected from construction of the breaching house, as the area is already disturbed. No significant impacts to endangered reptile populations are anticipated from clearing the site, because these species occur in substantial numbers. Construction impacts will be minimal and will be mitigated by standard erosion control procedures. Tree snails are not expected to occur in this location. If tree snails become listed as endangered and if they are found to exist in areas to be cleared, clearing trees could significantly impact the snails.

No significant impacts are expected during breaching training. The potential for impacts from the 6 oz shaped charges is minimal since the explosive is designed to blast doors or barricaded windows inward as a means of forcible entry. Once inside, the raiding force uses stimulated small arms ammunition made of plastic (SIMUNITIONS) rather than live ordnance, eliminating the chance of fatal or injury producing projectile impacts. The breaching house will be constructed of fire-resistant materials to reduce any potential for structure fire.

Proposed mitigation. No mitigation is proposed. Should tree snails be found in this area and listed as endangered, mitigation measures will be negotiated with USFWS if trees are proposed for clearing.

4.4.1.3 Paradrop Zone

Existing conditions. The proposed DZ is in an existing LZ, a disturbed area with no limestone forest and no endangered species observed in the immediate vicinity.

Potentially significant impacts. Creation of this DZ might involve limited clearing of nonnative brush species. No significant impacts are expected. If tree snails become listed as endangered and if they are found to exist in areas to be cleared, clearing trees could significantly impact the snails.

Proposed mitigation. No mitigation is proposed. Should tree snails be found in this area and listed as endangered, mitigation measures will be negotiated with USFWS if trees are proposed for clearing.

4.4.1.4 Bivouacs

Existing conditions. Two bivouac areas are proposed for continued use. Both of these are locations with disturbed vegetation, such as swordgrass savanna that forms a dense cover and burns easily.

Potentially significant impacts. Protected species are not expected to be significantly impacted by bivouac activities. If tree snails become listed as endangered and if they are found to exist in areas to be cleared, clearing trees could significantly impact the snails. Large groups moving about in the jungle could also knock snails off trees onto the ground, where they would be more vulnerable to predation. There is a high potential for brush fires, especially during the dry season (approximately January through May).[74]

Proposed mitigation. Bivouac activities have ongoing mitigation; i.e., a fire prevention plan is in place and helicopter water-drop assistance is available. Tents are set up with fire lanes for easy access, and a fire watch is set at night. A Fire Prevention and Response Plan (similar to that used for the Tandem Thrust 1995 exercise) will be finalized by COMNAVMARIANAS for use at the Ordnance Annex (see Appendix F). If snails are detected in the bivouac areas and if they are listed, bivouac activities will be restricted to avoid snail populated areas.

4.4.1.5 Land Navigation and Reconnaissance Patrols

Land navigation and patrols are conducted both in the northeastern corner and in the southern end of the Ordnance Annex. Both are small-unit stealth activities.

[74] Personal communication with Leslie Morton of COMNAVMARIANAS N456, September 24, 1997.

Existing conditions. The northeastern corner of the annex is an already disturbed area, lacking native vegetation. The southern area contains Almagosa Spring, which supports a *Merrilliodendron* forest known to harbor three rare but not officially protected species: the Marianas eightspot butterfly, the Almagosa Cave isopod, and the Almagosa Cave amphipod. This site is also a potential area for the reintroduction and maintenance of native tree snails, some of which are listed as endangered by the Territory of Guam. Another limestone sinkhole south of Almagosa Pit contains similar rare plant and animal species.

Potentially significant impacts. No significant impacts are expected from land navigation training in the northeastern corner of the annex. Rare species and tree snails in the southern portion of the annex are unlikely to be disturbed, as training is limited to small numbers of people moving by foot through these areas under stealth conditions, firing blanks only.

Proposed mitigation. As a precautionary measure, the Almagosa spring and nearby limestone sinkhole area will be designated NWD.

4.4.1.6 Simulated TRAP with CAS

COBRA helicopters and Harriers would provide close air support as a helicopter inserted security force "rescuers" in "enemy territory" at existing LZs.

Existing conditions. No endangered bird or bat species nest around existing LZs.

Potentially significant impacts. Rotary- and fixed-wing aircraft are relatively noisy and could disturb any endangered birds or bats present in the overflight areas.

Proposed mitigation. Harriers will remain above 630 m AGL and helicopter gunships will remain above 315 m AGL, except in the immediate vicinity of LZs already used by the CH-46 or CH-53 troop transport helicopters.

4.4.2 Cultural Resources in the Ordnance Annex

Existing archaeological/historic resources in the Ordnance Annex include multiple ancient Chamorro latte sites and World War II Navy structures (see Appendix J). Construction and use of the proposed sniper range and jungle trail may impact cultural resources by disturbance or direct impact, respectively (see Figures 2-3 and 4-7). The proposed breaching house will not impact significant cultural resources because SIMUNITIONS will be used rather than live munitions. Significance criteria are in Table 4-2.

A large portion of the annex will be designated NCRD to protect cultural resources from effects of bivouacs and excavation. Troops will be briefed on the significance of Chamorro artifacts prior to exercises and will be instructed not to litter or otherwise deface any sites. The briefing will include a description of cultural resource indicators (e.g., charcoal-stained soil, pottery fragments, bones). Training personnel will be instructed to stop any digging if such materials are

found and to immediately notify the COMNAVMARIANAS Cultural Resources Manager to determine whether digging may be resumed.

4.4.2.1 Sniper Range

The proposed sniper range may be used daily by small groups (two to six snipers), each firing up to 20 rounds of 7.62/5.56mm ammunition. Each team will be brought in by vehicle and dropped off on the road about 4,000 m northeast of West Tower. They will be directed to patrol along the road to a specific firing position within the general firing area. As a team, the snipers will determine the direction of fire using a compass, the distance between themselves and the target (using a laser range finder), and the difference in elevation between their position and the target (using a climbing altimeter). After setting their equipment, they will relay this information to the Range Safety Officer (RSO). The RSO will then check the firing position-to-target information, to ensure that firing will remain within the designated SDZ and avoid cultural resources. If all criteria are met, the RSO will clear the team to shoot; otherwise, the team will move to a different firing position (see Figure 4-7). After taking a predesignated number of shots, the snipers will retrieve all expended brass and gear and move to the extraction point via the road. Several sniper teams might use the range at any one time.[75]

Existing conditions. A recently discovered large latte village within the SDZ of the proposed sniper range consists of more than 40 latte sets and may be the largest and best preserved of such sites on Guam. A second latte complex also within the SDZ consists of 12 latte sets and is in the vicinity of the proposed breaching house. Both latte sites are determined to be historically significant under the NHPA.

Potential impacts. Projectiles missing targets on the sniper range could theoretically damage the latte village and latte complex within the proposed SDZ. The two sites are within the 4,800 m maximum range of the weapons,[76] but the latte sites will be protected from projectile impacts by intervening topography.

- No significant impact on the latte village is expected because it is naturally protected by the terrain from impacts originating at the designated firing points.
- No significant impact to the latte complex is expected because these lattes are well below the bullet trajectories involved.[77]

Proposed mitigation. Potentially significant impacts on cultural resources will be avoided by selecting the firing positions, target areas, and firing directions to meet the following conditions:

[75] Written communication with NSWU-ONE (September 19, 1997).

[76] The latte village is at least 2,400 m from the firing points at approximately the same elevation; it is about 1,500 m behind the targets on the back side of a ridge, overlooking an inland wetlands area. The smaller latte complex is on a gradually sloping area about 200 m southeast of the breaching house location and is within 1,000 m of, and about 30 m lower in elevation from, all proposed firing positions.

[77] Weapons would be fired straight down the range at a fixed target positioned clear of any latte complex. Each projectile follows a ballistic trajectory that arcs downward increasingly with distance and loss of velocity; 1,000 m is the maximum effective range. The bullet trajectory, in case of a miss, would intersect terrain directly behind a target or could continue over a valley and impact terrain well beyond.

- Provide target areas approximately 1 km or closer to firing positions and at about the same elevation as the firing position (training requirement).
- Site target areas to avoid the potential for projectiles to impact and damage cultural resources (mitigation). Targets will be located so that significant cultural resources are protected by topographic features, or so the horizontal and/or vertical distance between the target and firing position is close enough that the likelihood of a missed shot damaging a historically significant resource is minimized to nonsignificance.

Final firing positions and target locations will be determined so that latte sets will be avoided and the SDZ will remain within the Ordnance Annex boundaries without intersecting the hiking trail (see Section 4.4.3). The final SDZ will be reviewed and approved by a Navy archaeologist.

4.4.2.2 Jungle Trail with Pop-up Targets

Training at the proposed jungle trail involves a single person walking on a designated path and shooting at radio-activated pop-up targets located at short distances. The cardboard or plastic targets will stand alone on the ground; behind each target will be a sandbag berm to catch the bullets. A limited amount of vegetation clearing will be necessary to delineate the jungle path. The clearing activities will be performed by hand. Targets will be mounted on plastic stakes; they will be hand-carried and hammered into position.

Existing conditions. Many latte sets have been recently identified in the vicinity of this trail, which will be near the sniper range and within its SDZ.

Potential impacts. This activity has the potential to damage archaeological/historic resources in the line of fire by direct impact of the projectile, should targets and berms be missed.

Proposed mitigation. Mitigation includes verification from a Navy archaeologist that the targets are placed so that no significant cultural resources are in line to be impacted by projectiles, as well as confirming that the direction of fire is consistent with the safety fan for the proposed sniper range. No excavation will be permitted along the trail.

4.4.3 Range Safety

Existing conditions. The Ordnance Annex is not officially accessible to the public. However, a commonly used hiking trail enters the southwest boundary of the annex and connects Mount Lamlam, Mount Jumullong Manglo, and Imong (Figure 4-8). This trail is respected by COMNAVMARIANAS as an advertised hiking trail that has been open to the public for decades. The SDZ of the proposed sniper range flanks one portion of the trail. In addition, poachers are believed to illegally enter the Ordnance Annex in search of game.

Potentially significant impacts. Significance criteria are in Table 4-5. No impacts are expected to hikers who remain on the trail, as the firing directions and resulting SDZ for the proposed sniper range have been carefully adjusted to keep the trail clear of required safety buffer areas (see Figure 4-8). The SDZ for the jungle trail range is also clear of the trail.

Occasionally, representatives of GovGuam agencies or private contractors are invited to perform natural or cultural resource studies within the Ordnance Annex. The studies may be safely conducted after approval by the activity commander and coordination with security and natural resource staff, which will ensure the safety of civilians on or near the ranges.

Proposed mitigation. When the range is opened, COMNAVMARIANAS will publish a notice in local newspapers warning civilians not to stray from the hiking trail and not to illicitly enter the Ordnance Annex at other locations or for poaching.

4.5 AAFB AND COMMUNICATIONS ANNEX

4.5.1 Protected Species and Habitat

Protected species at AAFB include the Mariana crow, Mariana fruit bat, green sea turtle, and native tree snails. As of April 1998, fewer than 12 endangered Mariana crows remained on Guam, all of them at AAFB. Four of these were captive crows that were released recently at AAFB.[78] In the past, crows were observed at Northwest Field, the Tarague cliffline, and the MSA. No crows currently nest on the south runway at Northwest Field; the crow distribution is limited to the MSA and east to Pati Point, due to attrition. It is recognized that the crows could theoretically disperse throughout their former range if recovery efforts were successful.[79] Crow nesting season is estimated to be approximately October 1–April 30.

An endangered Mariana fruit bat colony of approximately 300 individuals roosts at Pati Point west of the main airfield, and a few isolated individuals occur at Ritidian Point. Fruit bats forage at night along the limestone cliffs between these two points, as well as at other areas in Tarague Basin, the MSA, and Northwest Field. Threatened green sea turtles are known to nest on sand beaches at AAFB. Threatened and endangered native tree snails occur in the Haputo ERA at the Communications Annex (Finegayan).

All military operations at AAFB are reviewed for environmental compliance through the 36th ABW's Risk Analysis program.[80] Ground training exercises are not authorized at the Pati Point area in order to avoid adverse impacts to the endangered Mariana fruit bats, or at locations that might adversely affect Mariana crows. Training in the MSA is restricted to foot traverse from Northwest Field to Main Base by small teams of SEALs.

Overview of training impacts. The only potentially significant impact of training at AAFB and the Communications Annex is the impact of aviation noise and visual disturbance on Mariana crows and Mariana fruit bats. Noise of RRR training will not occur in known crow nesting areas,

[78] Personal communication with Robert Anderson, Guam DAWR, April 27, 1998.

[79] Personal communication with Heidi Hirsch of AAFB, August 1997.

[80] The Air Force allocates staff and financial resources to natural resources management and environmental education and awareness programs at AAFB.

and personnel walking on established trails at the Haputo ERA and Tarague Beach will not significantly impact protected species. Significance criteria are in Table 4-1.

4.5.1.1 Overflights

FCLP training is infrequent, occurring only two to four times per year.[81] NVG training occurs approximately three nights per week, commencing after sunset for a duration of up to three hours. Unlike runways, CAL and LHA deck training involve small LZs, which restrict the number of helicopters that can be landed simultaneously. Each of these exercises has a designated flight track and approach and departure altitude, confining aircraft to certain areas agreed upon in consultation with USFWS.

Existing conditions. Aviation training does not occur in a known crow nesting area (the MSA), but occurs at Northwest Field and at Main Base which are within 1 km of the MSA.

Potential impacts. Noise and visual disturbance from FCLP, NVG, CAL, and LHA training may directly or cumulatively impact Mariana crows and Mariana fruit bats, but there is no conclusive evidence that these activities cause disturbance constituting a "taking."

USFWS conducted a three-year study between 1992 and 1995 to determine the effects of FCLPs and other aircraft overflights (including HC-5 helicopters used at night for NVG training) on the Mariana crows and Mariana fruit bats at Main Base.[82] The study found that crows responded to some low-altitude aircraft overflights with distress and flight, but there was no evidence that overflights contributed directly to nest abandonment or nest failure during this study. In fact, Mariana crows have been known to tolerate relatively high volumes of air traffic at altitudes 300 m above ground level (AGL).[83] Although the USFWS study also identified the potential for nocturnal FCLPs to disturb foraging bats under the FCLP track, it concluded that current air traffic volumes were tolerable to the Mariana fruit bat colony at Pati Point.

Proposed mitigation. Overflight conditions were negotiated with USFWS in May 1997. There will be no overflights below 488 m MSL[84] over MSA 1, year-round. Overflights below 488 m MSL will be allowed between June and August (Mariana crow nonbreeding season). From September through May, there will be no overflights of crow territories below 488 m MSL. Crow territories will be identified by DAWR, coordinated with AAFB environmental staff, forwarded to air operations (36 OSS), and briefed to all air crews and to the AAFB tower. Helicopters will

[81] Personal communication with Byrnes Yamashita, NAVFAC EFDPAC, January 13, 1997.

[82] USFWS (July 1996) *Final Report: The Effects of Aircraft Overflights on Endangered Mariana Crows and Mariana Fruit Bats at Andersen Air Force Base, Guam.* Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[83] During the peak of the Tandem Thrust exercises, a pair of Mariana crows (the "pipeline pair") constructed a nest within approximately 915 m (3000') of the active runway.

[84] Equivalent to 305 m or 1000 ft above ground level (AGL).

remain 0.9 km from the perimeter of the fruit bat colony at Pati Point, with the exception of flights originating from the end of the runways.[85]

4.5.1.2 Rapid Runway Repair

Existing conditions. No crows nest at Northwest Field. The proposed site is paved.

Potentially significant impacts. None. No blasting is required after initial construction of the training site, and no crows nest in the area.

Proposed mitigation. None is required.

4.5.1.3 Paradrops

Airborne operations for both small group (4 to 12 people per helicopter) and large group (90 or more people per aircraft) parachute jumps are ongoing at Main Base and Northwest Field. Pilots fly a pattern at no less than 305 m AGL during crow breeding season[86] and may fly as low as 152 m AGL in nonbreeding season.

Existing conditions. No crows nest at either location.

Potentially significant impacts. None, as no crows nest at either location. If crows were present, visual disturbance (jumpers may look like birds of prey) and noise from overflying aircraft (see above) could be significant. Disturbance is not expected to affect any crows present during the nonbreeding season, particularly as drops will be targeted at the runways and away from trees to avoid injuries to personnel.

Proposed mitigation. None is required.

4.5.1.4 Bivouacs

Field exercises at Main Base and Northwest Field that require bivouac for medical, communication, security, or other skills training have been conducted at the areas indicated on Figure 2-4 for over 15 years. Groups of 100 or more have not caused known disturbance to Mariana crows. Troops are not permitted to light open fires, clear vegetation, or dig, other than limited digging for foxholes. The area is closely monitored by AAFB personnel to maintain the integrity of field conditions for follow-on troop exercises.

Existing conditions. Crows are not known to have nested in the bivouac area in recent years.

[85] 35 CES/CC Memorandum for 36OSS/CC and HDB dated May 22, 1997. The 36th ABWI 13-202, Dec 12, 1996, will be revised to incorporate these changes.

[86] 36th Operations Support Squadron (36 OSS) and Helicopter Combat Support Squadron (HC-5)(undated) Letter of Agreement: Air Traffic Control (ATC) Procedures for HC-5 Operations at Northwest Field, Guam.

Potentially significant impacts. None. No open fires are allowed at bivouac areas. Tents are set up with established fire lanes, an adequate number of fire extinguishers are present, and a fire watch is set up at night.

Proposed mitigation. No further mitigation is proposed.

4.5.1.5 Over-the-Beach Training

Small special operations groups land in rubber boats at Haputo and Double Reef beaches in the Haputo ERA (located along the coastline of the Communications Annex at Finegayan) and at Tarague Beach at AAFB. At Haputo, the groups hike up the established trail and steps, and proceed on foot out of the ERA. SEAL teams landing at Tarague Beach proceed on foot to the AAFB small arms range.

Existing conditions. No endangered terrestrial species occur on the trails. Native tree snails inhabit trees adjacent to Haputo trail.

Potentially significant impacts. No significant impacts to native tree snails are expected from this activity because no tree cutting will occur and personnel will remain on the established trail.

Proposed mitigation. No mitigation is proposed.

4.5.2 Cultural Resources at AAFB and Communications Annex

4.5.2.1 AAFB

RRR is proposed using permanently established craters at a single location on a parking apron at Northwest Field. Field maneuvers and bivouac training are ongoing south of Northwest Field.

Existing conditions. Sites associated with World War II and the Vietnam conflict include primarily the runways at AAFB's Northwest Field. Therefore, Northwest Field is considered historically significant. The National Park Service nominated Northwest Field as a National Historic Landmark or Site, but the State Historic Preservation Office (SHPO) and the Air Force did not concur. The Air Force then initiated action to determine the area's eligibility for the National Register of Historic Places. The determination of Northwest Field's eligibility is still pending. If a determination is made to place the area on the National Register, a Memorandum of Agreement will be developed between the Air Force and SHPO to cover all training activities. No historically significant cultural resources have been identified at the RRR and existing bivouac sites.

Potential impacts. Significance criteria are in Table 4-2. RRR is not expected to have significant impacts on Northwest Field because its site was specifically selected as one devoid of cultural site potential. Bivouac activities at new locations south of Northwest Field could disturb cultural resources. No impacts of ongoing bivouacs have been identified, as no cultural resources are present at the existing site.

Proposed mitigation. A Memorandum of Agreement will be developed between the USAF and the Guam SHPO to cover RRR at its site if it is determined to be within a larger area eligible for listing in the National Register. Bivouacs will be confined to an area that has been used for this purpose for many years. Most of the western portion of AAFB will be designated NGD (see Figure 2-10).

4.5.2.2 COMMUNICATIONS ANNEX

Haputo Beach is used for swimmer insertion (from small boats) and access to the Communications Annex (Finegayan) and AAFB's Northwest Field.

Existing conditions. Haputo Beach is the site of a latte complex that is listed on the National and Guam Historic Registers. Also in this area are the Pugua Point rock shelters and Tweed's Cave, both of which are potentially eligible to be listed on the National Register.

Potential impacts. Once personnel are ashore, overland training maneuvers are not expected to have significant impacts on cultural resources because personnel will be restricted to designated/established paths to exit Haputo Beach prior to commencing tactical maneuvering through the Communications Annex and Northwest Field.

Mitigation. The coastal area and cliff face will be designated NCRD.

4.5.3 Range Safety

Existing conditions. The existing small arms ranges at AAFB and Finegayan are within areas isolated from civilian traffic, with cliffline backstops to control projectiles beyond range boundaries. Signs and flags delineate the site of the range and SDZ widths for boaters below the cliffs at Finegayan. Pedestrian access along the flanks of either range is controlled. Range safety SOPs are published and implemented for both ranges.

Potentially significant impacts. Significant impacts to civilians are not expected at the AAFB and Finegayan ranges, as SOPs and all routine safety measures are in place.

Proposed mitigation. No additional mitigation is required.

4.5.4 Aviation Safety

Existing conditions. There are two airfields at AAFB. Northwest Field has one runway used occasionally for fixed-wing aviation training and LZs used for various types of helicopter training. Main Base has Class B runways capable of supporting all aircraft in the DoD inventory. All flights are controlled by air traffic control personnel, coordinated with the FAA, and coordinated with activities at Guam International Airport. Ground access to either field area is controlled by USAF security personnel; access is allowed for official business only.

Potentially significant impacts. No significant impacts are expected, as both public notification procedures and established airfield operating procedures are in place and well established at AAFB.

Proposed mitigation. No additional mitigation is required.

4.6 IMPACTS ON FARALLON DE MEDINILLA

4.6.1 Protected Species and Habitat at FDM

Overview of training impacts. Potentially significant impacts to birds are anticipated from aerial bombardment and naval gunfire. Birds may be impacted directly by explosive force or fragmentation, or indirectly from alteration of habitat and food source. Noise disturbance has also been observed to cause some species of birds to fly off the island. The most serious potential impact is introduction of the BTS to FDM from Guam in target vehicles, which would have devastating effects on the island's bird population.

4.6.1.1 Existing Conditions

As most of the existing conditions on FDM are directly relevant to potential impacts, detailed information is provided here as well as in Chapter Three.

The following is a summary of the geology, botany, bird life, marine life, and marine conditions on FDM based on more than ten surveys conducted at the island over the last year.[87] Agencies participating in these surveys included USFWS, NMFS, and CNMI DFW. Detailed summaries of these and previous surveys performed on FDM and a synthesis of conclusions based on this information are found in the *Historical Overview of Farallon de Medinilla: 1543 to 1997* in Appendix D-1.

Physical description. FDM's geology has not been studied in detail, although it is obvious the emergent portion of the island is primarily limestone. FDM is tectonically related to Saipan and more southerly islands, as it is on the same ocean ridge; therefore, its geology can be extrapolated from Saipan's with some confidence. The island probably has a volcanic core overlain by reef limestone mixed with varying amounts of volcanic sediment. The island is likely to be highly faulted and is observably subject to caves and sinkholes, as the limestone is easily weakened by a combination of rainwater solution along faults, wave action undercutting cliffs,

[87] Half-day avifaunal, botanical, and marine surveys were conducted in November 1996, with a follow up survey in December 1996; a series of seven bird surveys were conducted by helicopter in conjunction with requirements from USFWS Biological Opinions between February and August 1997; and a three-day marine survey was conducted in July 1997. No further on-island surveys will be permitted by the Navy, due to the November 1996 identification of extremely hazardous cluster bomblets scattered over the island.

and small crustaceans that bore into the limestone near the waterline. These islands are subject to frequent earthquakes ranging from 5 to 8 on the Richter scale.

The surface is an irregular plateau, dropping 10–100 m to the ocean on all sides. Certain areas, primarily in the central isthmus, are regions of obvious recent mass-wasting where large sections of deteriorated rock have slid into the ocean. Large landslides are distinguishable underwater to depths of approximately 20 m and periodically generate substantial sediment plumes (although none were observed during the marine survey). Clear evidence of ordnance impacts on cliff tops and faces was seen on certain portions of the island.

Terrestrial flora. Various vegetation surveys of FDM over time demonstrate that the species present on the island have not been significantly altered over the last hundred years. The structure of the plant community, however, has apparently undergone changes over this period. Shrub-like trees 3.5 m high were reported on the island as recently as 1975, but in 1996 nothing over 1.8 m high was observed. Current vegetation structure on the island appears heavily impacted by surface disturbance; the vegetation is not homogenous, but rather a mosaic of several types, lacking clear boundaries. Despite this fact, the island supports a dense cover of low vegetation suitable for bird nesting, primarily in the northern portion of the island. Vegetation is less dense in the southern portion.

Both native and weedy species occur on the island, most of them littoral. No threatened or endangered plant species were observed in 1996. Of the small number of native species that occur, seaside cotton (*Gossypium hirsutum*) and the bunch grass (*Digitaria gaudichaudii*) are considered rare or uncommon. The rest of the species observed are widespread plants.

Terrestrial fauna. Nine species of seabirds, five species of migratory birds, and three species of resident land birds were inventoried during the November 1996 avifaunal survey (Appendix D-2). The seabirds include three species of boobies (red-footed, brown, and masked), great frigatebirds, red-tailed tropic birds, noddies, and terns. Many of these species, including the three species of booby birds, have been documented consistently on the island during 17 different studies over a 95-year period. The Micronesian megapode, the only endangered bird noted in the surveys, was spotted in the central portion of the island and on the eastern edge during two surveys. It is estimated by the USFWS that not more than ten individuals occur on the island, representing between 0.7 percent and 1.0 percent of the total population of the Marianas archipelago.[88]

Several bird species utilize the shrubby vegetation, bare/grassy areas, or caves for nesting on the island. Nests of all three species of booby, the brown noddy, black noddy, white tern, and great frigatebirds have been observed. Masked booby nesting is restricted to only four Mariana islands, and FDM appears to have the largest nesting population of these. Most of the masked boobies breed along the eastern edge of the island, along with the brown boobies, which are ground nesters (see Figure 3-3). The great frigatebird is thought to have only two small breeding

[88] USFWS (May 16, 1997) Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at Farallon de Medinilla, CNMI.

colonies in the Marianas, one of which is on FDM. The great frigatebirds and red-footed boobies were observed to breed along the western edge of the island. Birds for which nesting has not been observed, but which are thought likely to nest on FDM, include the Micronesian megapode, sooty tern, white-tailed tropic bird, and red-tailed tropic bird.

Estimates of the booby population on FDM have a large variance. The most recent (November 1996 and March 1997) surveys estimated between 400 and 750 masked boobies, between 500 and 5,000 red-footed boobies, and approximately 200 brown boobies. Surveys conducted between 1979 and 1988 characterize the maximum booby population as between 750 and 2,200 individuals.[89] The earliest documented survey providing an estimate of the booby population on FDM, the 1975 EIS, used extrapolation to estimate a population of up to 50,000 individuals, after the island had been bombed with 22 tons of ammunition per month for the preceding four years. This estimate is disputed by a biologist who visited the island at the time of the 1975 EIS preparation.[90] He recalls that the 1974 booby population was approximately the same as or possibly smaller than the population shown in a 1996 USFWS videotape of FDM. The wide discrepancies between the 1975 estimate and all of the subsequent survey results suggest either that very large changes occurred in the local bird populations in the time interval between these surveys, or that the earlier extrapolated estimate was inaccurate. Because the 1975 EIS's observational methodology was not documented, and because the findings of a limited observation were extrapolated to the entire island surface, there is some question as to the accuracy of the population estimate.

Two Mariana fruit bats were observed on the island in December 1996; these animals are not protected federally, but are listed on the CNMI Endangered Species List and are protected from hunting throughout the CNMI. Three small coconut crabs (*Birgus latro*) and two species of lizard, the snake-eyed skink (*Cryptoblepharus poecilopleurus*) and the blue-tailed skink (*Emoia caeruleocauda*), were observed on the island in November 1996. Rats (*Rattus* spp.) were also observed in November 1996 and may be preying on bird eggs.

Marine environment. Humpback whales are known to appear between Saipan and FDM, but no whales or any other type of marine mammal were observed during the ten recent biological surveys of FDM. One green sea turtle was observed on the surface off the leeward side of the island during the November 1996 marine survey. Two green sea turtles were observed during the three-day marine survey in July 1997; one was observed on the water surface on the eastern (windward) side of the island, and one was underwater near the shoreline cliff on the western (leeward) side. Two small beaches exist on FDM, but neither of these appear suitable for green sea turtle nesting. Water clarity off these beaches is limited due to turbidity plumes; the emergent portion of the beach consists of rubble/cobbles with little sand and no vegetation, and the beaches are wave-washed.

[89] Two other bird surveys published shortly afterwards characterize the maximum population of boobies (between the years of 1979-1988) as between 750-2200 individuals on FDM, or a total of 1,380 to 3,800 individuals in the whole Mariana Islands. (J. Reichel (1991) "Status of Conservation of Seabirds in the Mariana Islands," in *Seabird Status and Conservation: A Supplement, ICBP Technical Publication No. 11* edited by J.B. Croxall and USFWS (1985) *Job Progress Report Research Project Segment: Seabird Survey and Inventories for October 1, 1984 through September 30, 1985.)*

[90] Personal communication between Michael Lusk (USFWS) and Bob Moncrieff, July 8, 1998.

The overall fish community contained numerous species and diversity in July 1997. However, low numbers of commercially desirable reef fish and evidence of fouled bottom fishing gear indicate there is a degree of fishing pressure being exerted on the nearshore fishery resources surrounding FDM.[91] The greatest abundance and diversity of reef fishes were associated with the complex and rugged substrate mainly on the leeward side, particularly in the areas offshore from the central and northern portion of FDM. At the extreme southern end of the island, an assemblage of 80 to 100 juvenile gray reef sharks (*Carcharhinus amblyrhynchos*) was observed. They were not present the following day, suggesting that the site is not a permanent point of aggregation. A complete survey list of the conspicuous and dominant fish species, including those important for commercial or subsistence use, is included in Appendix D-17.

Coral development, mostly occurring on the tops of submerged boulders, was consistently observed to be substantially higher on the leeward side compared to the windward reefs (up to 50 to 70 percent cover on some areas of the leeward side as opposed to 25 to 30 percent cover on the windward side). The dominant force affecting coral development appears to be wave energy and scouring. There was little visible evidence of impacts from explosives on the marine community and reef, with the exception of a single explosive scar on the slope of a shallow reef on the south end of the island. UXO was observed in waters around the entire island but was concentrated offshore of the middle portions. Few, if any, fragments of exploded ordnance were noted on the reef surface. Most of the intact bombs on the reef were not filled with explosives, but rather had inert fillers and were armed with smoke tracers. Once lodged in the substrate, UXO was observed to be colonized by coral and algae similar to other hard surfaces.

Coral growth can be impacted by sediment plumes from surface runoff. It is unclear to what degree military bombardment has aggravated the rate of mass wasting that has led to sediment plumes, and to what extent this type of erosion may be impacting coral growth. There was no apparent correlation between coral development and areas of presumed exposure to terragenous sediment plumes.

4.6.1.2 Potential Impacts of FDM Aerial Bombardment and Naval Gunfire and Proposed Mitigation

FDM has been used as a bombardment range since October 1971. Frequency and duration of use have varied over the years. The range includes the island as well as a 3-mile radius surrounding the entire island (see Figure 2-5 inset). Old car bodies have been imported as bombing targets and reference points. Munitions are either aerially delivered by attack and bomber aircraft, or surface delivered by combatant ships and raiding craft; UXO is found throughout the island. The types of explosive used include point-detonating (explode upon impact), variable-time or mechanical-fused (explode in the air, thus affecting a larger area), and illumination shells. The bomb type and delivery method affect the area of effect; for example, variable-time-fused bombs may affect a larger land area and are more likely to produce casualties than point-detonating bombs. Targeting does not normally occur north of the range limit line (see Figure 2-5), but all

[91] John J. Naughton, National Marine Fisheries Service (July 8-10, 1997) Farallon de Medinilla Survey.

areas on the island are susceptible to UXO. Scatterable submunitions have been found on the island, which heighten safety concerns for human use of all land areas.

Ammunition with two general types of fuses will be used during proposed training: variable-time-fused rounds that produce fragmentation air bursts, and point-detonating explosives that explode on contact. Bombs and projectiles may be either explosive or inert. Projectiles may be fired from guns or rocket propelled. In addition, illumination rounds, consisting of parachute-retarded magnesium flares, are used at night and sometimes fall to ground while still burning. Other pyrotechnic rounds include practice (inert) bombs and projectiles with smoke-marking fuses.

Potential impacts.

- Harming, harassing, or mortality (taking) of individuals of an endangered bird, bat, or turtle species would be a significant impact. A taking could be caused by bomb explosion (upon impact or by detonating UXO on the ground), fire, or change in vegetative structure and resulting loss of habitat as a result of fire.
- Destruction of >1 percent of the coral surrounding the island would be a significant impact.

The potential for a take is directly related to proximity of the animal to targeted areas, although all parts of the island are susceptible to being hit, as accuracy differs among weapon types. Therefore, the location of target affects which bird species is most likely to be impacted. Targeting the western cliff edges would impact breeding great frigatebirds and red-footed boobies, while targeting the eastern cliffs would impact breeding masked and brown boobies. Placement in the interior portion of the island would impact fewer breeding seabirds, but could impact the megapode. Known past impacts and/or potential future impacts are as follows:

- **Mortality.** Some individual moralities have been observed as a direct result of range use. In seven aerial surveys (February-August 1997) a total of two or three dead seabirds was observed on the ground near new bomb craters.[92] However, there remains a diverse avifauna utilizing the island, and no significant changes in the number of ground-nesting birds was found between pre- and postbombardment surveys conducted twice in 1997. The survey results fail to demonstrate significant short-term direct impacts on the seabird population or on the endangered megapode from military operations over the last year.

  The cumulative effects of military use on the net long-term change in species abundance and absolute abundance of birds using the island are not possible to determine. Present-day counts may represent a condition different from that which existed earlier, but no studies were conducted on which to base an estimate of the change, or to attribute cause(s) of such changes. Natural factors such as weather and oceanic conditions may have as profound effects on bird distribution and abundance as do man-made causes.

[92] (On two separate occasions, a red-footed booby flew into the rotors of the survey helicopter and was killed, nearly taking down the aircraft each time.)

- **Habitat destruction.** Several burn areas, including the vegetated northern portion of the island, were noted during the August 1997 post-impact survey. Fire is one of the factors that has apparently altered the vegetation structure over time; shrubby vegetation and bare areas have replaced former stands of trees reportedly up to 4 m in height. Other factors that may have caused periodic changes in vegetation structure include typhoon-related storm damage to plants through wind pruning and scouring, and salt damage by wind-blown sea spray. These natural forces affecting vegetation structure have been constant over time. It is likely that fire and ground disturbance from use of ordnance have been the primary factors in altering vegetation distribution from its natural state. This may have correspondingly affected the population distribution of bird species making use of the island, by favoring ground and scrub roosters and nesters over those preferring greater vertical structure.
- **Erosion.** UXO will continue to accumulate on the island as a result of training activities, making foot access (for the purpose of moving targets, conducting surveys, or performing on-the-ground training) dangerous. It is likely that impacts from ordnance on the margins of the island contribute in some degree to the natural process of fracturing and erosion.
- **Coral.** There is little evidence of coral destruction as a result of bombing. Because corals are relatively slow to regenerate, direct effects of bombing over time should be discernible if they were occurring. The dominant force limiting coral development appears to be wave energy and scouring.
- **Protected marine animals.** There is a possibility for incidental takes of protected sea turtles and marine mammals, if these animals were present, by direct impact or from the concussive effects of bombs hitting the water. Since no marine mammals have been spotted during the ten surveys conducted over the last year, and green sea turtles (three in total) were spotted in only two of the ten surveys, the potential for harm to these species is minimal.

Proposed mitigation. Targets will be placed with the assistance of a biologist so that the majority of ordnance delivered will avoid the most sensitive areas for nesting and roosting birds (see Figure 2-11). Fighter and attack aircraft will target inland portions of the northern and southern portions, avoiding the isthmus. Aircraft dropping a series of bombs will avoid targeting the eastern cliff face. Because surface-delivered ordnance (i.e., naval gunfire) is of flat trajectory, projectiles fired under the target line would impact the cliff, and those fired above it would fly over the island and impact in the ocean. Surface fire will be delivered from firing positions west of the island only, thereby reducing effects on the extensive eastern sea cliffs.

USFWS guidelines will be followed for permitted takings of bird and turtle species. When possible, the NMFS will be notified by the Navy of missed bombs and missiles entering marine waters, and the Pacific Islands Protected Species Program will be notified within 24 hours of protected species takes.

Other mitigation measures will include broadcasting rodenticide pellets to limit the rat population at FDM. Additional compensatory mitigation measures may be negotiated in consultation with the USFWS and NMFS. These primarily include enhancing the megapode population on another island in the Marianas to address long-term survival of the species.

4.6.1.3 Brown Tree Snake

Existing conditions. Currently there are 19 targets (mostly old car bodies) located along the length of the island. These cannot be relocated due to the presence of cluster bombs. More targets, including vehicles, dumpsters, and Conex boxes, will be brought to the island from Guam or Saipan as part of the proposed action.

Potential impacts. The most serious impact that could result from bringing targets from Guam is introduction of the BTS and the potential for establishing a BTS population on the island. The dense shrubby vegetation, presence of two species of lizards as intermediate prey, and abundance of seabird eggs, hatchlings, and adult birds would facilitate successful colonization. The ground-nesting birds, including the Micronesian megapode, would be particularly vulnerable. The cave nesters would likely be less so.

Proposed mitigation. Target materials shipped from Guam will be inspected, steam cleaned, and staged in snake-free areas by USDA Wildlife Services prior to transport to FDM, in accordance with the BTS Plan. Constructed targets may be used in place of recovered vehicles.

4.6.2 Public Safety

During exercises, aircraft make multiple bombing runs on the island, and ships armed with MK45 5-inch .54 caliber guns fire from up to 24 km (13 nautical miles) away (see Appendix B-17).

Existing conditions. UXO is found throughout the island, consisting of various iron bombs, naval gunfire projectiles, and small, hard-to-detect cluster bomblets (submunitions). The latter include models with a very high sensitivity to disturbance and are extremely dangerous. Their recent discovery on the island precludes civilian or military personnel access to the island, except EOD units.

Civilians do not have access to this uninhabited and essentially inaccessible island. The airspace is restricted to civilian aircraft for a radius of 5 km (3 mi.) around the island.

Nearby ocean areas are used by commercial and sports fishermen. Water space is restricted for a radius of 5 km around the island when a NOTMAR is published for scheduled training.

Potential impacts.

- UXO will accumulate on land and to a lesser extent in the water, but will not impact civilians who cannot access the island.
- No interference with civilian aviation is expected from operations on FDM, due to airspace restrictions (Restricted Area 7201), routine NOTAM publication, and routine notification of the FAA on Saipan prior to exercises.

- Public safety hazards to fishing boats inside the restricted water space during exercises will be avoided by routine surveys of the exercise area prior to bombing, NOTMAR publication, and marine radio broadcasts.

Proposed mitigation. Bombing, strafing, and naval gunfire exercises at FDM will receive media coverage in advance, aimed at advising commercial fishermen of impending exercises.

4.7 NON-DOD LOCATIONS

4.7.1 NON-DOD LOCATIONS: GUAM

Existing conditions. Parachute drop zones in Dandan are on private property. The terrain is described as suitable for small unit, precision drops, and is used by the Guam Army National Guard.

Riverine training on private land on the Talafofo and Ylig rivers is not included in the Preferred Alternative, and impacts were not evaluated in detail.

Potential impacts. Impacts to public safety are possible if the parachute operations are not scheduled in advance and announced to the FAA to ensure no interference with/by commercial aviation.

Proposed mitigation. Continue to advise the public via press releases and NOTAMS of scheduled parachute operations.

4.7.2 Non-DoD Locations: NVG Training on Rota

4.7.2.1 Protected Species and Habitat

Night vision goggle training on Rota—which is not included in the Preferred Alternative—consists of flying 19 closed-pattern loops with occasional short touchdowns in the same area used for commercial fixed-wing flight approaches and turnarounds. The proposed helicopter flight tracks for NVG training are adjacent to crow habitat (Figure 4-9). Training would occur approximately 120 times per year, with planes originating from AAFB. The proposed NVG training would commence one hour after sunset or after the last commercial flight, whichever is later, and would end by 10:00 PM, so noise would be continuous for a period of up to three hours.

Existing conditions. The largest remaining population of the endangered Mariana crow in the Mariana Islands is on Rota (approximately 600 crows according to a 1996 survey).[93] The eastern end of the island is considered the best crow habitat on Rota. Mariana crow population densities

[93] Daniel J. Grout, Michael Lusk, and Steven Fancy (FWS) (June 1996) Results of the 1996 Mariana Crow Survey on Rota.

of high, medium, low, and none are depicted in Figure 4-8,[94] as are locations of known crow nests. An aggressive Mariana crow banding study was initiated by the USFWS in October 1996 and will provide further information on location of active crow nests; recently USFWS has found an active crow nest within 0.5 km of the northwest corner of the Rota airport boundary.[95]

Endangered Mariana fruit bats roost primarily in the Sabana Heights Wildlife Conservation Area, located approximately 5 km southwest of the Rota International Airport (see Figure 3-4). At night they forage over nearly the entire island, wherever food is available.

Potential impacts.

- Short helicopter touchdowns could introduce BTS to Rota. As discussed in Section 3.3.1.4, the BTS has been sighted on Rota but is not thought to be established there. Unless intercepted, introduced BTS could cause ecological and economic problems similar to those on Guam.
- Noise from NVG training could significantly disturb Mariana crows nesting in the vicinity of Rota International Airport. At present, no statistically based data on peak sound level effects on Mariana crows are available, although some incidental observations have been recorded.[96] Therefore, it cannot be determined whether training will disturb Mariana crows nesting and/or foraging in woodlands adjacent to the airport.
- The peak NVG sound level at the nearest known crow nest (approximately 1.5 km away) was calculated to be 84 dBA; this would be reduced by the shielding effect of intervening vegetation (Appendix N). For nests in the high-crow density areas further away from the airport, noise attenuation due to vegetation would be significant, greatly reducing the peak sound levels experienced. Impacts from NVG training may be similar to those indicated for low-altitude aircraft overflights at AAFB,[97] where NVG training has been allowed by the USFWS. (A detailed discussion of aircraft overflight impacts is in Section 4.4.1.1.)

  Mariana fruit bats, which may forage over the area at night, could also be significantly impacted by noise. Visual impacts would be nonsignificant.

Proposed mitigation. This activity is not included in the Preferred Alternative, and no mitigation is proposed.

[94] Densities were determined by a 1982 study and identified in the Physical and Economic Master Plan for Rota, prepared by Juan C. Tenorio & Associates, Inc.

[95] Personal communication with J.M. Morton, Ph.D., USFWS, December 24, 1996.

[96] Anecdotal evidence of disturbance of Mariana crows from HC-5 helicopters was documented in 1980 (personal communication with Bob Beck, Guam DAWR, May 16, 1996). Nest defense and the attack of female crows by outside male crows were among the types of behavior displayed.

[97] Impacts on the Mariana crow from low-altitude aircraft overflights at AAFB include distress and flight, which may disrupt nest construction, incubation, and nest attendance during breeding season. (USFWS, July 1996).

4.7.2.2 Aviation Safety on Rota

Existing conditions. The Rota International Airport, which operates under visual flight rules (VFR), has navigational lights and a radio beacon but does not have a control tower. Approaching aircraft are requested to contact the terminal via the common terminal area frequency to verify weather, visibility, and traffic conditions. Rota provides air service to Guam and Saipan; most traffic occurs during daylight hours, with the last regular flight at 7:30 PM.[98] Aircraft approaching on instrument flight rules must communicate with the FAA's Guam Center Radar Approach Control. Night flights are not scheduled. Flight activity after dark is a new use for the airport with a potential for risk to public safety.

Potential impacts. No interference with civilian aviation would occur on Rota, as commercial flights normally cease after 7:30 PM, and the proposed NVG training (not included in the Preferred Alternative) would commence one hour after sunset or after the last commercial flight, whichever is later, and would end by 10:00 PM.

Proposed mitigation. None is required.

4.8 SUMMARY OF IMPACTS OF PREFERRED ALTERNATIVE

A variety of potentially significant and nonsignificant impacts were identified in association with the proposed action and all alternatives. The significant issues were analyzed in detail (see preceding sections) and are summarized in Section 4.7.1 below. Nonsignificant issues were also analyzed, although the analysis is not presented in detail in this text. Potential nonsignificant impacts were identified and mitigation measures have been proposed. Table 2-11 includes all potential impacts of the proposed action as well as proposed mitigative measures.

4.8.1 Summary of Significant Issues

Analysis of potentially significant issues presented in this chapter has led to the following conclusions regarding the Preferred Alternative:

Impacts on biological resources. The Preferred Alternative will generate the following significant impacts:

- Damage a maximum of 35 m^2 coral at Unai Babui (to be mitigated by Navy support of coral research)
- Remove up to 7 ha of Tinian monarch habitat for small arms range construction (to be mitigated by planting 4 ha of tangantangan elsewhere in the EMUA if the monarch is protected at the time of range construction)

[98] Personal communication with Willis Cannon, Saipan FAA, May 16, 1996.

- Temporarily disturb Mariana crows during nonbreeding season at AAFB
- Disturb fruit bats during night foraging at AAFB
- Disturb or take Micronesian megapodes on FDM (to be mitigated by enhancement of megapode habitat on the island of Sarigan)

All of these impacts are potentially cumulative, as well as direct. The potential for BTS export from Guam will be strictly controlled by compliance with USDA direction, in accordance with the BTS Plan. Other potential disturbance of endangered species will be mitigated by avoidance (NT and NWD overlays).

Impacts on archaeological and historic resources: The Preferred Alternative, with proposed mitigation, is not expected to have adverse impacts on known cultural resources and is unlikely to impact as-yet-unidentified resources.

Wastewater disposal on Tinian: Analysis indicates that only the No New Action Alternative has the potential to adversely affect existing municipal wastewater systems.

Disposal of SW and HW generated on Tinian: Analysis indicates that no significant impacts are expected under any alternative. SW and HW generated during exercises on Tinian will continue to be removed to Guam and the continental U.S. for appropriate disposal. The expected volumes are too small to significantly affect Navy PWC landfill service life.

Impacts of aviation training on public safety: No impacts are expected under any alternative, due to routine compliance with FAA and military airfield regulations and orders.

Impacts of firing ranges on public safety: No significant impacts are expected for the Preferred Alternative, with routine notifications, observance of range safety SOPs, and safety sweeps of over-water SDZs prior to range use. On Tinian, there is a potential for injury to persons entering the existing UXO contaminated area.

Socioeconomic impacts: Closing the EMUA during exercises will impact the Tinian tourism industry, which is expected to grow in the future. In addition, there is a potential for cumulative impacts on civilian air and water traffic if the new casino industry greatly increases the number of tourists traveling to Tinian.

4.8.2 Cumulative Impacts

Cumulative impacts due to repetitive training in a given land area have been addressed in the foregoing sections as direct impacts, because the nature of the proposed action is defined as repetitive use of a land area. However they are defined, these impacts are of the "wear and tear" variety and consist primarily of the increased likelihood of a resource being damaged over time. For example, repeated travel by tracked vehicles over a certain ground area is likely to increase the probability of damage to cultural resources in the soil, if the activity were not mitigated by avoidance. In areas populated by endangered birds, a single aircraft overflight might cause a bird to temporarily leave its nest but would have no permanent effect, whereas repeated overflights

might cause the bird to abandon its nest site altogether, possibly resulting in failure to brood and raise young.

Existing or known future projects with impacts which could be cumulative with the proposed action are as follows:

Casinos on Tinian. Casino resorts will have impacts on infrastructure which will be cumulative with impacts of the proposed action. The impacts are primarily associated with relatively uncommon large-scale exercises on Tinian and would be common to all alternatives except No Land Use.

- Utilities will be in demand by the casinos at a much greater level than by the military, due to the large number of employees and visitors involved. Tinian officials have indicated that small amounts of potable water and electricity use are available to the military for short periods of time without adverse local impacts. However, if sufficient casinos are constructed and operated in the future to draw on the full capacity of the local utility supplies, significant impacts to such utilities could result. Because the impacts of the casinos alone would be significant, it is expected that local authorities would need to develop a solution regardless of the small impact of occasional military training.
- Wastewater disposal is an unresolved issue on Tinian, which has no wastewater treatment plant and no plans to construct a municipal WWTP (see Section 4.1.3). The first large casino to open currently has a package treatment plant and leachfield. Military impacts on the two existing municipal septic systems has been evaluated for present conditions and found to be nonsignificant. It is anticipated that the DoD will have its own small septic field and wastewater disposal capacity well before the time that any cumulative impacts threaten to become significant.
- Airport and harbor traffic will be intensified if tourist visits to Tinian increase. Occasional military use of both facilities has the potential to interfere with tourist traffic if not mitigated by communication with local authorities. This impact and proposed mitigation are addressed in Section 4.1.7.

Tourist visits on Tinian. Tourists may accidentally or intentionally harm cultural or natural resources, particularly on Tinian where there is no control over access. Tourist impacts would therefore be cumulative with training impacts on such resources. These impacts, and proposed mitigation, are discussed throughout this chapter in the sections on cultural and natural resources.

Commercial fishing. The proposed action has the potential to harm or destroy fish and other marine animals in the vicinity of Apra Harbor and the vicinity of FDM. Both areas are subject to commercial fishing pressures, possibly to the detriment of the species fished. Overfishing impacts would be cumulative with the impacts of underwater demolition and, to a lesser extent, aerial bombardment and naval gunfire.

Commercial shipping and BTS interdiction. The proposed action involves transport of cargo between Guam and various locations currently believed to be free of brown tree snakes.

Commercial and private shipping from Guam is subject to less rigorous inspection standards that military shipments and has a clear potential to introduce BTS to other islands or to the continental U.S. The USDA on Guam is working diligently to implement a civilian inspection program but has no enforcement authority.

Solid waste disposal on Guam. Disposal of military waste from Tinian at the PWC landfill on Guam will very slightly (<1 percent) reduce its capacity to accept waste from other military sources. It will not affect the civilian landfill situation, as PWC does not and will not in the future accept civilian waste for disposal.

Release and/or reuse of military lands on Guam. Various portions of military bases on Guam are planned to be turned over to the local government, primarily as part of a GLUP or BRAC action. Impacts are not expected to be cumulative with the proposed action, which has very different effects. The proposed action does and will affect only the lands retained by the military on Guam.

All of the above-described impacts are included in Table 2-11, together with proposed mitigation measures.

4.8.3 Unavoidable Adverse Impacts and Unresolved Issues

Certain types of required training will have unavoidable adverse impacts, which can only be mitigated by compensatory mitigation:

- Amphibious vehicle landings will damage live coral and coral substrate on certain shallow reef flats.
- Bombardment of FDM is likely to harm, harass, or kill individual endangered or migratory birds.
- The proposed mortar range on Tinian (not in the Preferred Alternative) would generate UXO. The impact area would be difficult or impossible to completely clear of UXO.

The only unresolved issue is the effect of aircraft noise on Mariana crows and other endangered bird and bat species. No conclusive evidence of permanent harm resulted from a recent USFWS study of certain aircraft noise at AAFB, and the effects of proposed NVG training on Rota (not in the Preferred Alternative) are unknown.

4.8.4 Relationship of Short-Term Uses and Long-Term Productivity

Use of existing military sites for proposed training activities is not generally expected to detract from long-term productivity, given the precautions in place to prevent contamination of soil or groundwater at any location. No large-scale building is proposed which would pave over potentially arable or otherwise useful undeveloped land. In the event that any of the existing

military-controlled land areas were to be declared excess, such areas would not be rendered unable to be productive as a result of the proposed action. In fact, the military need for large, undeveloped training areas has tended to result in long-term protection of natural and cultural resources from the effects of commercial development.

The exception is the proposed creation of a mortar range on Tinian (not part of the Preferred Alternative). Such a range would result in long-term UXO contamination in a limited area, indefinitely removing that land area from future human use for other purposes.

4.8.5 Irreversible and Irretrievable Commitments of Resources

The proposed action will involve periodic commitment of resources for individual exercises and for the few proposed construction projects.

If the proposed Tinian mortar range were constructed and used, resulting UXO contamination would very likely irreversibly commit the impact area to permanent fencing and restricted access. However, the mortar range is not included in the Preferred Alternative.

4.8.6 Environmental Justice

Under Executive Order 12898, dated February 11, 1994, federal agencies are required to address the potential for disproportionately high and adverse environmental effects of their actions on minority and low-income populations. Agencies are required to ensure that their programs and activities that affect human health or the environment do not directly or indirectly use criteria, methods, or practices that discriminate on the basis of race, color, or national origin. NEPA documents are specifically required to analyze effects of federal actions on minority and low-income populations and, whenever feasible, to develop mitigation measures to address significant and adverse effects on such communities. In addition, the Executive Order requires provision of opportunities for community input in the NEPA process. It states that the public, including minority and low-income communities, should have adequate access to public information relating to human health or environmental planning, regulation, and enforcement.

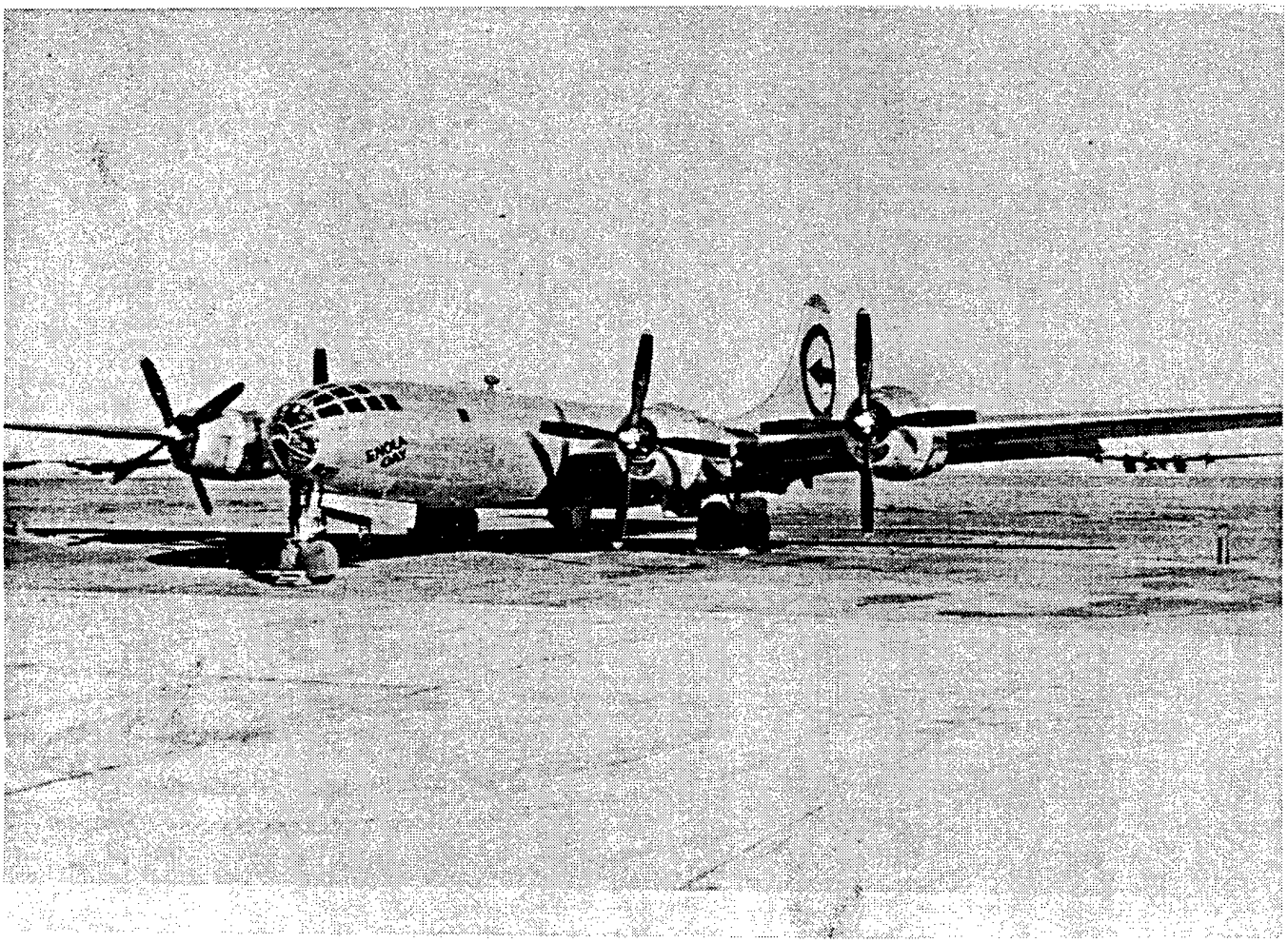
Anticipated impacts of the proposed actions–training on military-controlled lands in the Marianas–are expected primarily upon military personnel working and living on the affected bases, with the exception of the civilian population of Tinian. The population of those working and living on military bases does not comprise any particular minority, since the Navy must comply with U.S. Equal Employment Opportunity Commission regulations designed to implement Public Law 88-352. With regard to impacts on low-income populations, it is reasonable to assume that the populations of Guam military installations are not "low-income" (below the poverty line, as defined by the U.S. Government). In general, Navy and Air Force bases provide a source of highly technical jobs, which in turn command better-than-average salaries.

The socioeconomic study performed as part of this DEIS (Appendix H) determined that the population of Tinian is not economically disadvantaged or low-income on the average. Periodic

closure of the EMUA may stop or limit the scope of historic site tours. Tour operators do not represent a particular minority group that will be disproportionately affected.

Closure of the EMUA will also require subsistence and recreational fishers to use alternative sites for fishing. Fishing occurs virtually anywhere there is reef. Figure 4-9 shows fishing locations identified in a study of the MLA.[99] At least six identified fishing areas (and undoubtedly many privately-known fishing sites) are available along the west coast south of the EMUA. Therefore, closure of the EMUA will not restrict subsistence fishing and will not thereby discriminate against low-income populations.

[99] Personal communication June 1998, Henry Cabrera, Tinian Division of Fish and Wildlife.



Enola Gay B-29, which dropped an atomic bomb on Hiroshima (National Archives at College Park)

REFERENCES

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

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Amy Sheridan Project Manager	MS in Geology BA in English	Contributed to the organization and content of all sections; wrote Executive Summary, Sections 1.3-1.7, Chapter 2, Chapter 4 sections on solid waste, socioeconomics, and Section 4.8
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Art Whistler Isle Botanica	PhD in Botany MS in Botany	Botanical survey for Tinian Botanical survey for Guam: Ordnance Annex and Apra Harbor Botanical survey of FDM

REFERENCES: ABBREVIATIONS & ACRONYMS

AAFB	Andersen Air Force Base
AAV	Assault Amphibian Vehicle
AAAV	Advanced Amphibious Assault Vehicle
ABW	Air Base Wing
AGL	Above Ground Level
AICUZ	Airfield Installation Compatibility Use Zone
ARE	Attack Response Exercise
ASW	Anti-Submarine Warfare
ATD	Annual Training Duty
ATIS	Airport Terminal Information System
BRAC	Base Realignment and Closure
BTS	Brown Tree Snake
C7F	Commander, U.S. 7th Fleet
C-RAP	Center Radar Approach Control
CAA	Clean Air Act
CAD	Cartridge Activated Device
CAL	Confined Area Landing
CAS	Close Air Support
CCT	Combat Control Teams
CDS	Container Delivery System
CEQ	Council on Environmental Quality
CES	Civil Engineer Squadron
CLZ	Craft Landing Zone (for LCAC)
CME	Combat Mobility Element
CNMI	Commonwealth of the Northern Mariana Islands
COMNAVMARIANAS	Commander, U.S. Naval Forces Marianas
COMPHIBGRU ONE/ELEVEN	Commander, Amphibious Group One/or Eleven
COMSEVENTHFLT	Commander, U.S. Seventh Fleet
CONUS	Continental U.S.
CPX	Command Post Exercise
CRRC	Combat Rubber Raiding Craft
CS	Combat Support
CSS	Combat Service Support
CTF	Commander, Task Force (Number)
CUC	Commonwealth Utility Commission
CZM	Coastal Zone Management
DAWR	Division of Aquatic and Wildlife Resources
DEIS	Draft Environmental Impact Statement
DEQ	Division of Environmental Quality
DoD	Department of Defense
DOT	Department of Transportation
DPW	Department of Public Works
DRMO	Defense Reutilization and Marketing Office
DZ	Drop Zone
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMO	Emergency Management Office (CNMI)
EMR	Electromagnetic Radiation

EMUA	Exclusive Military Use Area
EOD MU-5	Explosive Ordnance Disposal Mobile Unit-Five
EPA	Environmental Protection Agency
ERA	Ecological Reserve Area
EZ	Extraction Zone
FAA	Federal Aviation Administration
FARP	Forward Area Refueling Point
FCC	Federal Communications Commission
FCLP	Field Carrier Landing Practices
FDM	Farallon de Medinilla
FEIS	Final EIS
FWS	Fish and Wildlife Service
GAA	Guam Airport Authority
GEPA	Guam Environmental Protection Agency
GIAT	Guam International Air Terminal
GovGuam	Government of Guam
GPA	Guam Power Authority
GTA	Guam Telephone Authority
HAHO	High-Altitude, High-Opening (Parachute)
HALO	High-Altitude, Low-Opening (Parachute)
HC-5	Helicopter Combat Support Squadron Five
HF	High-Frequency
HM/HW	Hazardous Materials and Hazardous Waste
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HPO	Historic Preservation Officer
HW	Hazardous Waste
I MEF	I Marine Expeditionary Force
IARII	International Archaeological Research Institute, Inc.
ID	Infantry Division
IED	Improvised Explosive Device
IFR	Instrument Flight Rules
III MEF	III Marine Expeditionary Force
III SRI	III Surveillance, Reconnaissance and Intelligence Group
IO	Indian Ocean
IWS	Individual Wastewater System
JA/ATT	Joint Airborne/Air Transportability Training
km	Kilometer
kph	Kilometers per hour
kW	Kilowatt
LAPES	Low-altitude, parachute extraction system
LAV	Light Armored Vehicle
LBA	Lease Back Area
LCAC	Landing Craft, Air Cushion
LCC	Amphibious Command Ship
LCM-8	Landing Craft, Medium
LCU	Landing Craft, Utility
Ldn	Day-Night Equivalent Sound level
LHA	Landing Helicopter, Assault
LHD	Amphibious Assault Ship (Multipurpose)
LSD	Landing Ship, Dock

LPD	Landing Platform, Dock (amphibious assault ship)
LZ	Landing Zone
m	Meter
m^3	Cubic Meter
m^3/day	Cubic Meter per Day
MARE	Major Accident Response Exercise
MARFORPAC	Marine Forces, Pacific
MEDEVAC	Medical Evacuation
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
mm	Millimeter
MOA	Memoranda of Agreement
MP	Military Police (US Army and USMC)
MSA	Munitions Storage Area
MSL	Mean Sea Level
MTC	Marianas Telecommunications Corporation
MW	Megawatts
NAS	Naval Air Station
NCB	Naval Construction Brigade
NCRD	No Cultural Resources Disturbance
NCTAMS	Naval Computer and Telecommunications Area Master Station
NEO	Noncombatant Evacuation Operation
NEPA	National Environmental Policy Act of 1969
NGD	No Ground Disturbance
NKK	Nan'yo Kohatsu Kaisha (South Seas Development Company)
NM	Nautical miles
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NRMP	Natural Resources Management Plan
NSWU-1	Navy Special Warfare Unit One
NVG	Night Vision Goggles
NWD	No Wildlife Disturbance
OL	Off Limits
OSS	Operations Support Squadron
PACAF	Pacific Air Forces
PAG	Port Authority of Guam
POL	Petroleum Oil, Lubricant
PT	Physical Training or Portable Self-Contained Toilets
PUAG	Public Utility Agency of Guam
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act
RHIB	Rigid Hull, Inflatable Boat
ROD	Record of Decision
ROWPU	Reverse Osmosis Water Purification Unit
RRR	Rapid Runway Repair
SAR	Search and Rescue
SARA	Superfund Amendment and Reauthorization Act

SDZ	Surface Danger Zone
SFG (ABN)	Special Forces Group, Airborne
SOP	Standing Operating Procedures
SP	Security Police (USAF), and Shore Patrol (USN)
SPIE	Special Purpose Insertion and Extraction (Helicopter Rigging)
SRF	Ship Repair Facility
SRI	Surveillance, Reconnaissance and Intelligence
STS	Special Tactics Team
SUSV	Small Unit Support Vehicle
T-AH	Hospital Ship
T-AK	Maritime Prepositioning Ship
TD-AK	Maritime Prepositioning Ship
TACP	Tactical Air Control Party
TCGCC	Tinian Casino Gaming Control Commission
TEWT	Tactical Exercise Without Troops
TRAP	Tactical Recovery of Aircraft and Personnel
TRUE	Training in an Urban Environment
TSCA	Toxic Substances Control Act
TT 93, TT 95	Tandem Thrust '93, '95 [military exercises]
TTPI	Trust Territory of the Pacific Islands
UHF	Ultra-High Frequency
USAF	U.S. Air Force
USARPAC	U.S. Army, Pacific
USCG	U.S. Coast Guard
USCINCPAC	Commander-in-Chief, U.S. Pacific Forces
USFWS	U.S. Fish and Wildlife Service
USMC	U.S. Marine Corps
USN	U.S. Navy
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VGS	Variable Grade Sewer
VHF	Very High Frequency
VOA	Voice of America
WESTPAC	Western Pacific

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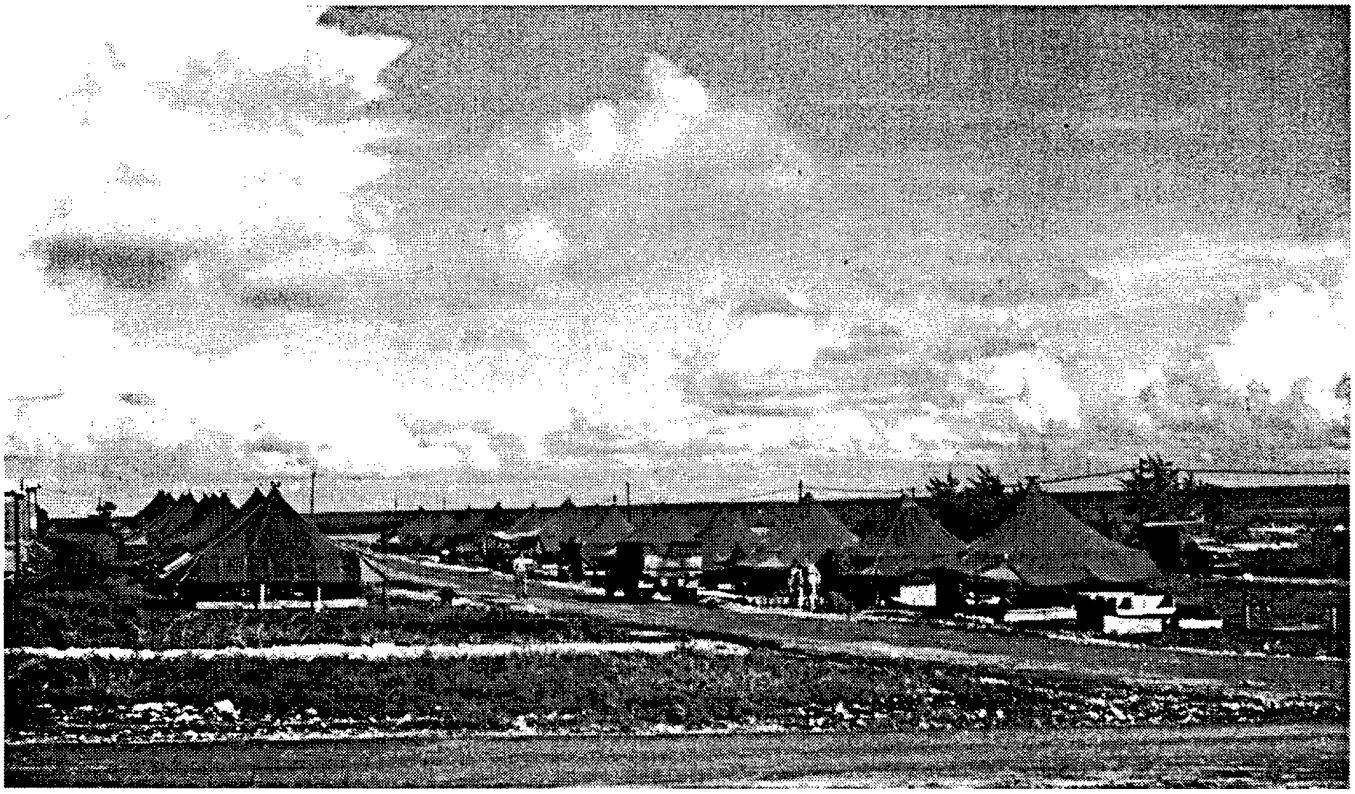
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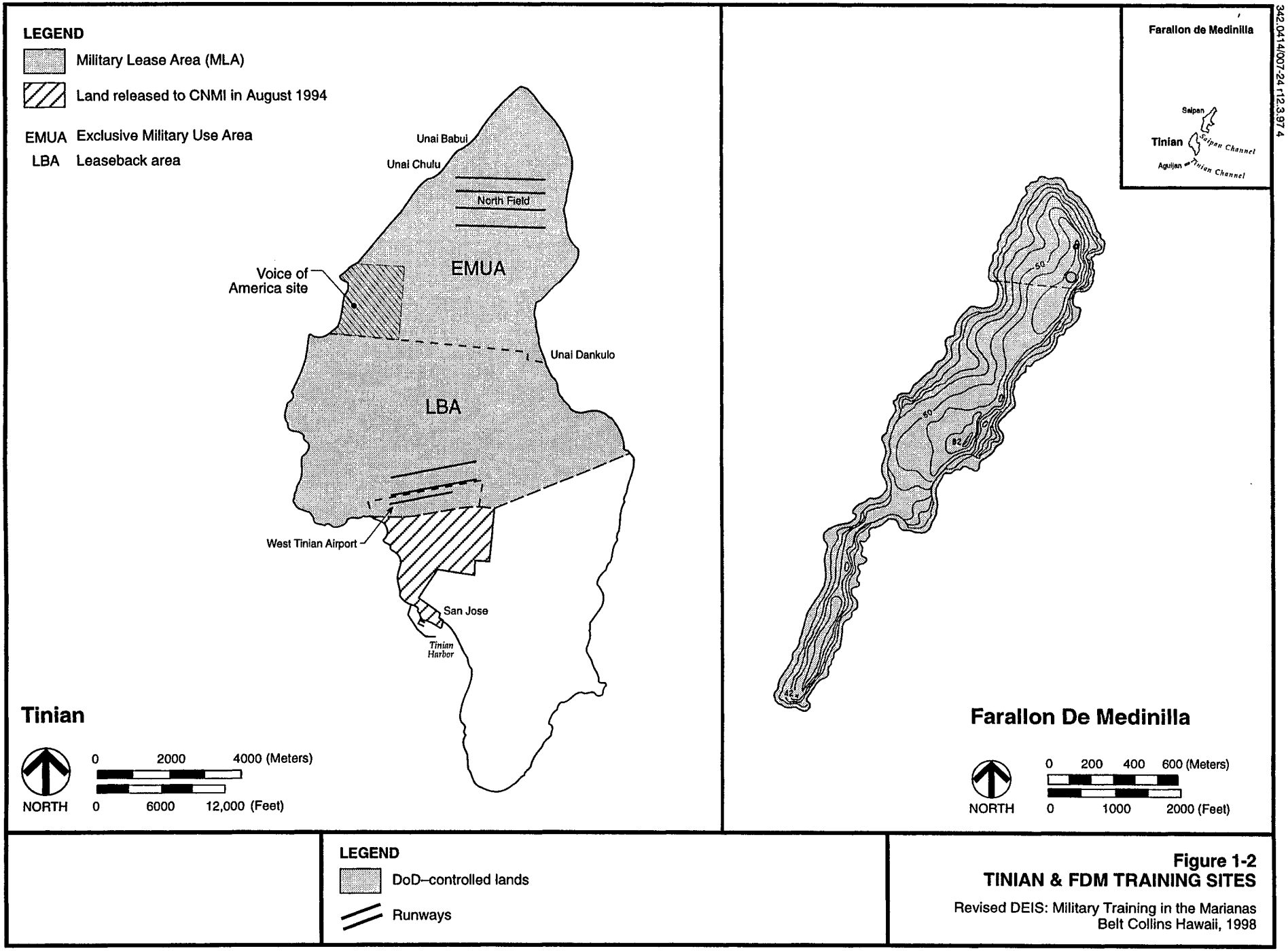
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Tent camp on Tinian (Smithsonian Institute, National Air and Space Museum)



Atomic bomb assembly building, Tinian (Smithsonian Institute, National Air and Space Museum)



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Figure 1-2
TINIAN & FDM TRAINING SITES

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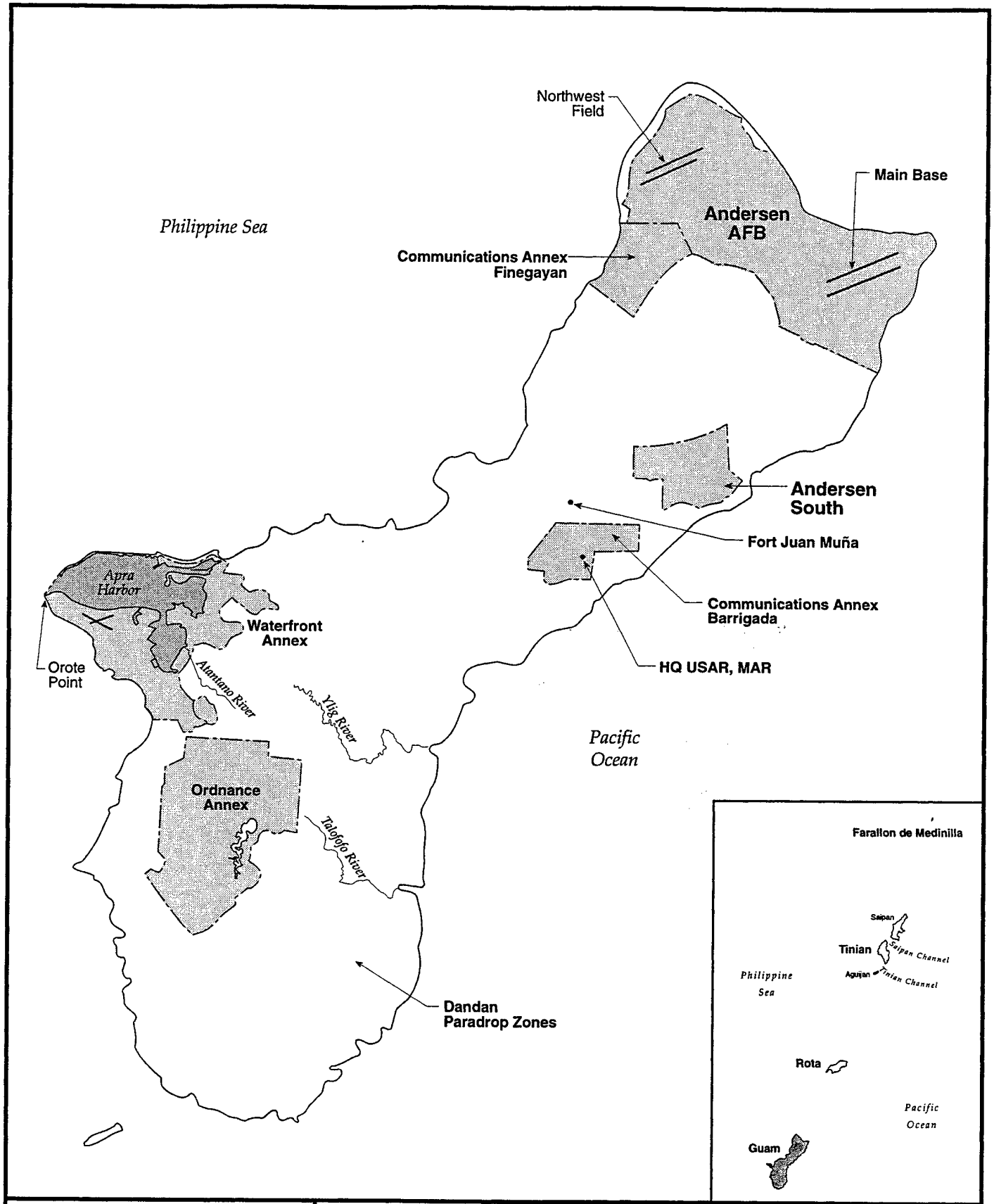
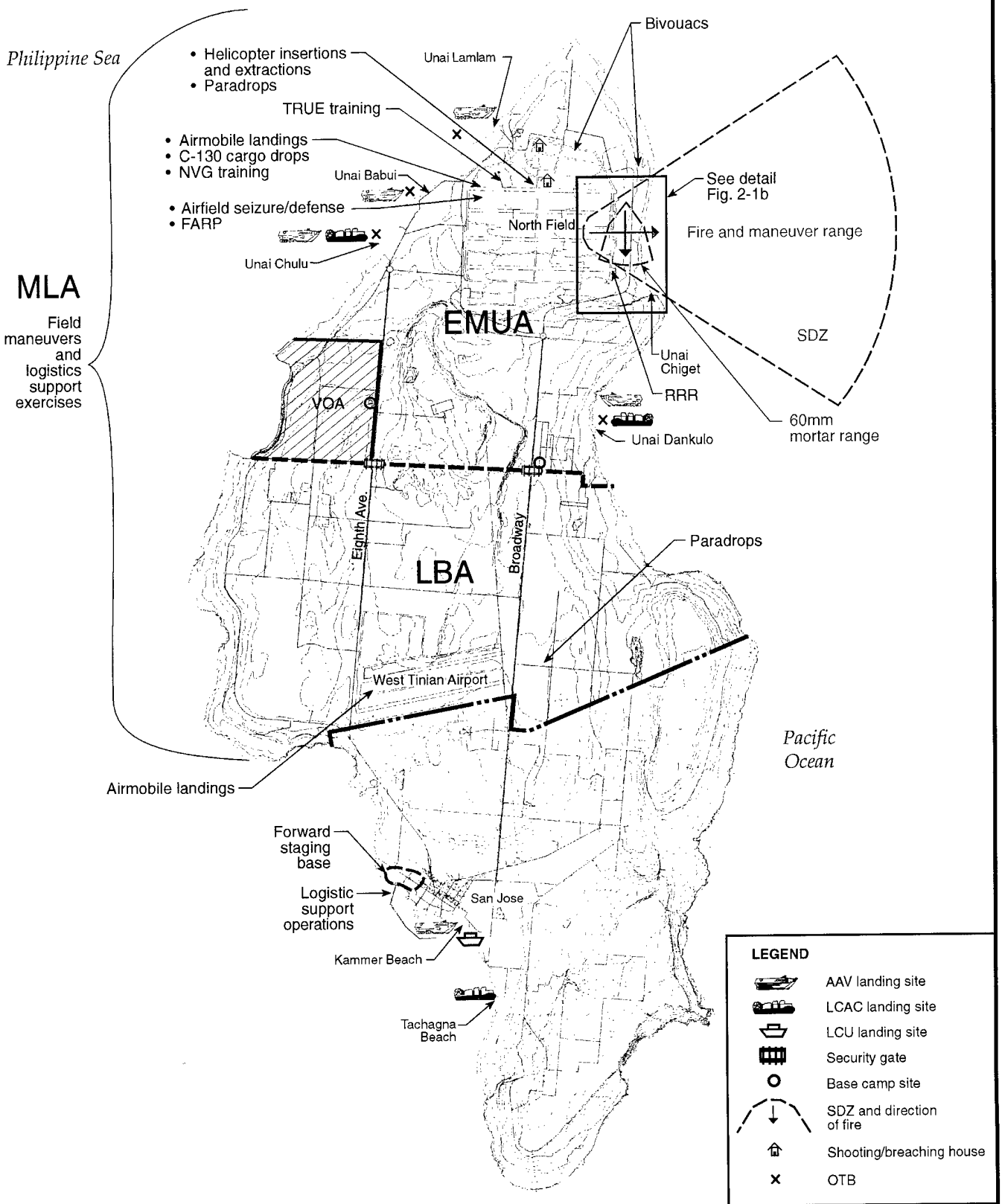


Figure 1-1
GUAM TRAINING SITES

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Belt Collins Hawaii, 1998



Source: Marianas Training Plan Briefing Booklet

NORTH

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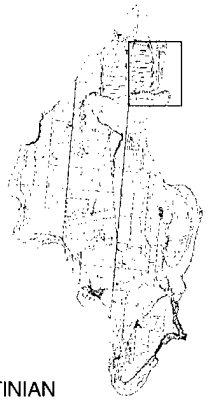
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ALTERNATIVES:
Black = No new action (continue)
Green = Preferred (new)
Red = Not-preferred (new)

See text for abbreviations

Figure 2-1a
TINIAN LAND USE

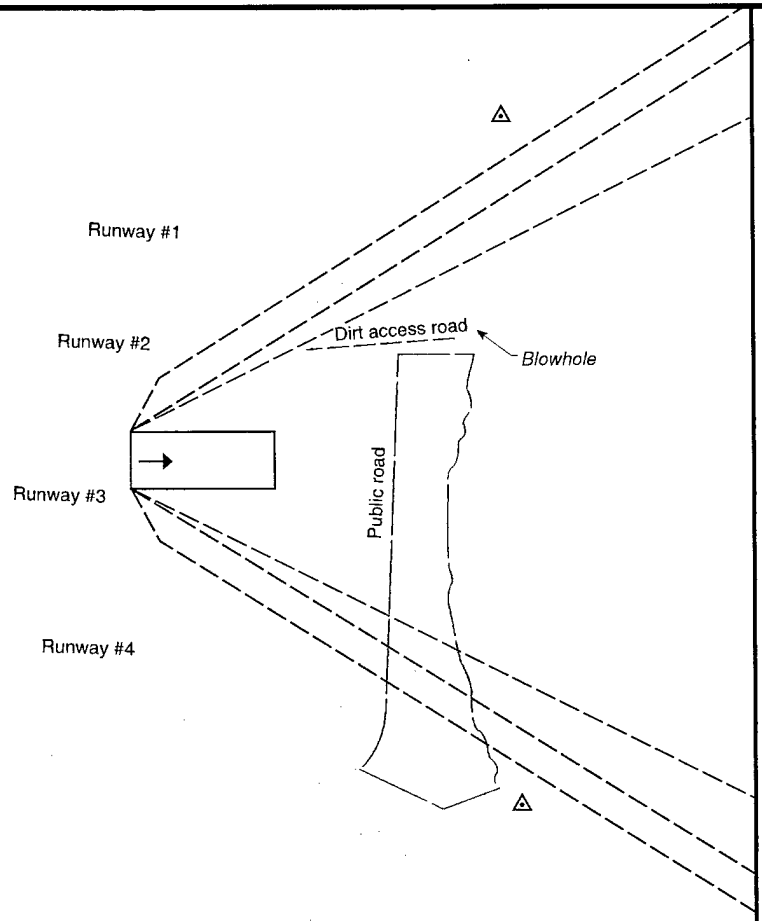
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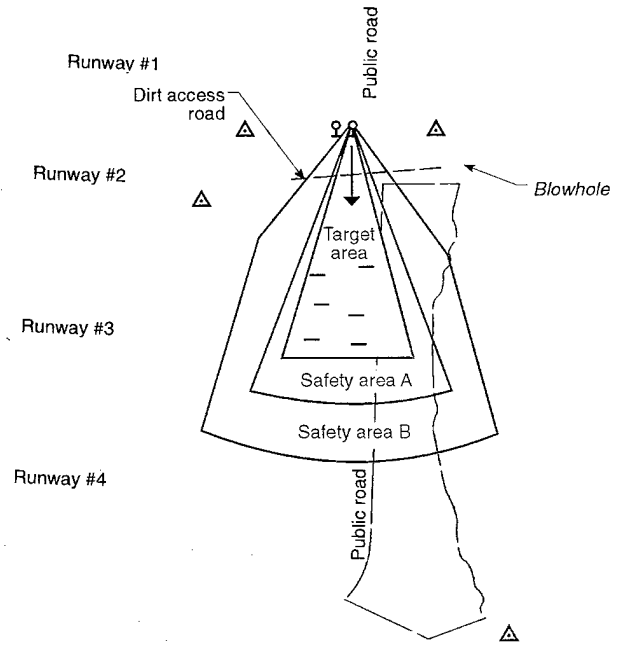
TINIAN

LEGEND

- Mortar firing position
- Observation post
- Possible target areas
- Existing UXO contamination
- Fire & maneuver area
- Mortar range impact area
- SDZ & direction of fire



SMALL ARMS RANGE



MORTAR RANGE

Sources: AR 385-63, MCO P3570.1A

NORTH

0 250 500 (Meters)

0 1000 2000 (Feet)

ALTERNATIVES:
Black = No new action (continue)
Green = Preferred (new)
Red = Not-preferred (new)

See text for abbreviations

Figure 2-1b
CONCEPTUAL PLANS FOR SMALL ARMS AND MORTAR RANGES ON TINIAN

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Belt Collins Hawaii, 1998

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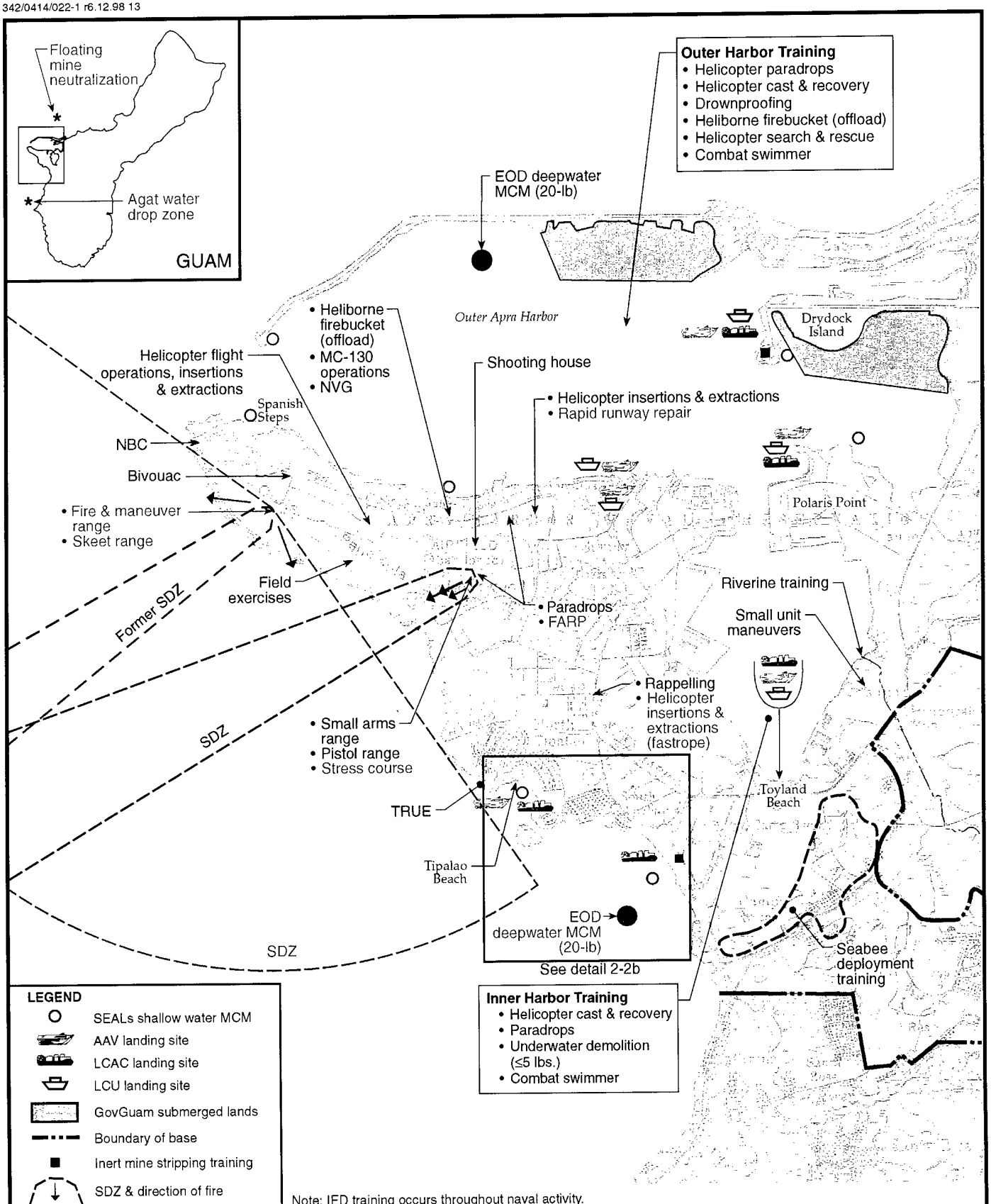


Figure 2-2a
WATERFRONT ANNEX LAND USE

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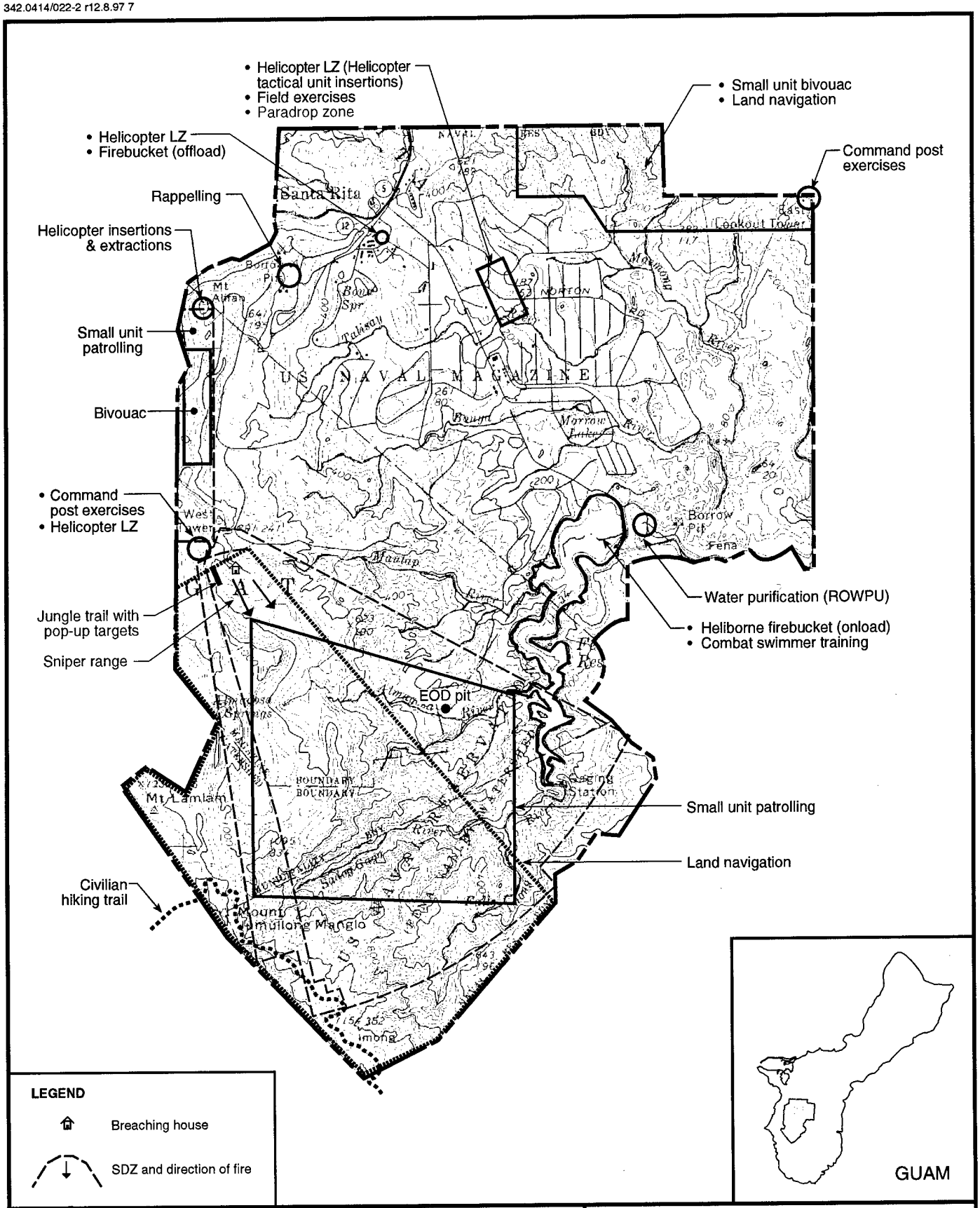


Figure 2-3
ORDNANCE ANNEX LAND USE

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Belt Collins Hawaii, 1998

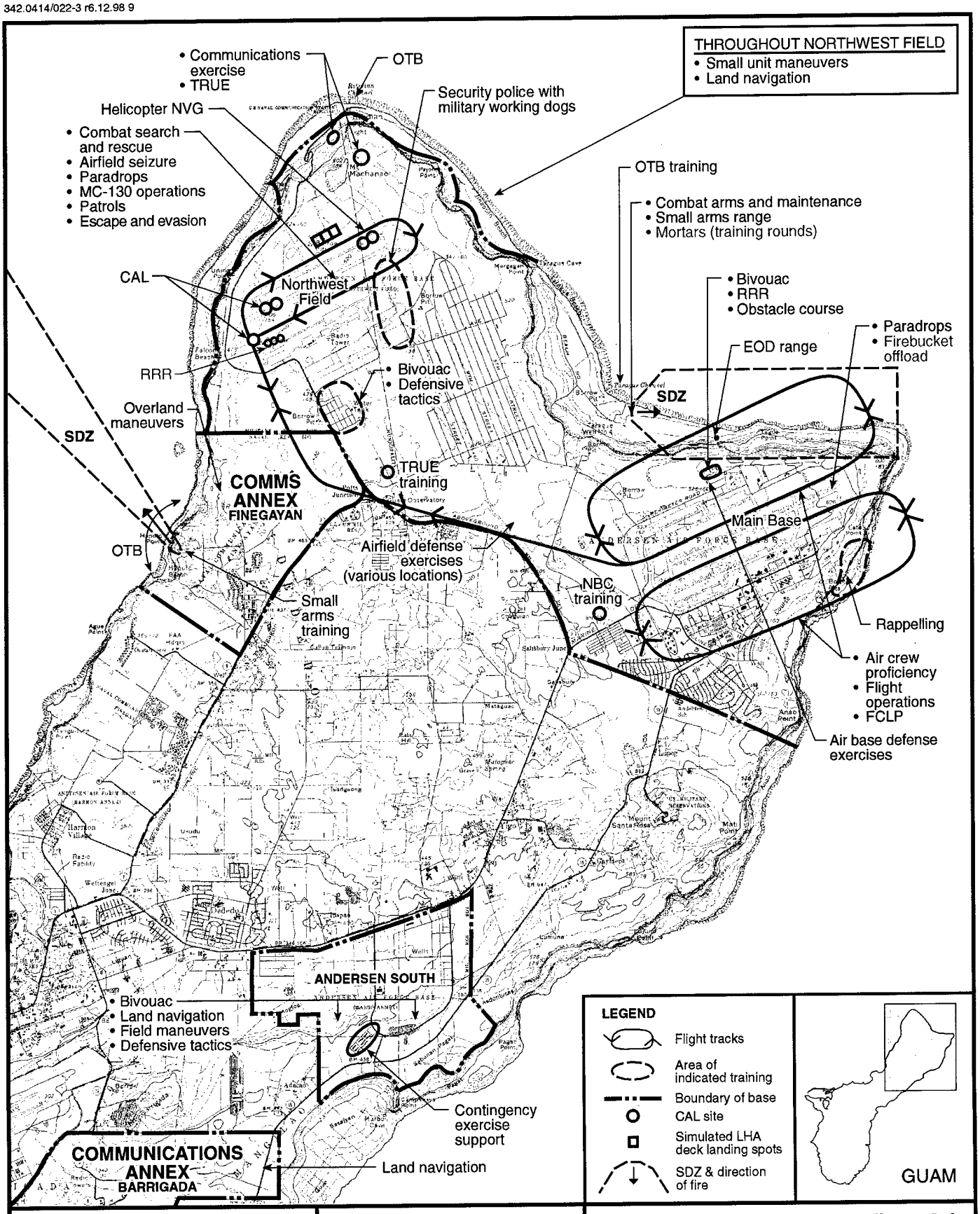
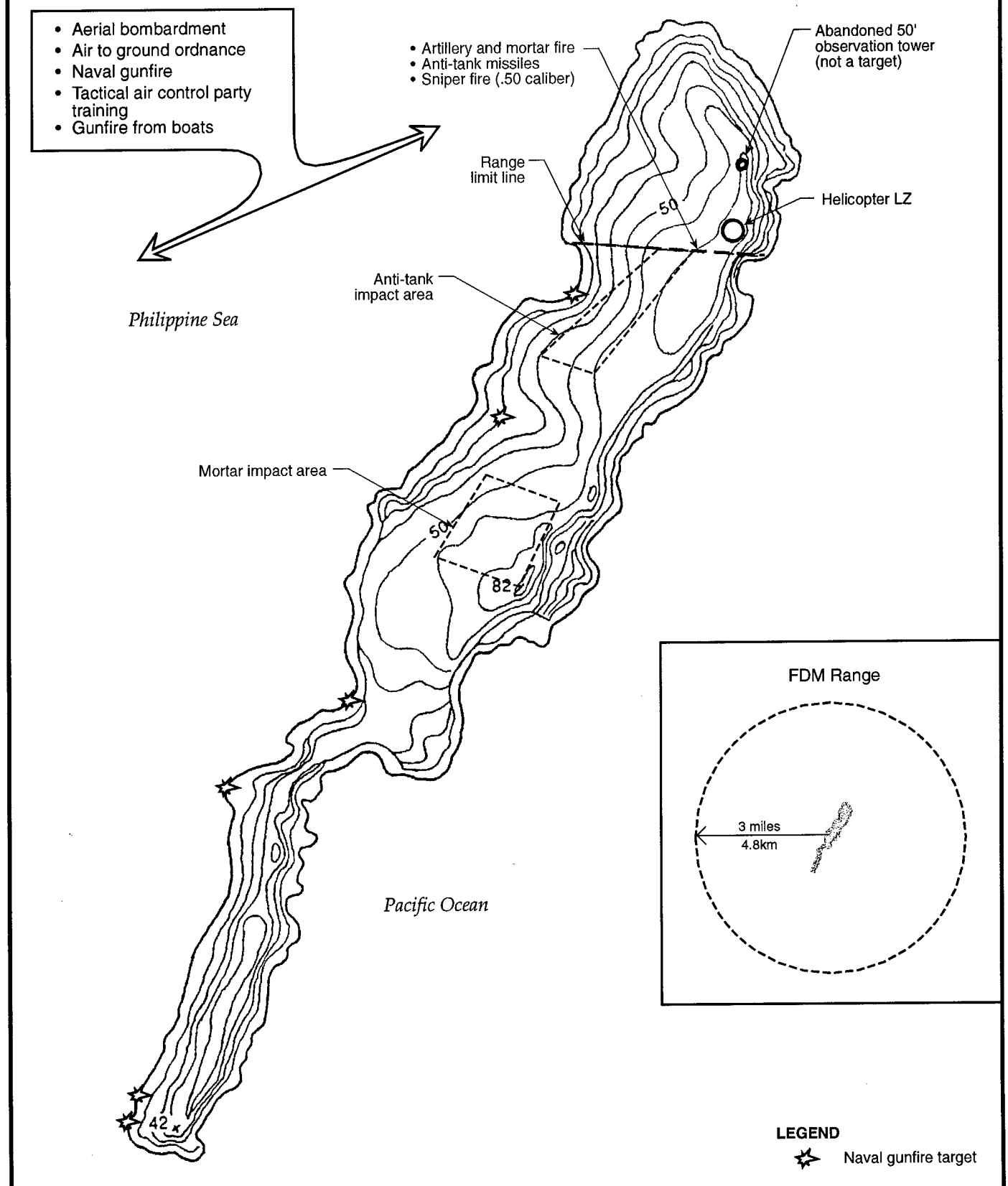


Figure 2-4
ANDERSEN AIR FORCE BASE AND COMMUNICATIONS ANNEX LAND USE
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: Marianas Training Plan Briefing Booklet

NORTH

0 100 200 300 (Meters)

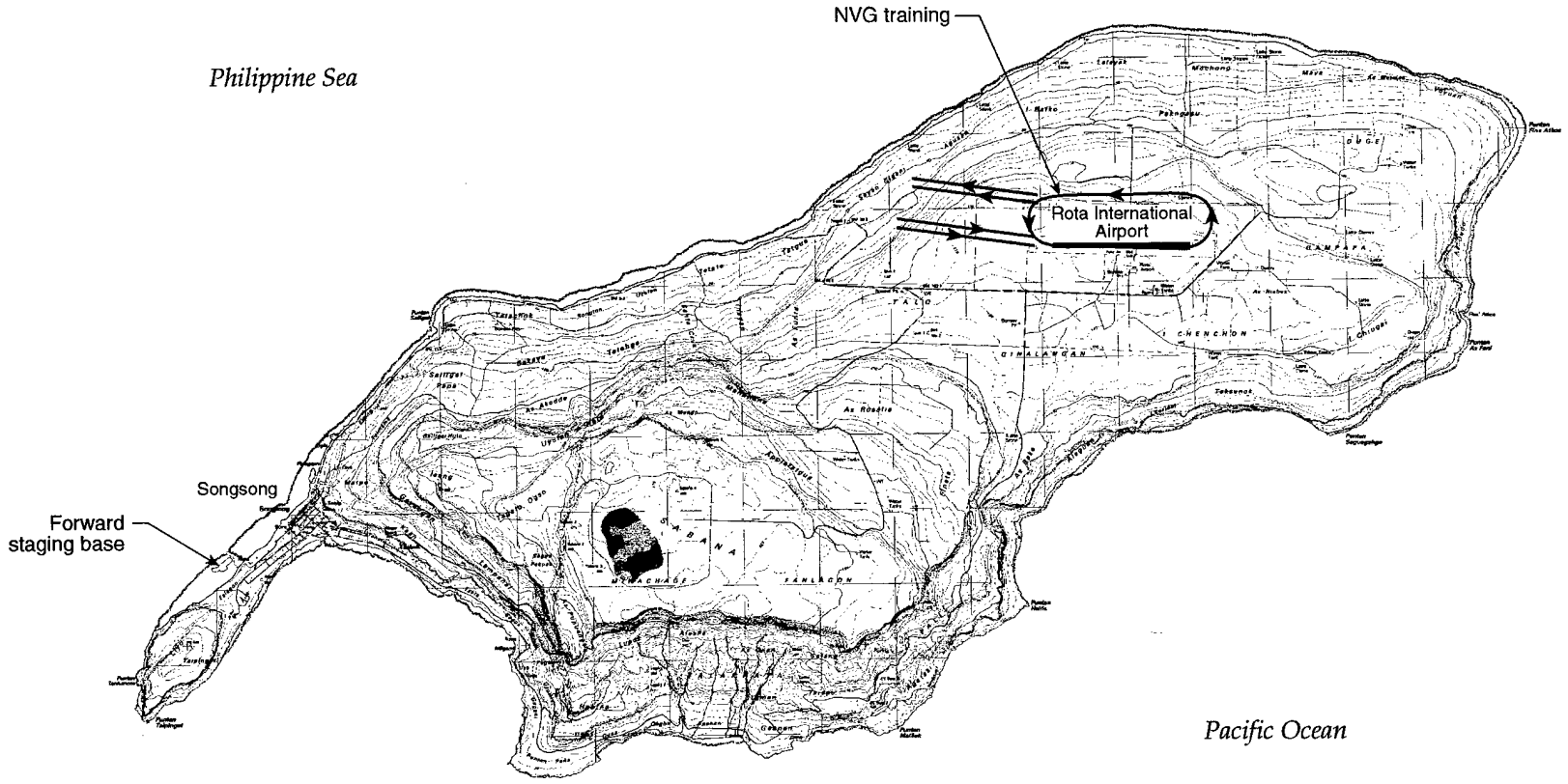
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ALTERNATIVES:
Black = No new action (continue)
Green = Preferred (new)
Red = Not-preferred (new)

Figure 2-5
FARALLON DE MEDINILLA LAND USE

Revised DEIS: Military Training in the Marianas
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Source: Marianas Training Plan Briefing Booklet

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

Commercial aircraft flight tracks

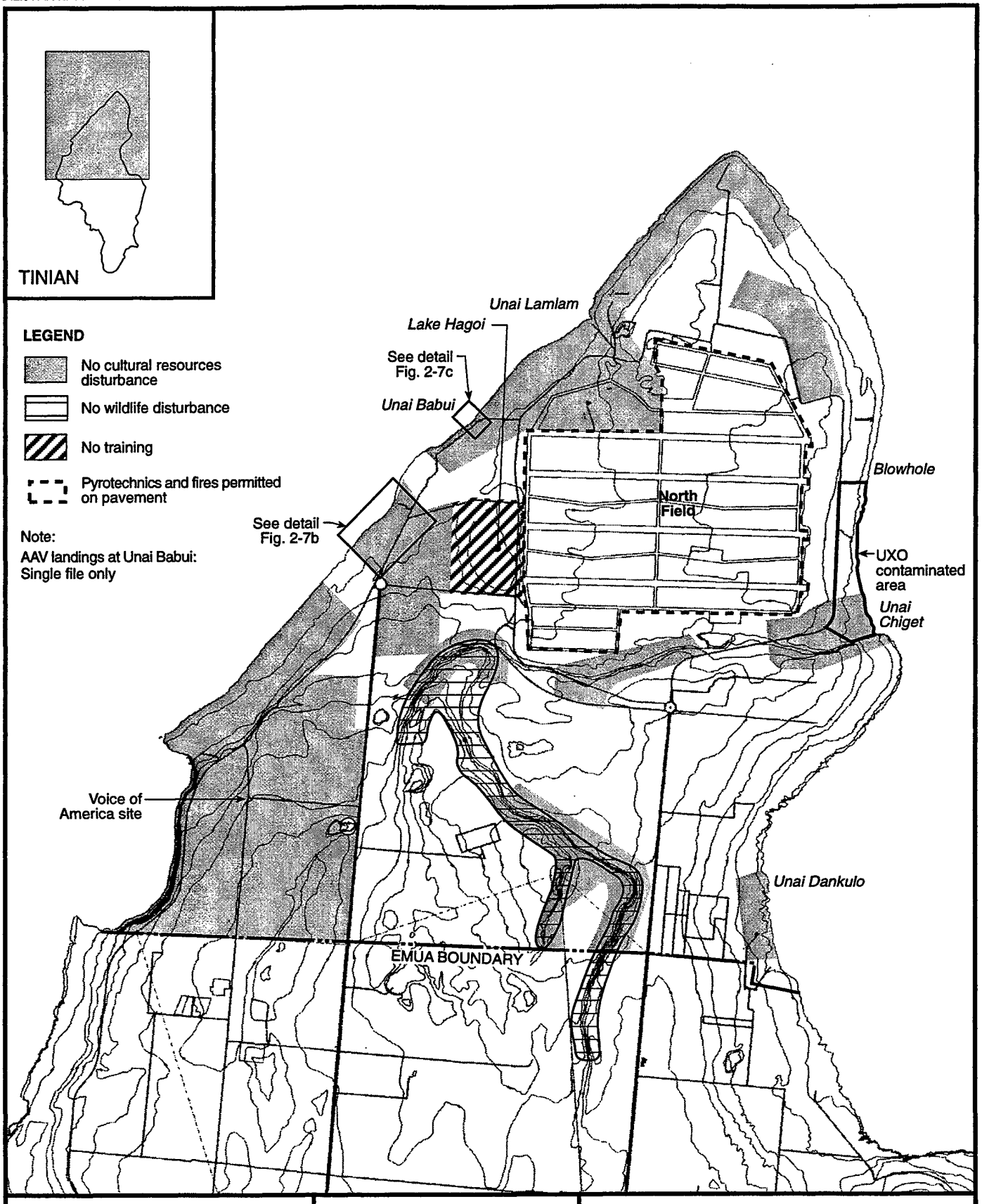
Training flight tracks

ALTERNATIVES:
Black = No new action (continue)
Green = Preferred (new)
Red = Not-preferred (new)

See text for abbreviations

Figure 2-6
ROTA LAND USE

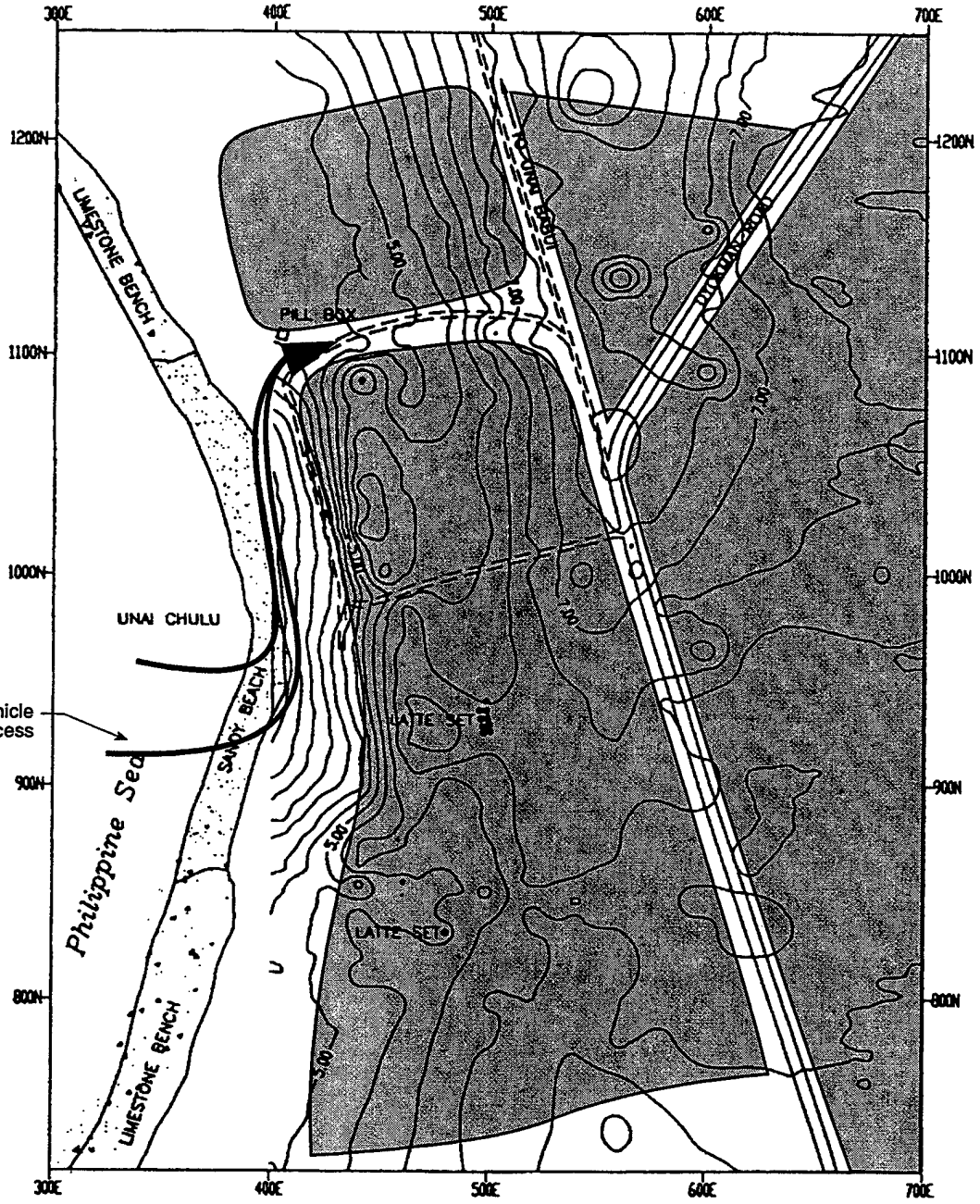
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Details found in Section 2.8

Figure 2-7a
TINIAN CONSTRAINED AREAS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: IARII (Sept. 1996) *Prefinal Military Excercises and Historic Sites in the Military Lease Area of the Island of Tinian, CNMI: An Archaeological Assessment*

Note: Contour lines at 0.5m intervals.

Details found in Section 2.8

NORTH

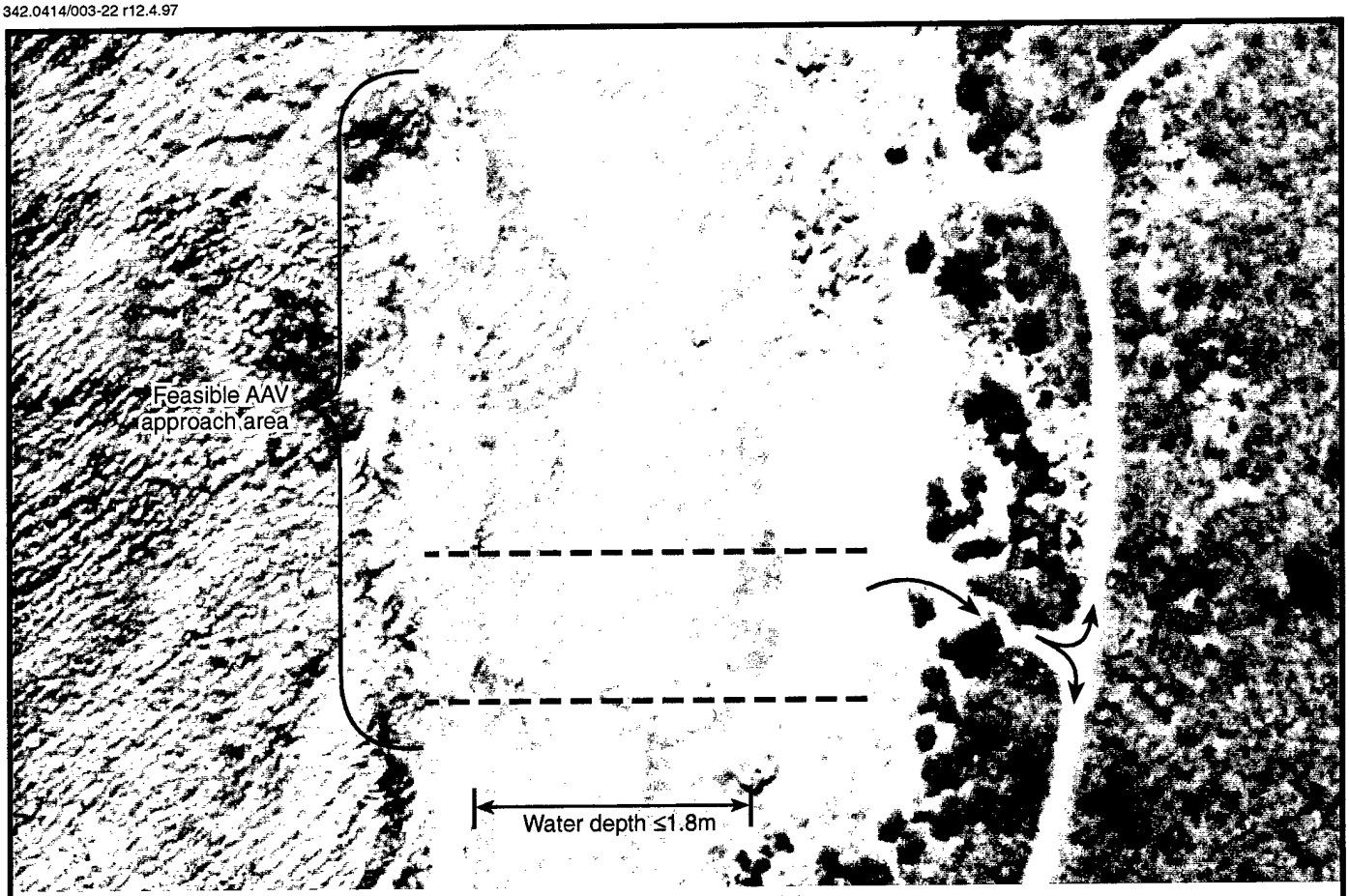
0 25 50 75 100 (m)

0 50 100 150 200 (ft)

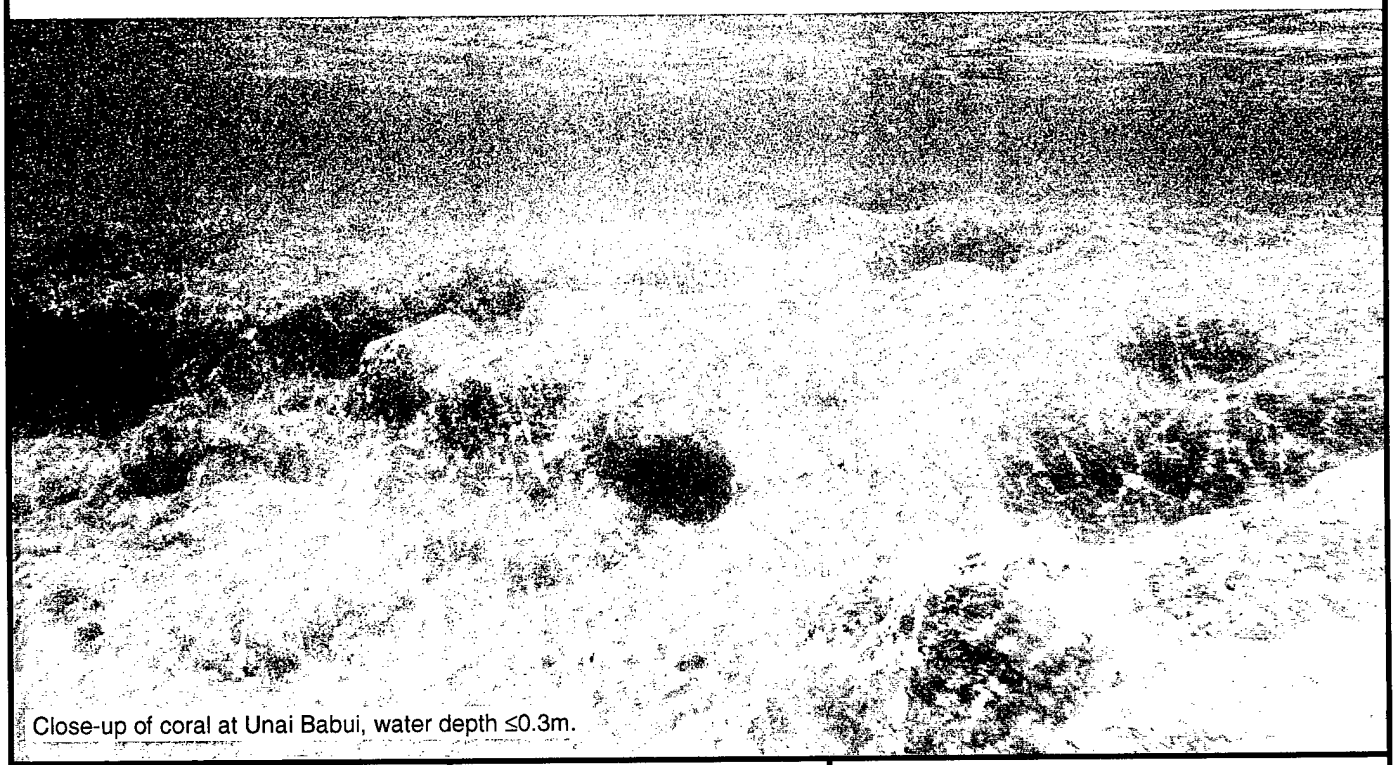
LEGEND

- Permissible vehicle traffic areas
- No cultural resources disturbance
- No training

Figure 2-7b
DETAILED CONSTRAINTS AT UNAI CHULU
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



AAV approach lane 22m wide, surveyed area designated between dashed lines.



Close-up of coral at Unai Babui, water depth ≤0.3m.

NORTH

0 10 20 (Meters)

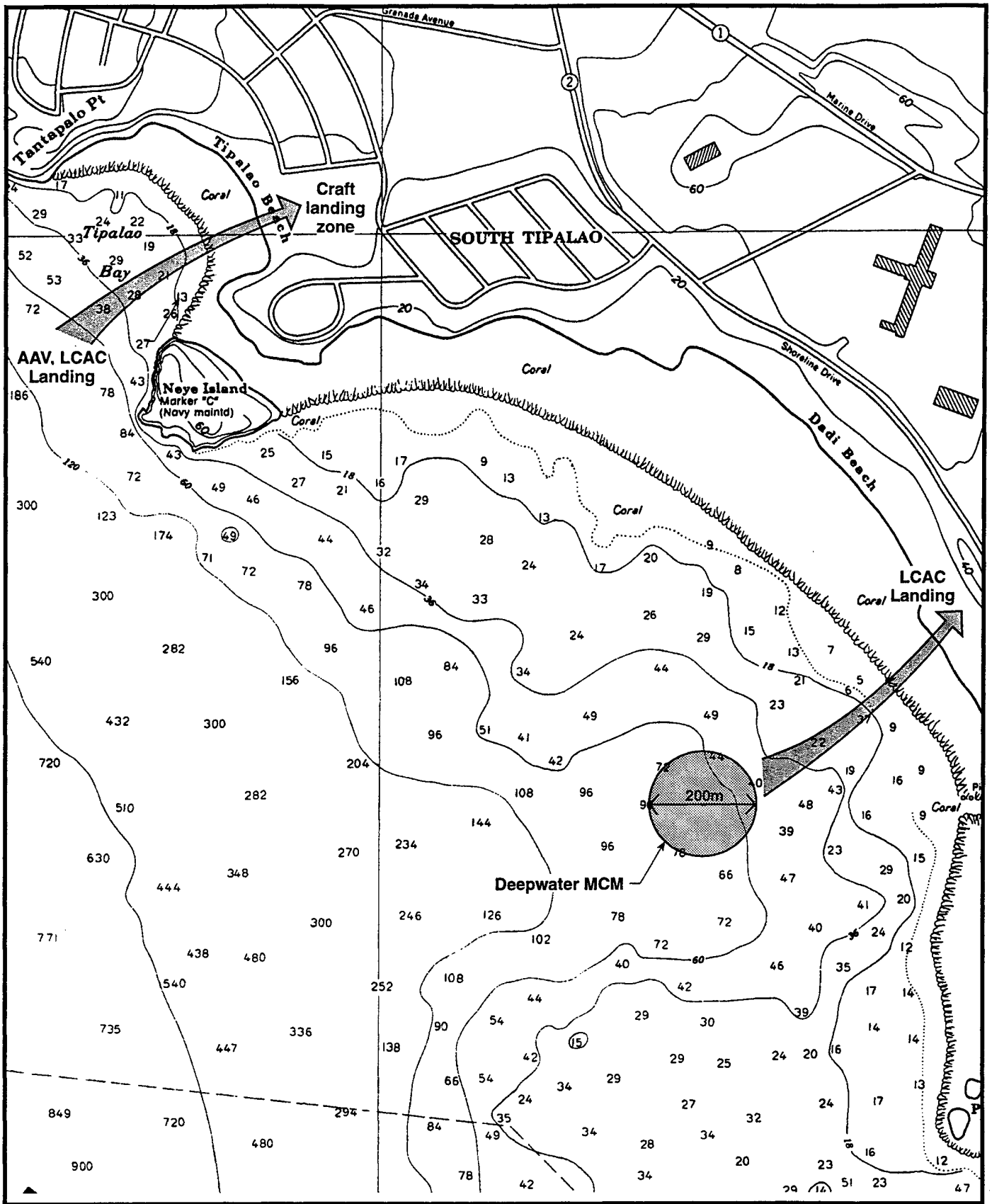
0 40 80 (Feet)

LEGEND

Recommended AAV approach lane

Direction of AAV travel

Figure 2-7c
APPROXIMATE AAV LANDING AREA, UNAI BABUI
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



NORTH

0 100 200 (Meters)

0 400 800 (Feet)

Source: NOAA Nautical Chart Catalogue No. 2, Panel B, Apra Harbor, Island of Guam

Depth in feet MLLW

Figure 2-2b
DADI BEACH DETAILS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

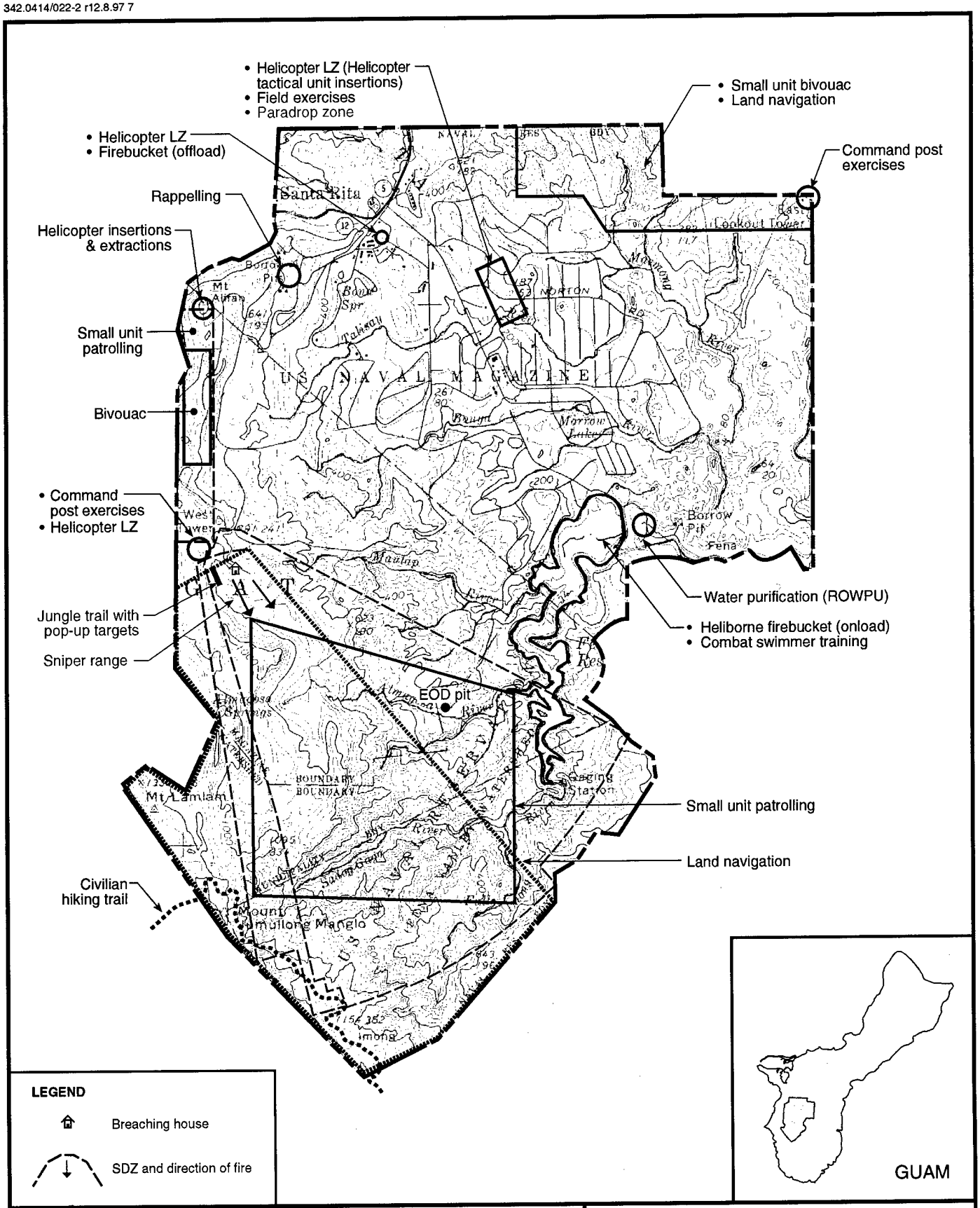


Figure 2-3
ORDNANCE ANNEX LAND USE

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

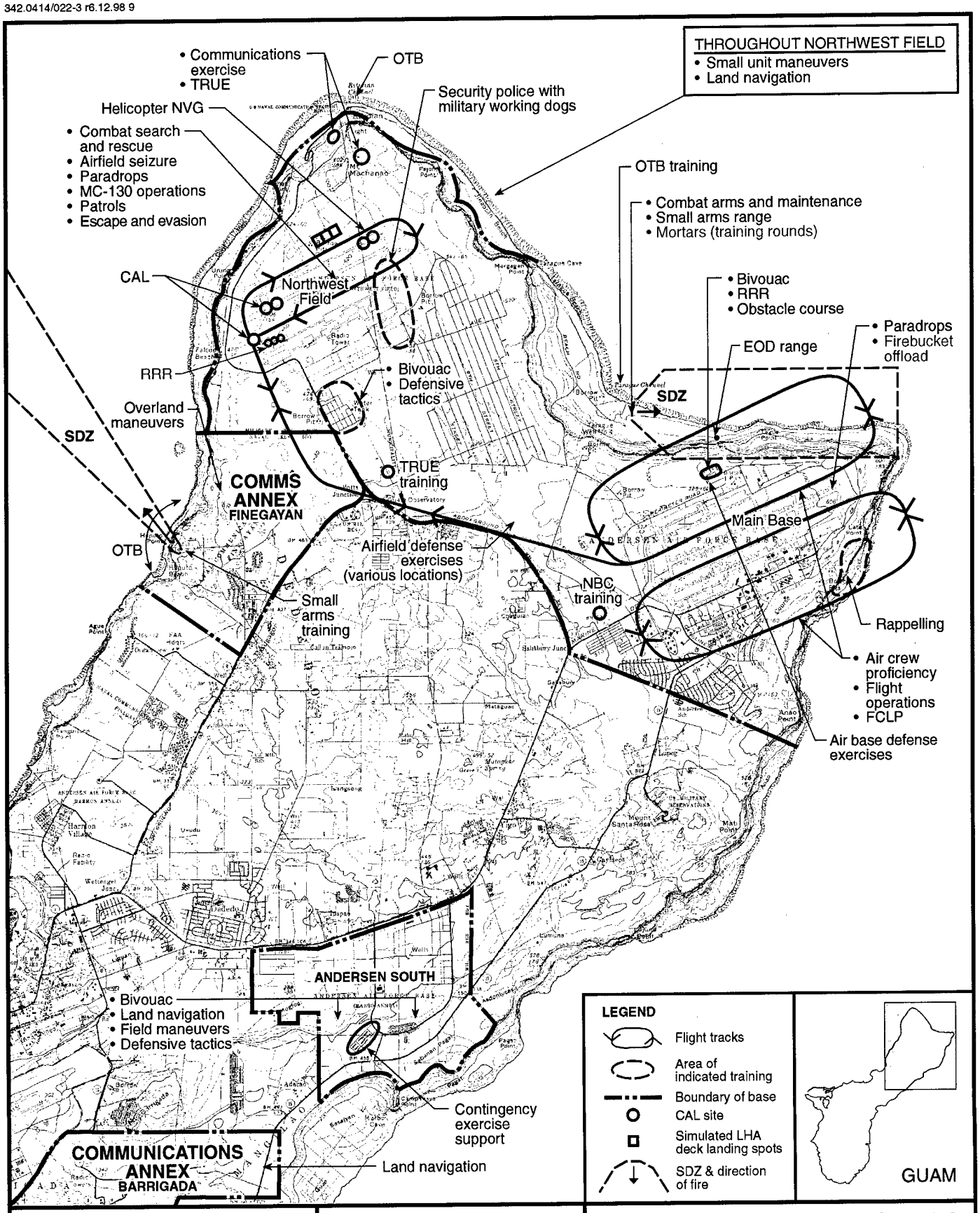
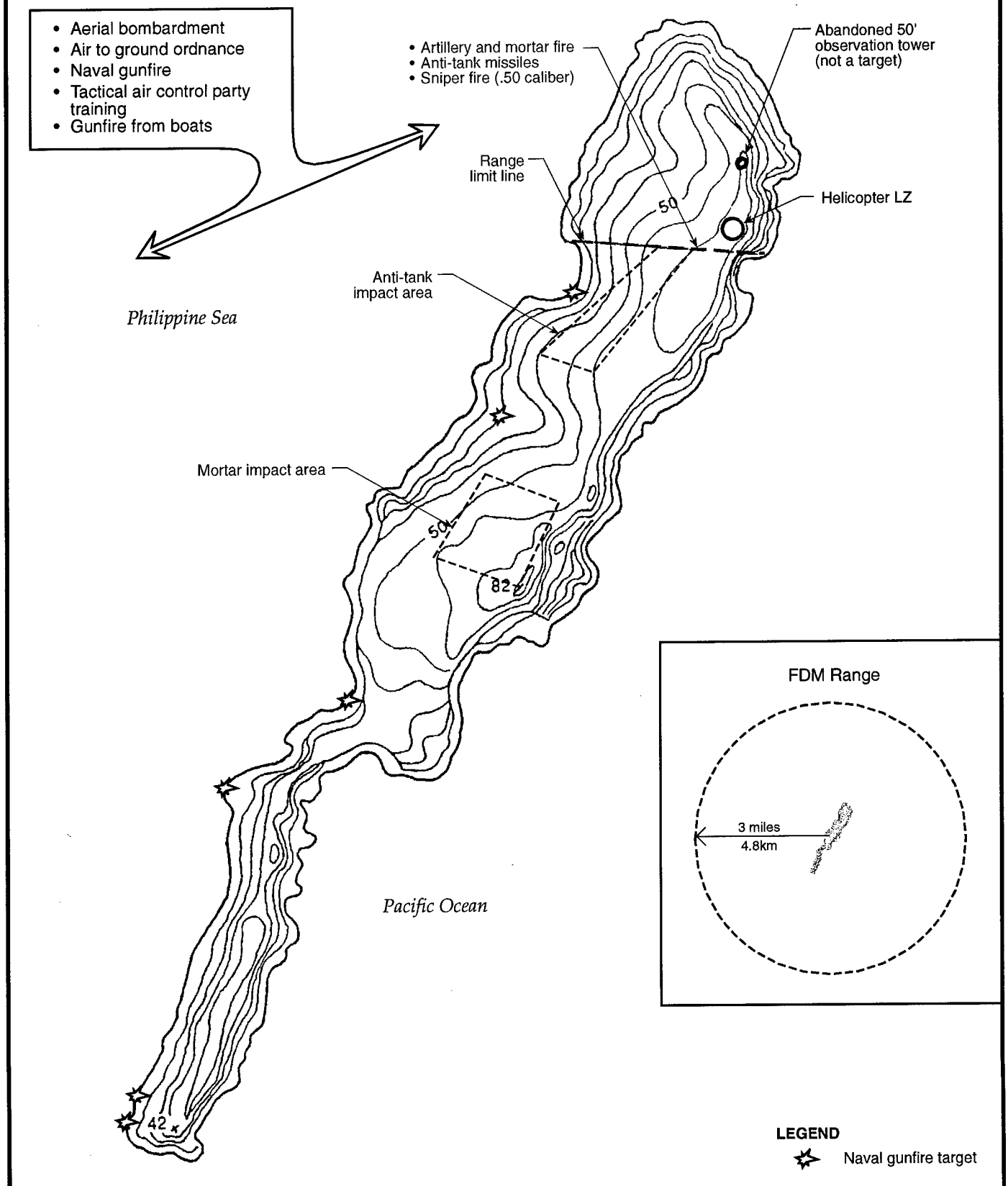


Figure 2-4
ANDERSEN AIR FORCE BASE AND COMMUNICATIONS ANNEX LAND USE
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: Marianas Training Plan Briefing Booklet

NORTH

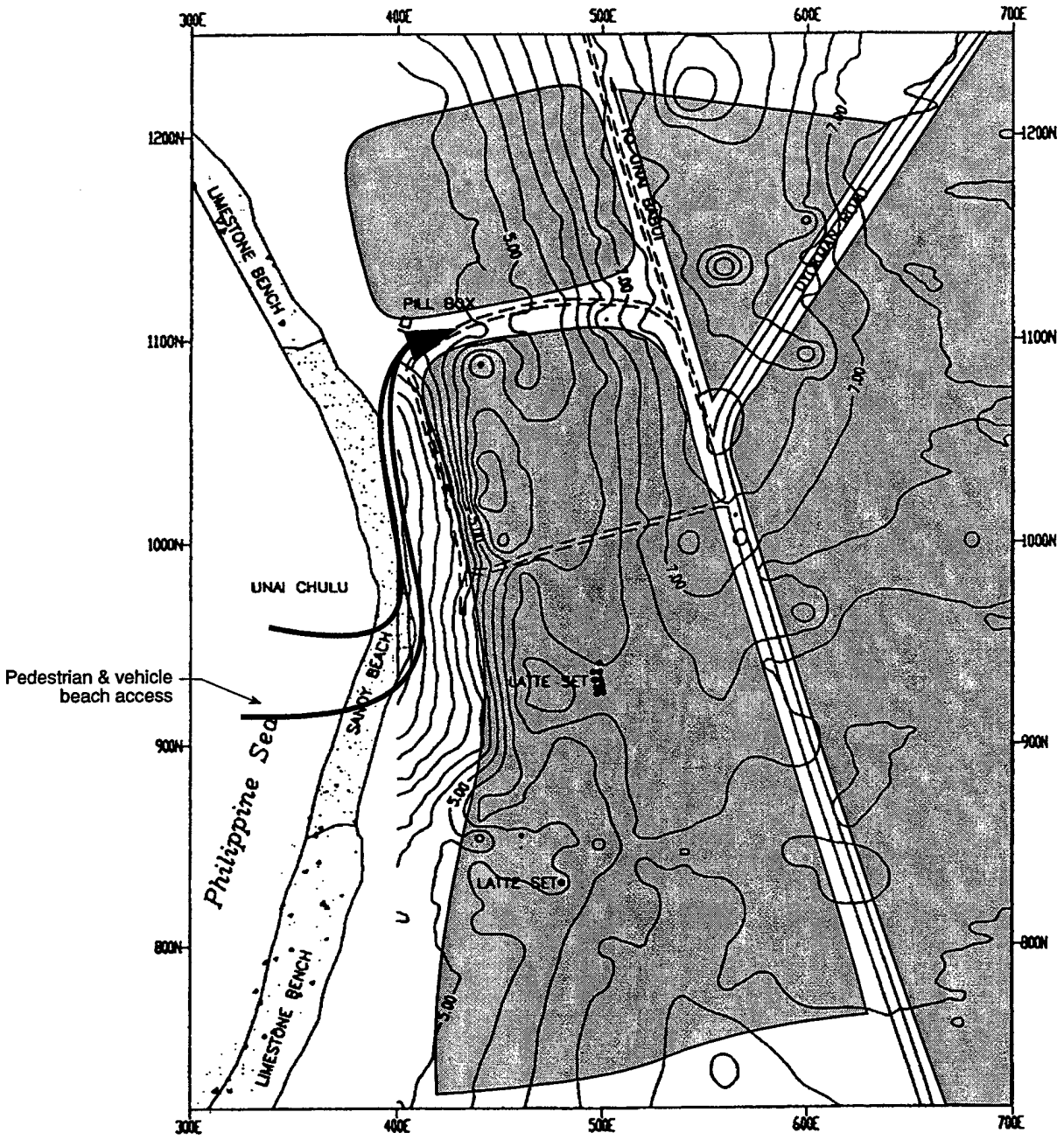
0 100 200 300 (Meters)

0 500 1000 (Feet)

ALTERNATIVES:
Black = No new action (continue)
Green = Preferred (new)
Red = Not-preferred (new)

Figure 2-5
FARALLON DE MEDINILLA LAND USE

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: IARII (Sept. 1996) *Prefinal Military Excercises and Historic Sites in the Military Lease Area of the Island of Tinian, CNMI: An Archaeological Assessment*

Note: Contour lines at 0.5m intervals.

Details found in Section 2.8

NORTH

0 25 50 75 100 (m)

0 50 100 150 200 (ft)

LEGEND

- Permissible vehicle traffic areas
- No cultural resources disturbance
- No training

Figure 2-7b
DETAILED CONSTRAINTS AT UNAI CHULU
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

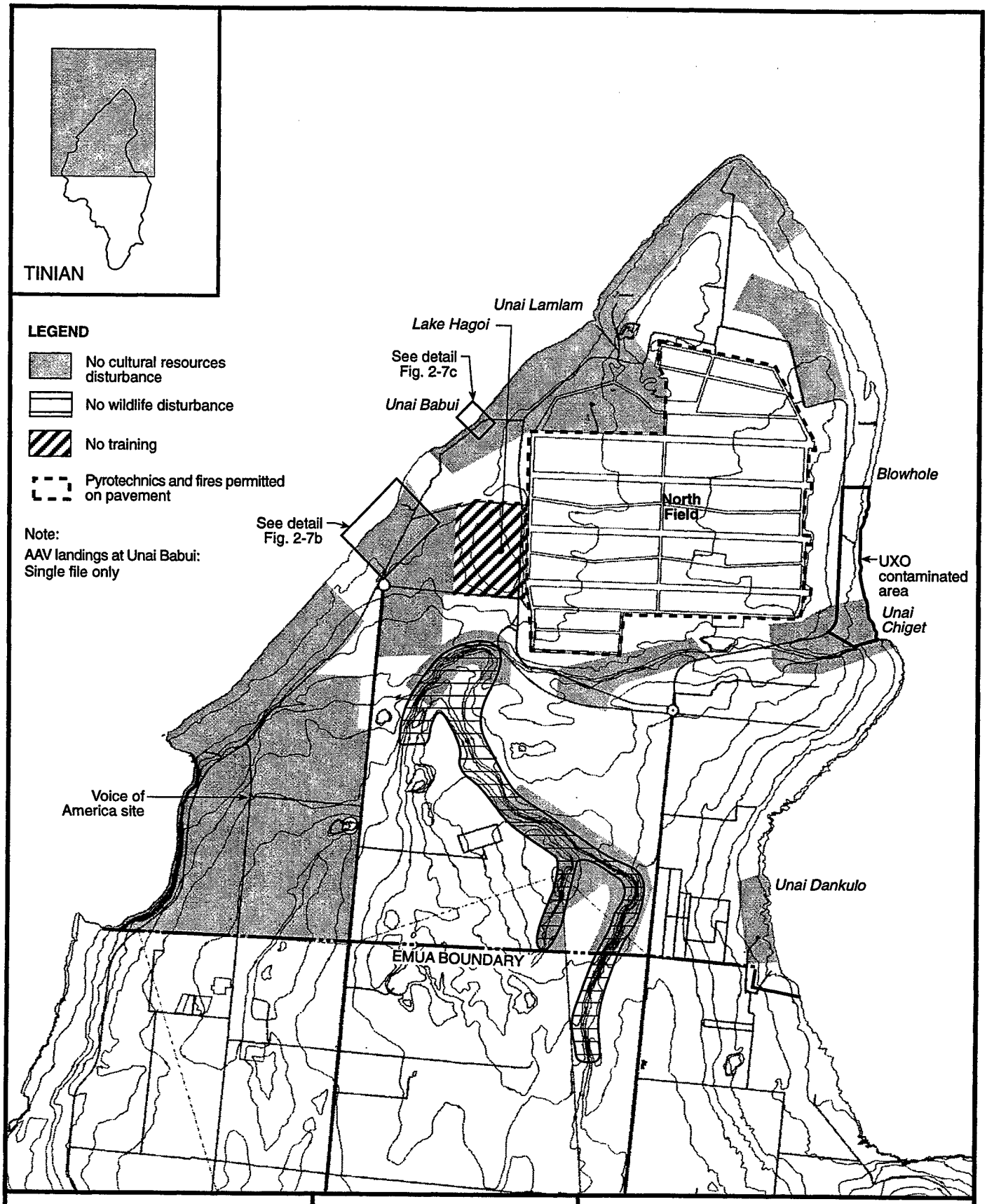
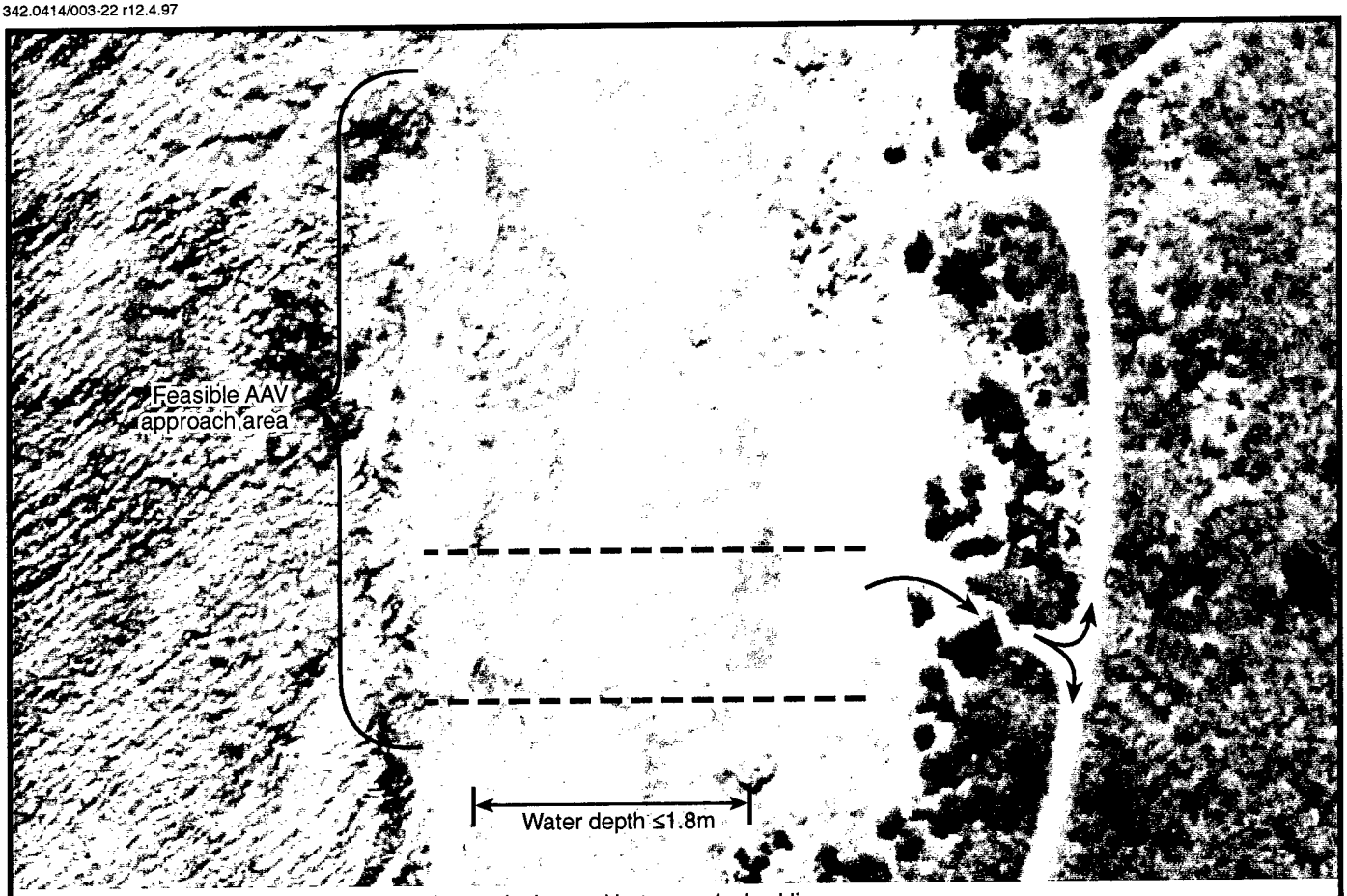
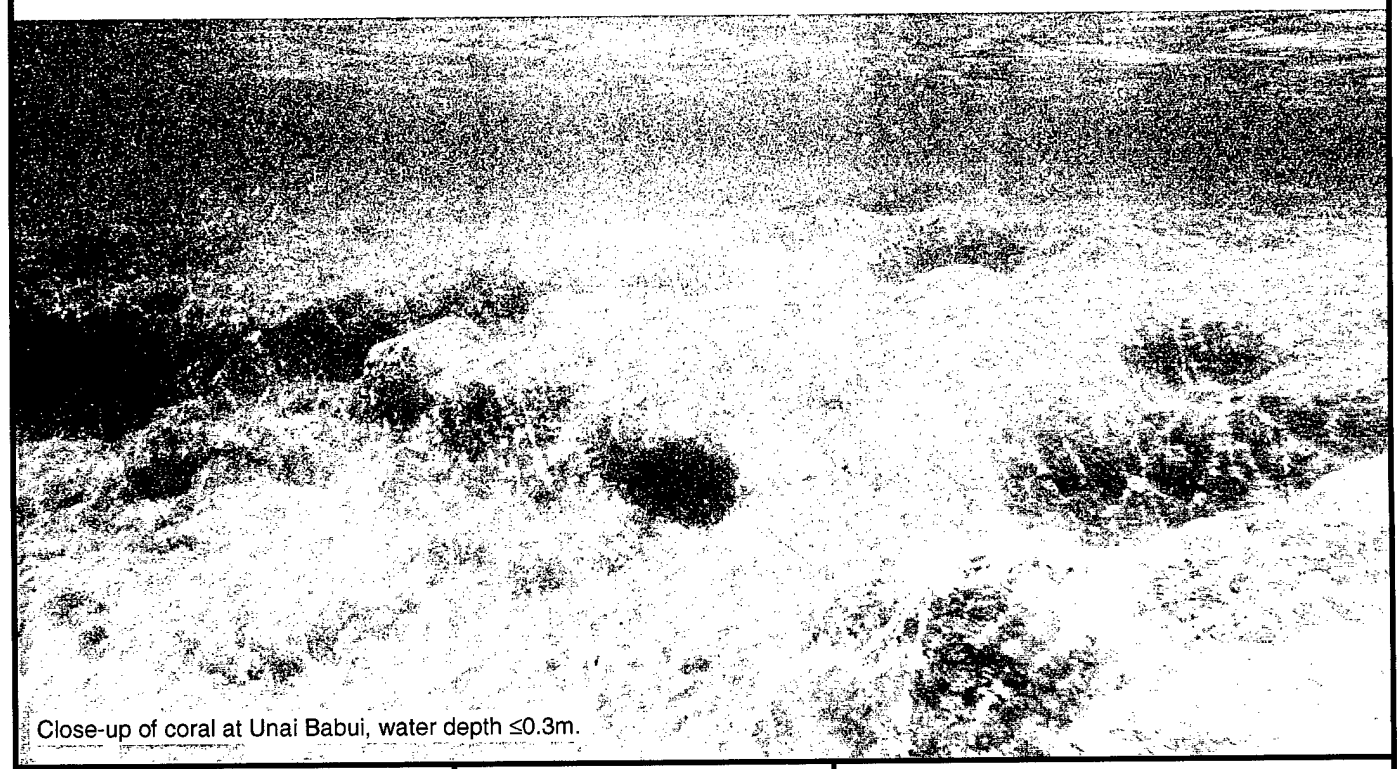


Figure 2-7a
TINIAN CONSTRAINED AREAS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



AAV approach lane 22m wide, surveyed area designated between dashed lines.



Close-up of coral at Unai Babui, water depth ≤0.3m.



LEGEND

- Recommended AAV approach lane
- Direction of AAV travel

Figure 2-7c
APPROXIMATE AAV LANDING AREA, UNAI BABUI
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

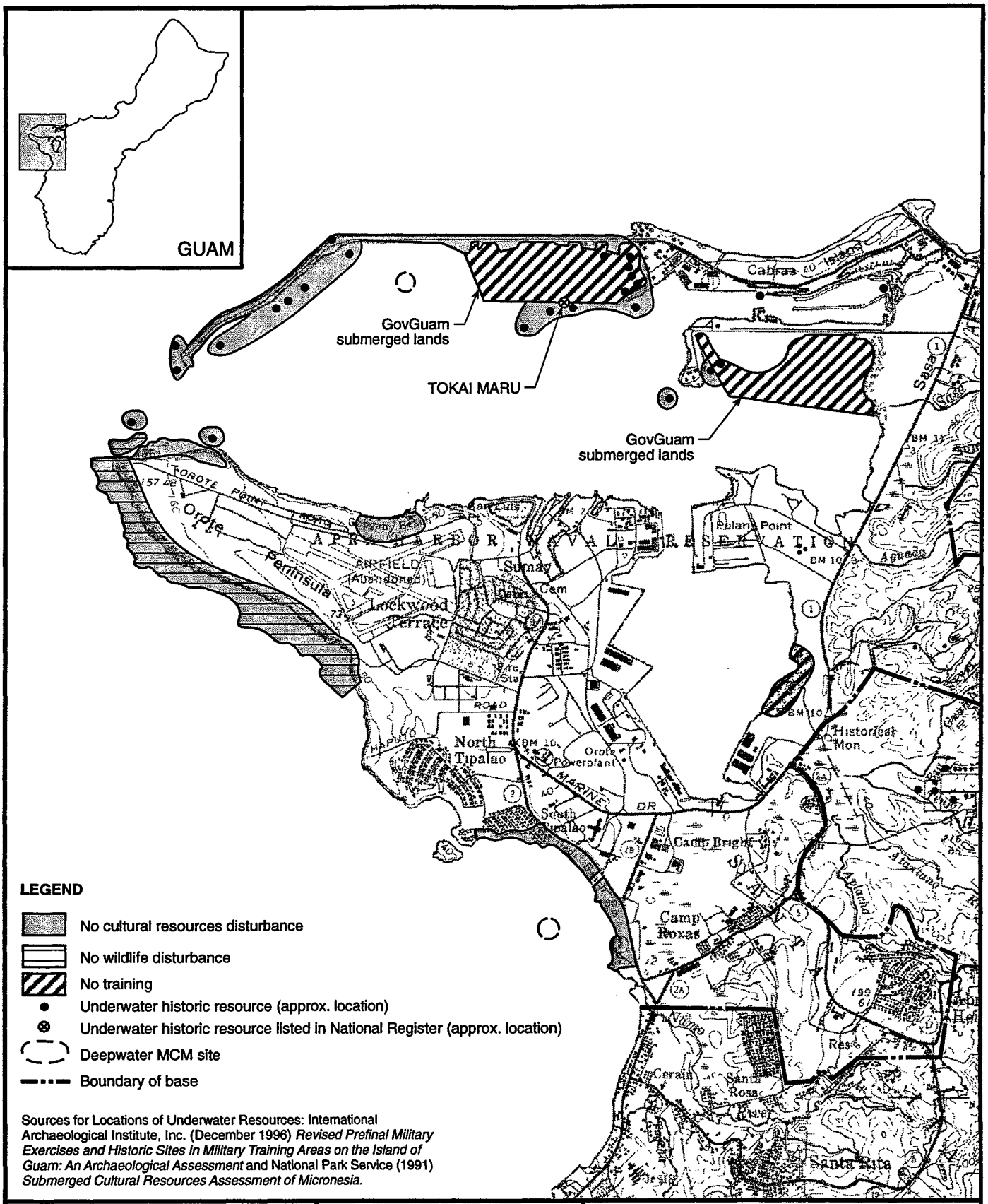
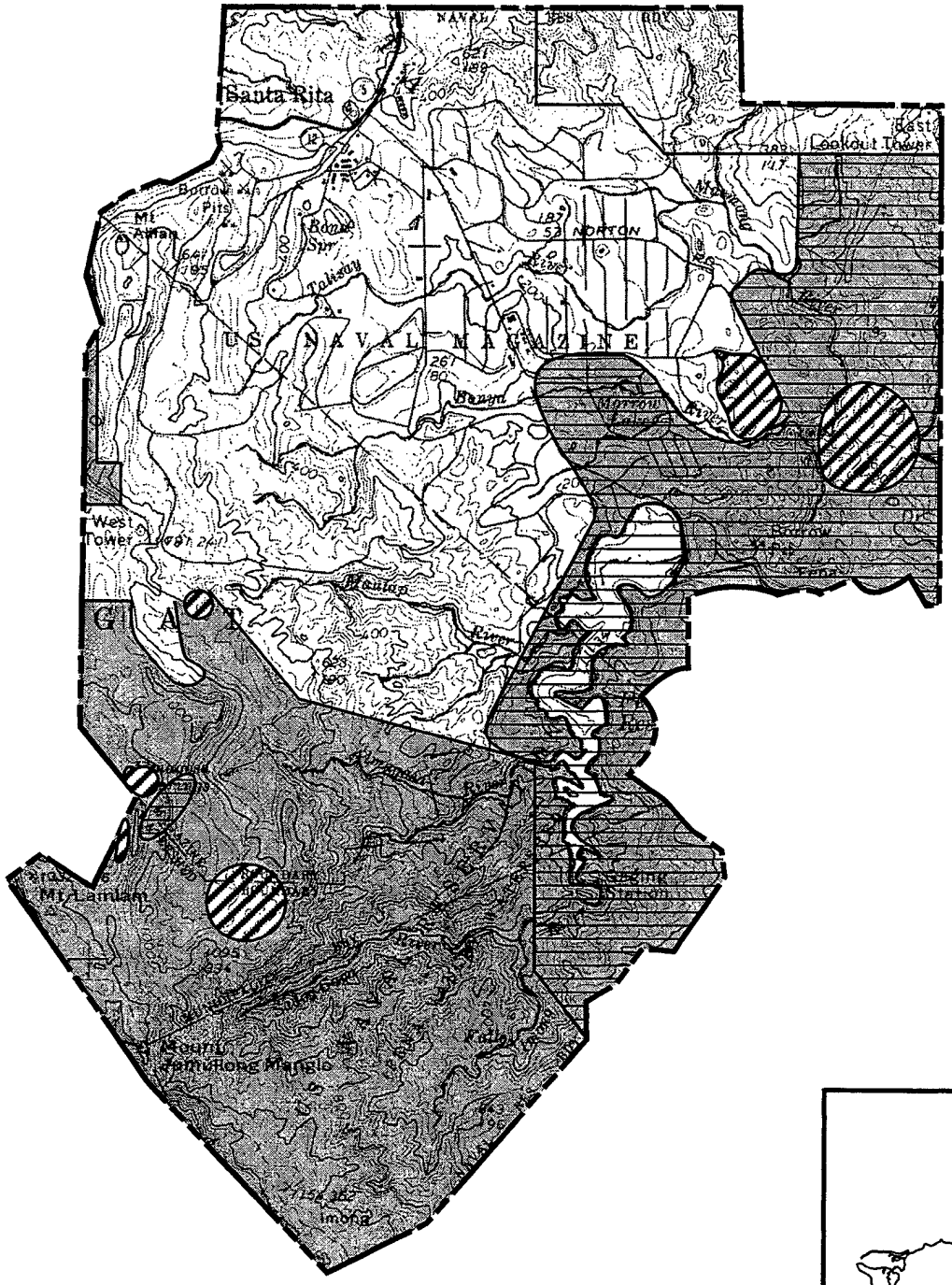


Figure 2-8
WATERFRONT ANNEX CONSTRAINED AREAS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



No new bivouac sites to be used without approval of COMNAVMARIANAS Cultural Resources Manager.

Details found in Section 2.8

NORTH

0 500 1000 (Meters)

0 2000 4000 (Feet)

LEGEND

- No cultural resources disturbance
- No wildlife disturbance
- No training

Figure 2-9
ORDNANCE ANNEX CONSTRAINEDAREAS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

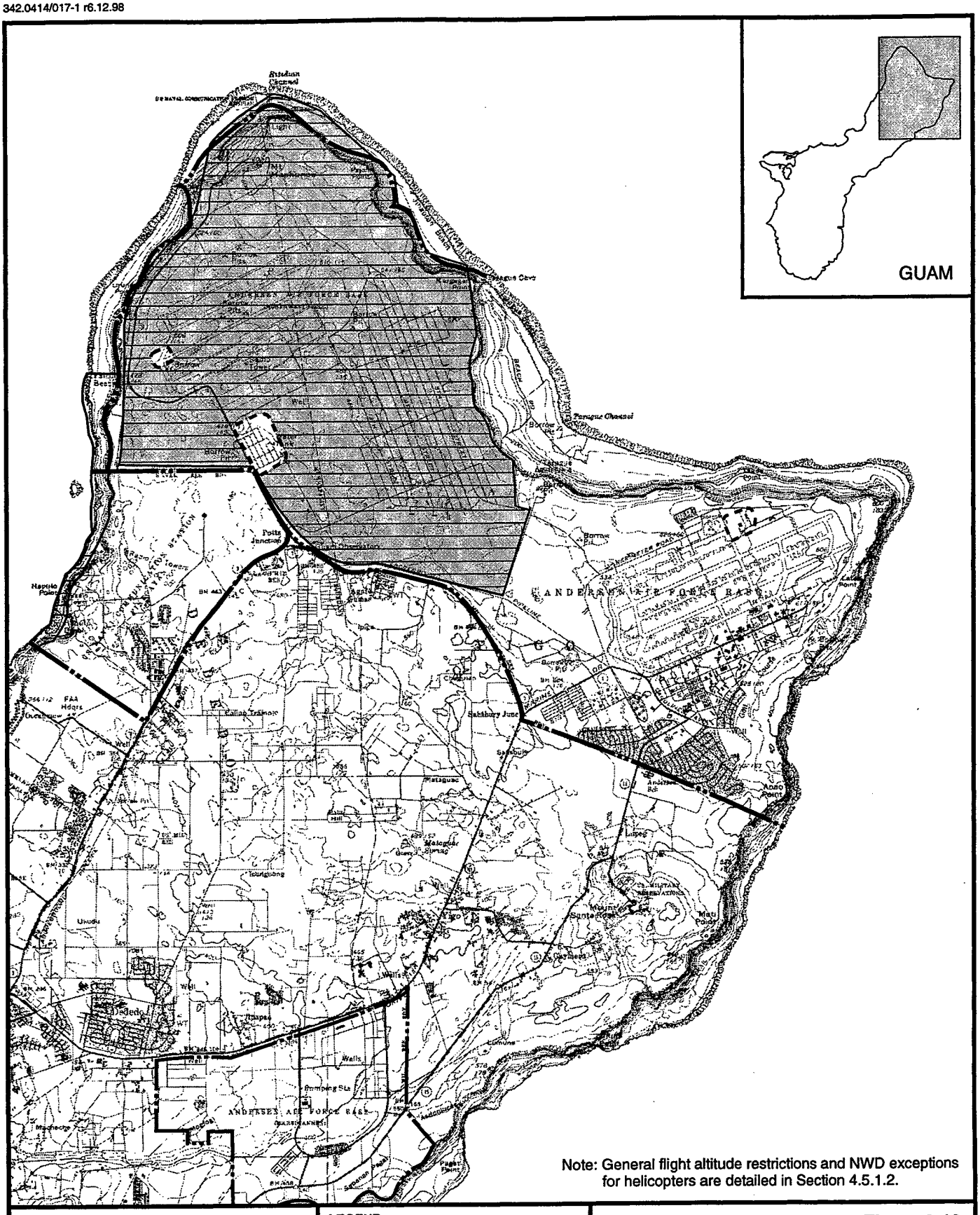
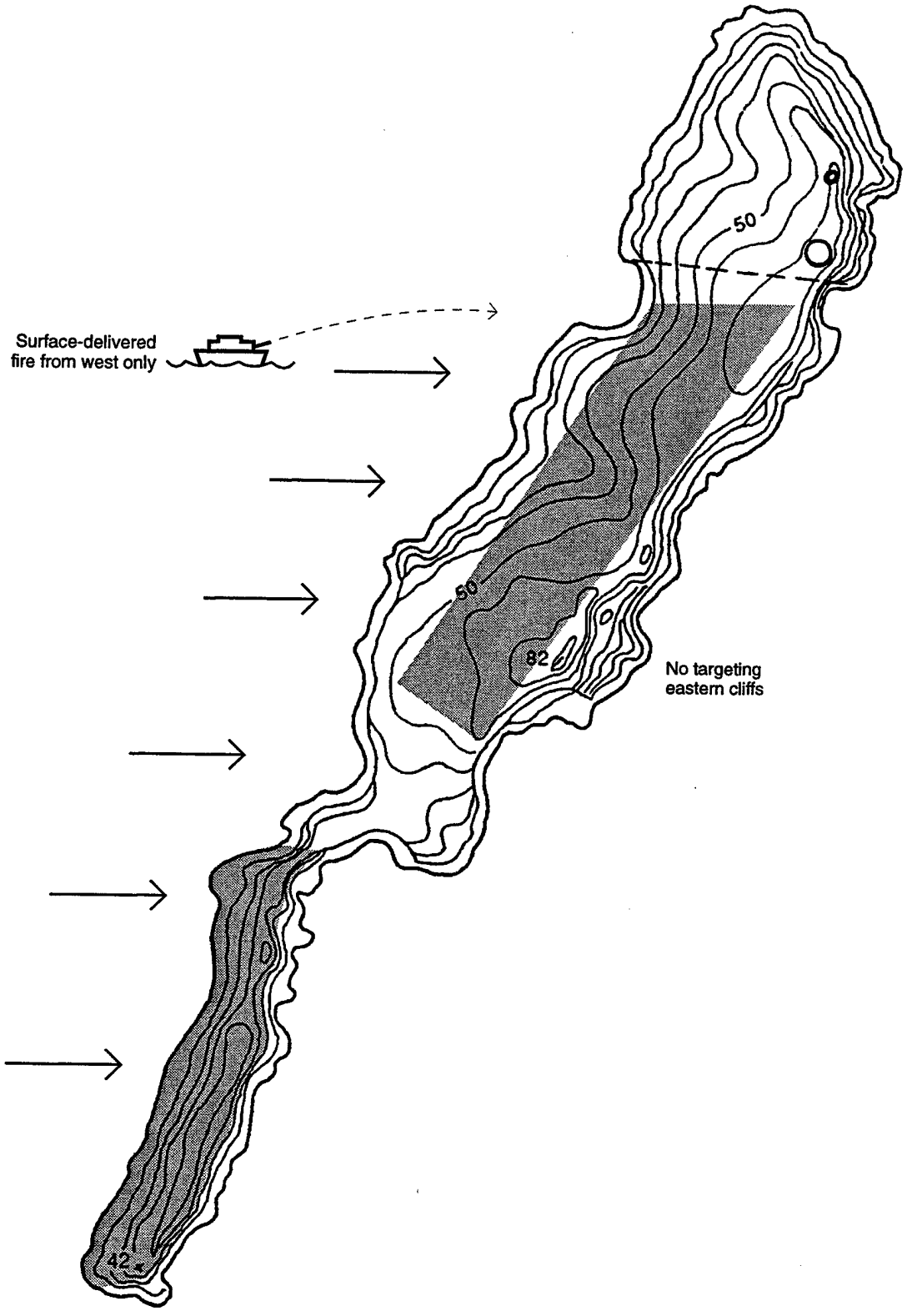


Figure 2-10
ANDERSEN AFB AND COMMUNICATIONS ANNEX CONSTRAINED AREAS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



NORTH

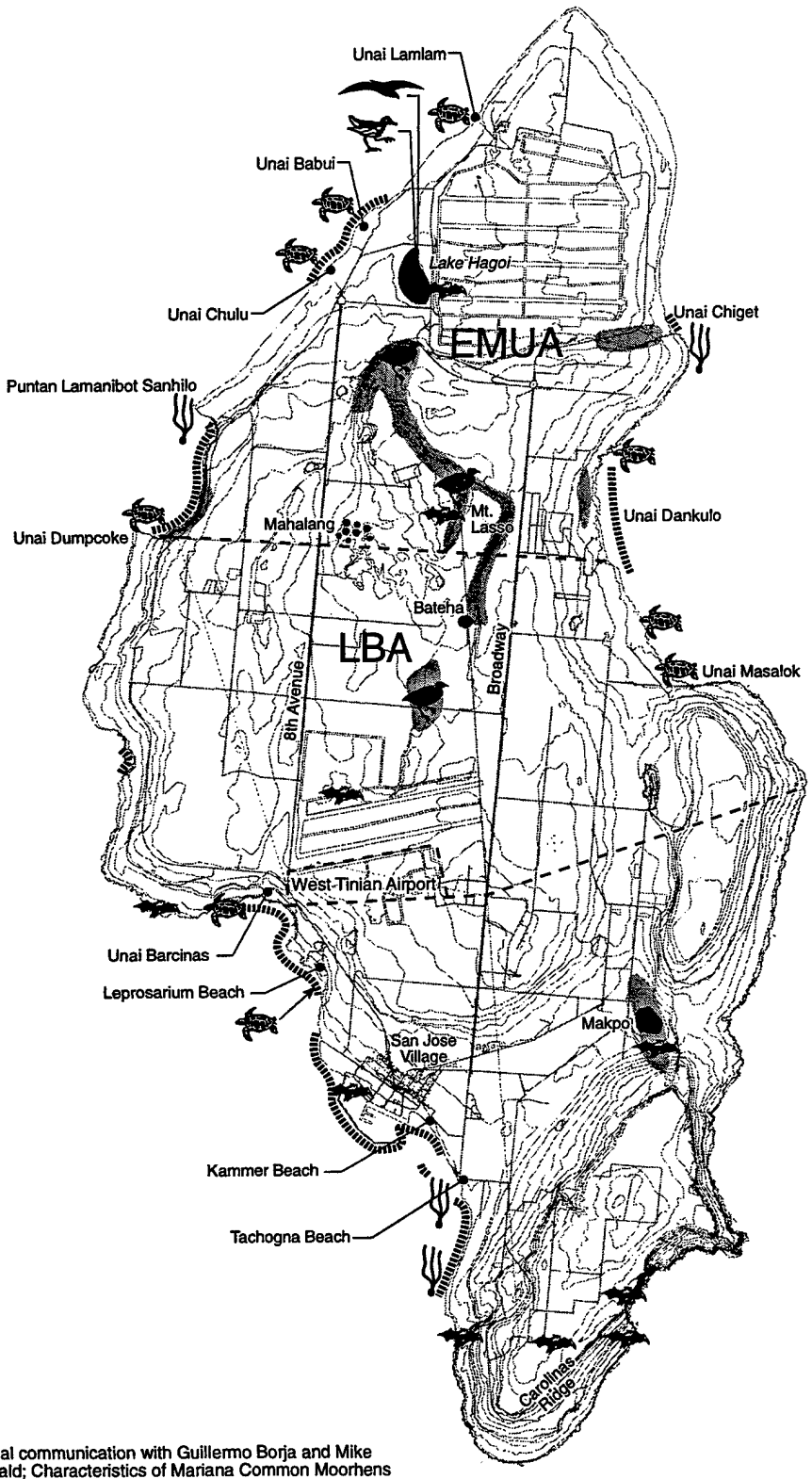
0 100 200 300 (Meters)

0 500 1000 (Feet)

LEGEND

Aerial bombardment target areas

Figure 2-11
FDM FIRING DIRECTION AND TARGET PLACEMENT CONSTRAINTS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



LEGEND

- Coral reef
- Potential green sea turtle nesting sites
- Recent fruit bat sitings
- Seagrass beds (turtle feeding areas)
- Mariana common moorhen
- Micronesian megapode
- Tinian monarch (distributed throughout the island)
- Migratory birds
- Wetland
- Limestone forest

Sources: Personal communication with Guillermo Borja and Mike Fitzgerald; Characteristics of Mariana Common Moorhens and Wetland Habitats, Tinian; Atlas of the Reefs & Beaches of Saipan, Tinian & Rota; Environmental Assessment, Tinian, Tandem Thrust 1995; Wildlife Research Report, Tinian.

Note: Symbols are representational only.

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 3-1
SENSITIVE HABITATS AND THREATENED AND ENDANGERED SPECIES, TINIAN
Revised DEIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1998

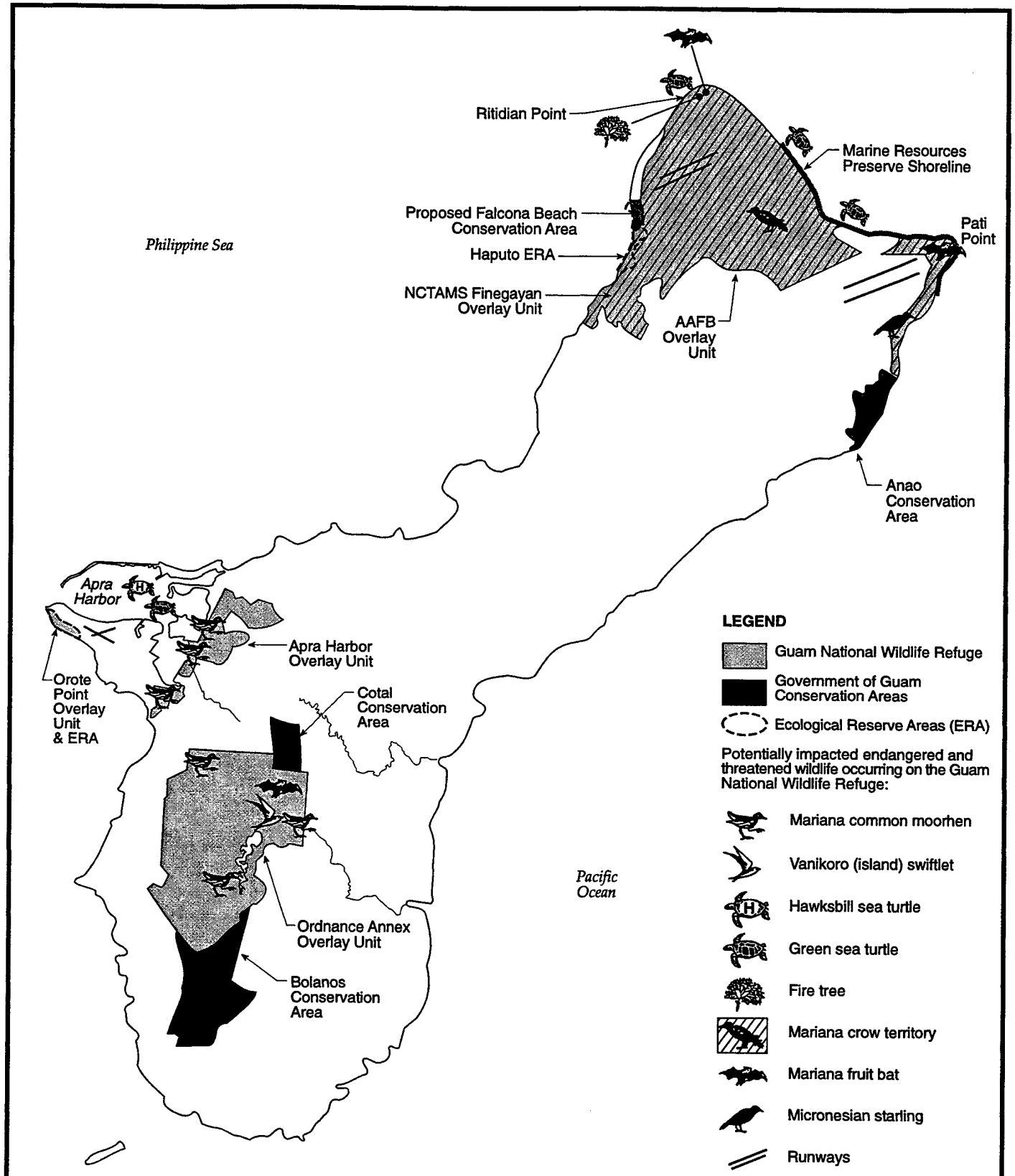


Figure 3-2
NATIONAL WILDLIFE REFUGE, OVERLAY UNITS, AND CONSERVATION AREAS OF GUAM
Revised DEIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1998

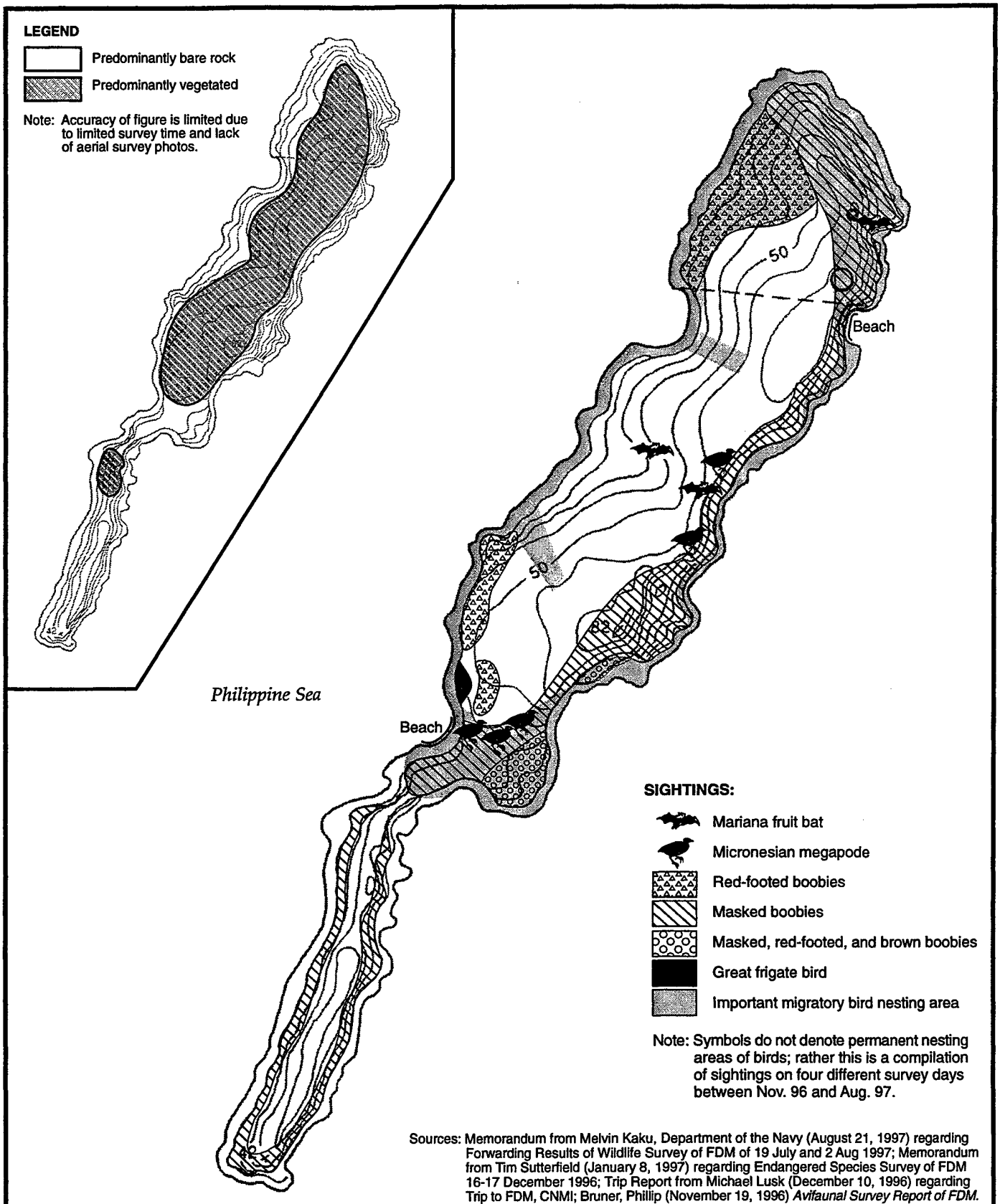
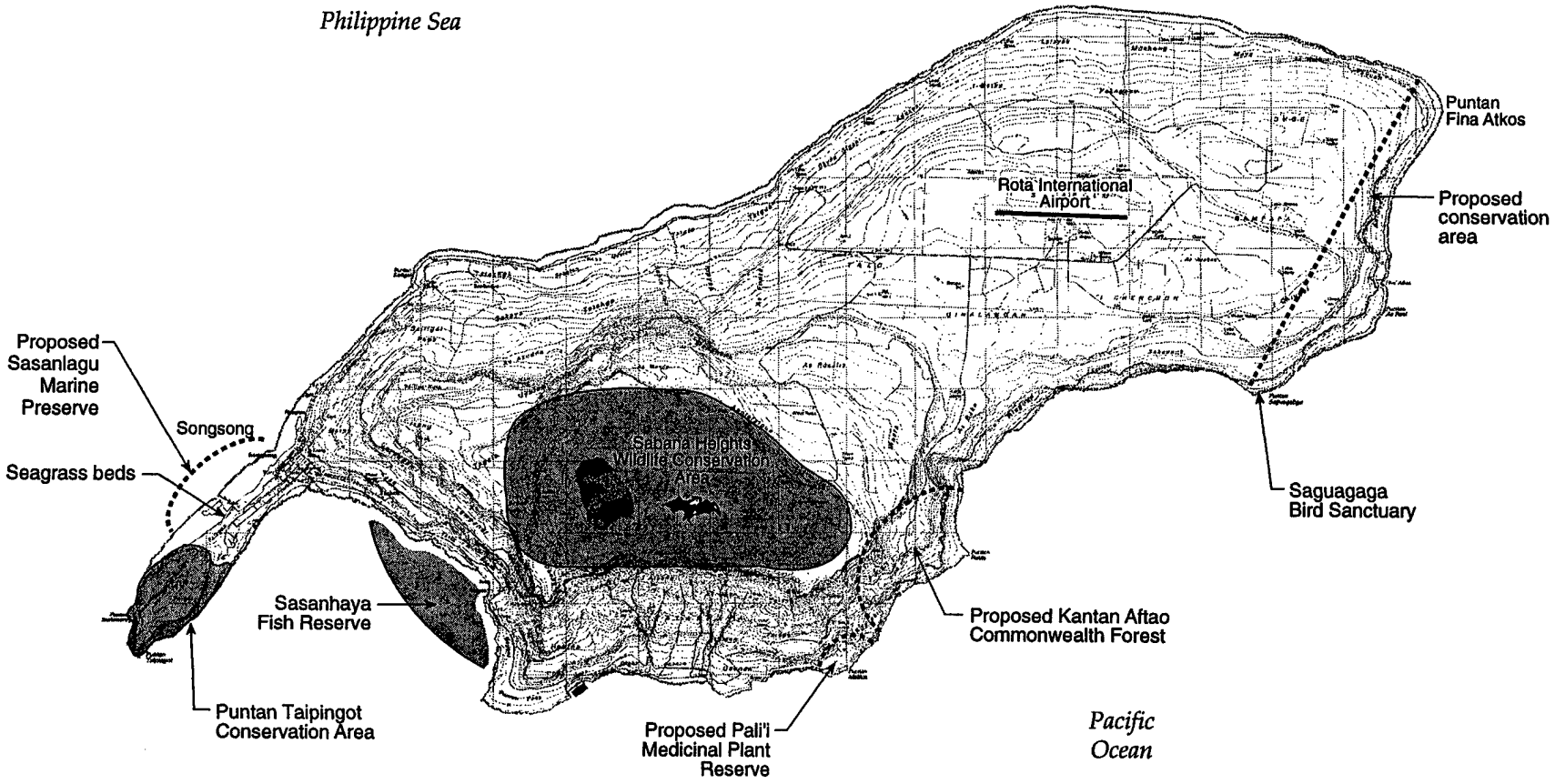


Figure 3-3
BIRD AND BAT SIGHTINGS, FARALLON DE MEDINILLA
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

342.0414/007-12 r12.4.97



Note: The exact boundaries of the conservation areas and proposed conservation areas have not yet been established.

Source: Atlas of the Reefs and Beaches of Saipan, Tinian, and Rota; Physical and Economic Master Plan for Rota; Letter from Arnold Palacios

NORTH

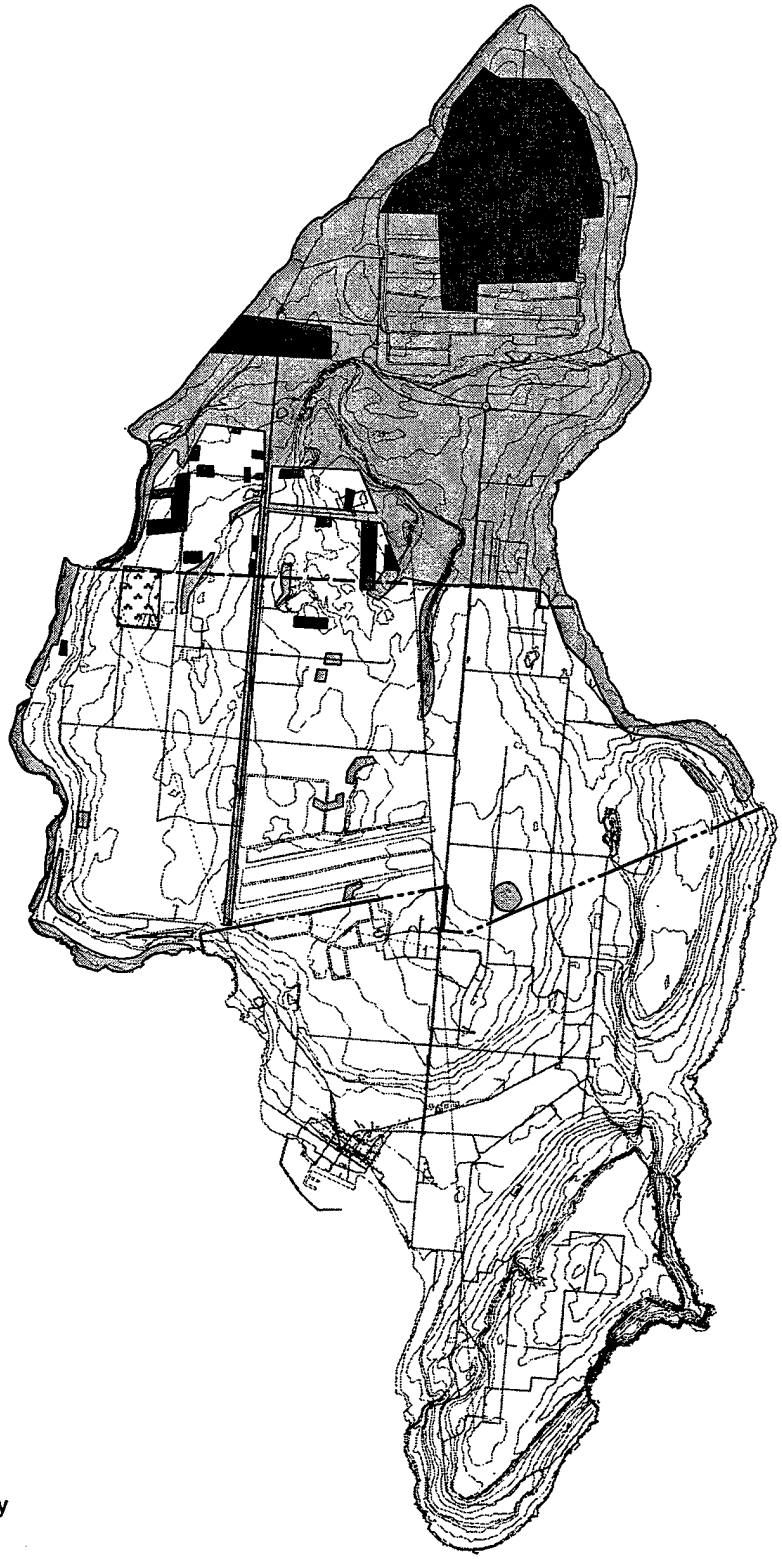
0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

- Proposed Conservation Area
- Conservation Area
- Runway
- Mariana crow (distributed throughout the island)
- Mariana fruit bat (disperses throughout island for nighttime feeding)

Figure 3-4
SENSITIVE HABITATS AND THREATENED AND ENDANGERED SPECIES, ROTA
Revised DEIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1998



SURVEY INTENSITY

- High
- Medium
- Low
- Site-specific
- EMUA boundary
- MLA boundary

Source: Welch & Tuggle, 1996

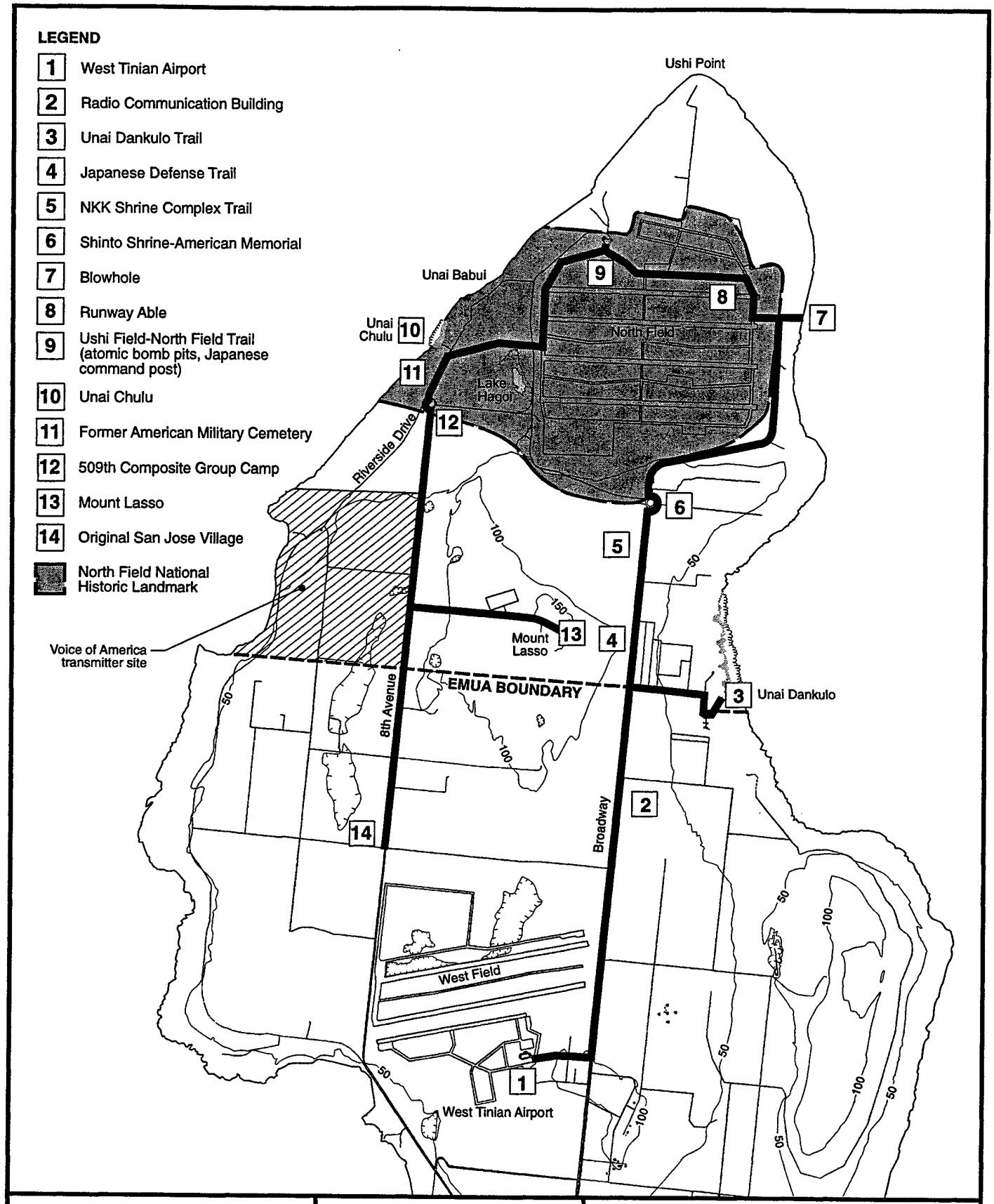
NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 3-5
TINIAN ARCHAEOLOGICAL SURVEYS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: Self-Guided Tour of Historic North Tinian, 1995

NORTH

0 .5 1 2 (Km)

0 .5 1 (Miles)

LEGEND

Auto route defined in tourist brochure

1 Location of site or trail

Figure 3-6
TINIAN HISTORIC SITES

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

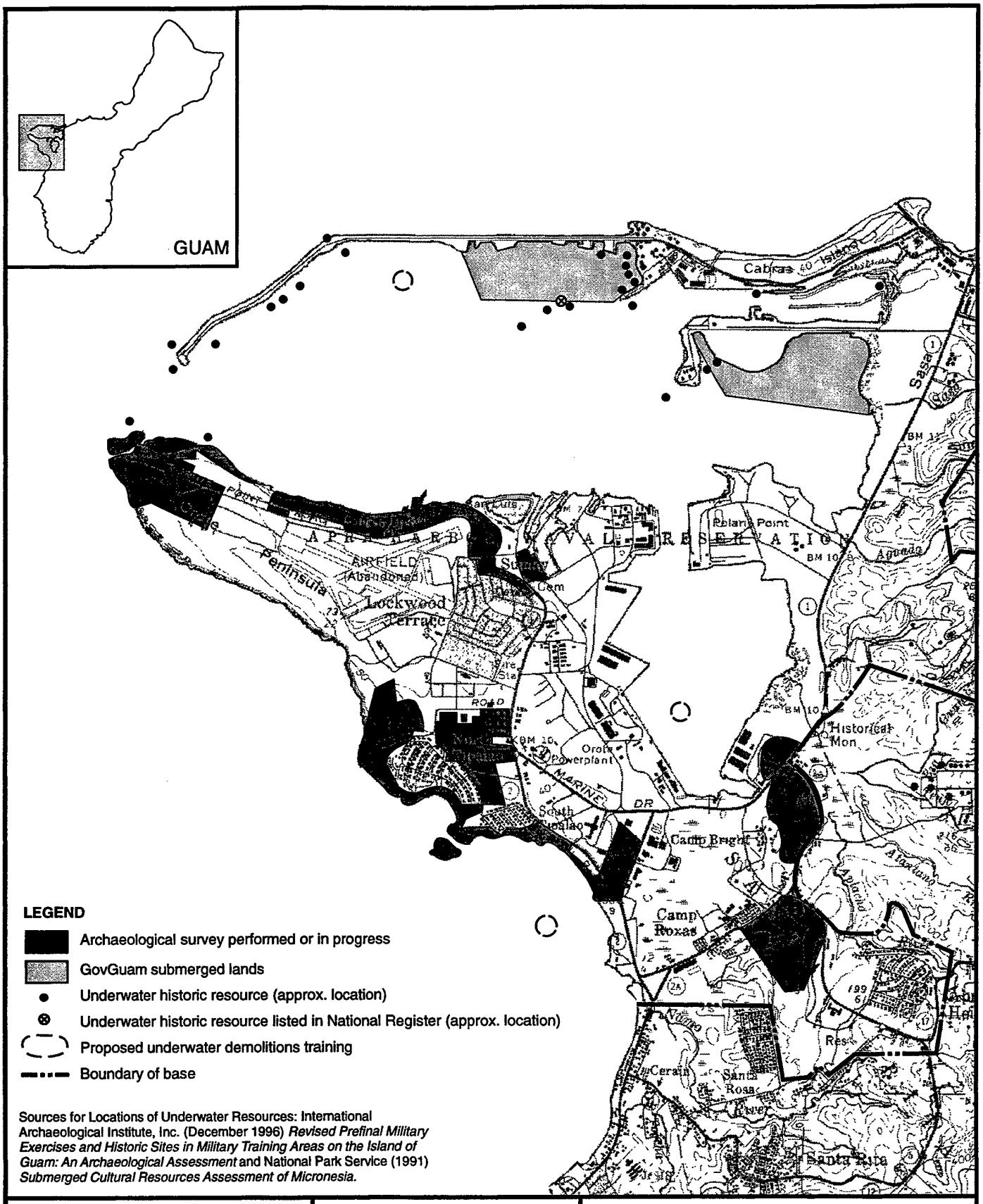


Figure 3-7
WATERFRONT ANNEX
ARCHAEOLOGICAL SURVEYS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

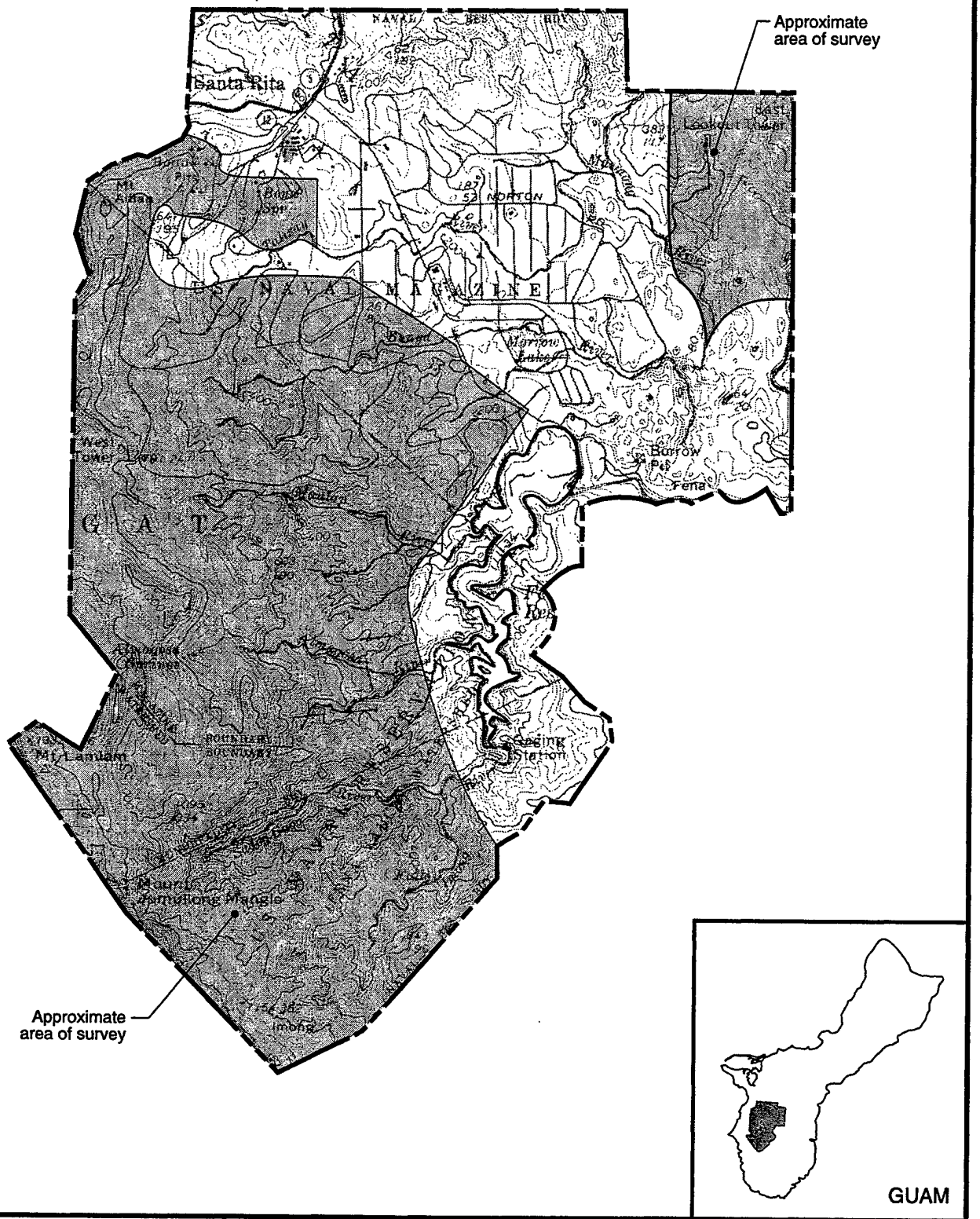
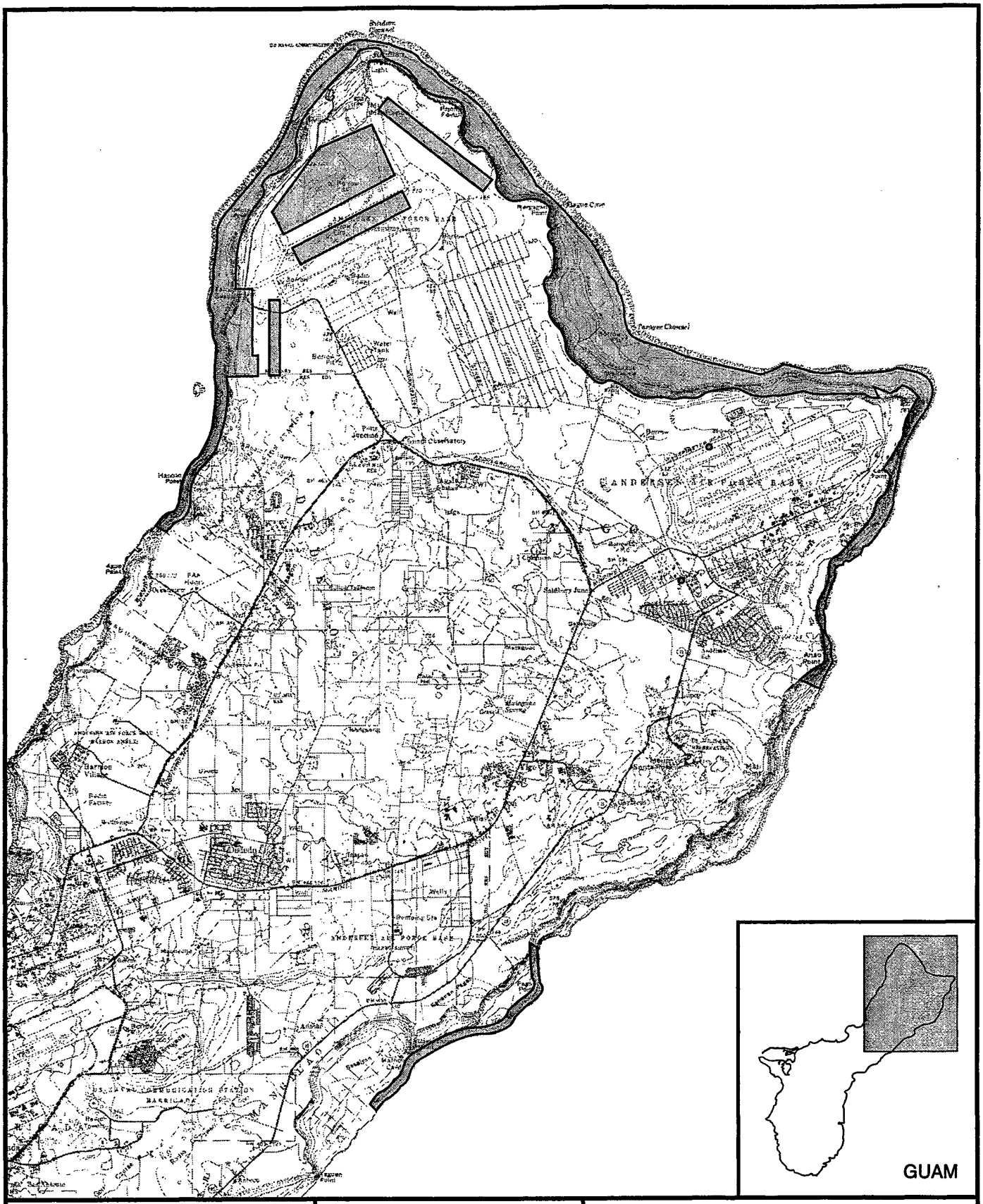


Figure 3-8
ORDNANCE ANNEX
ARCHAEOLOGICAL SURVEYS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

342.0414/018-2 r12.15.97



NORTH

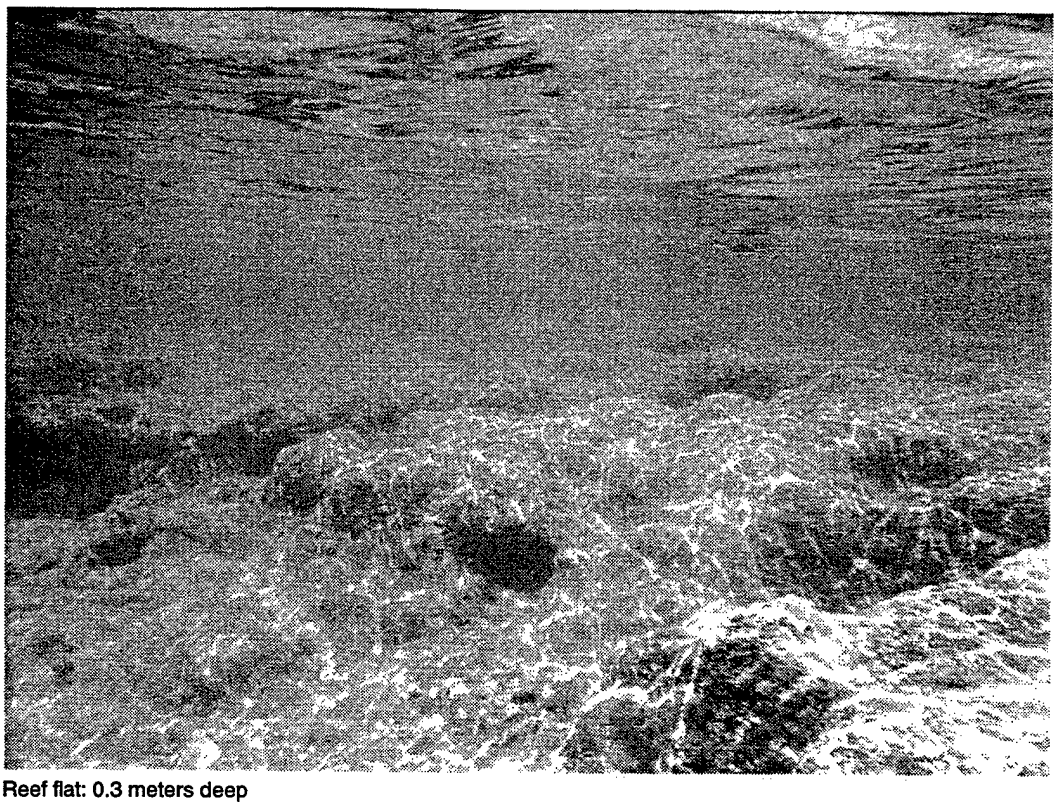
0 1000 2000 (Meters)

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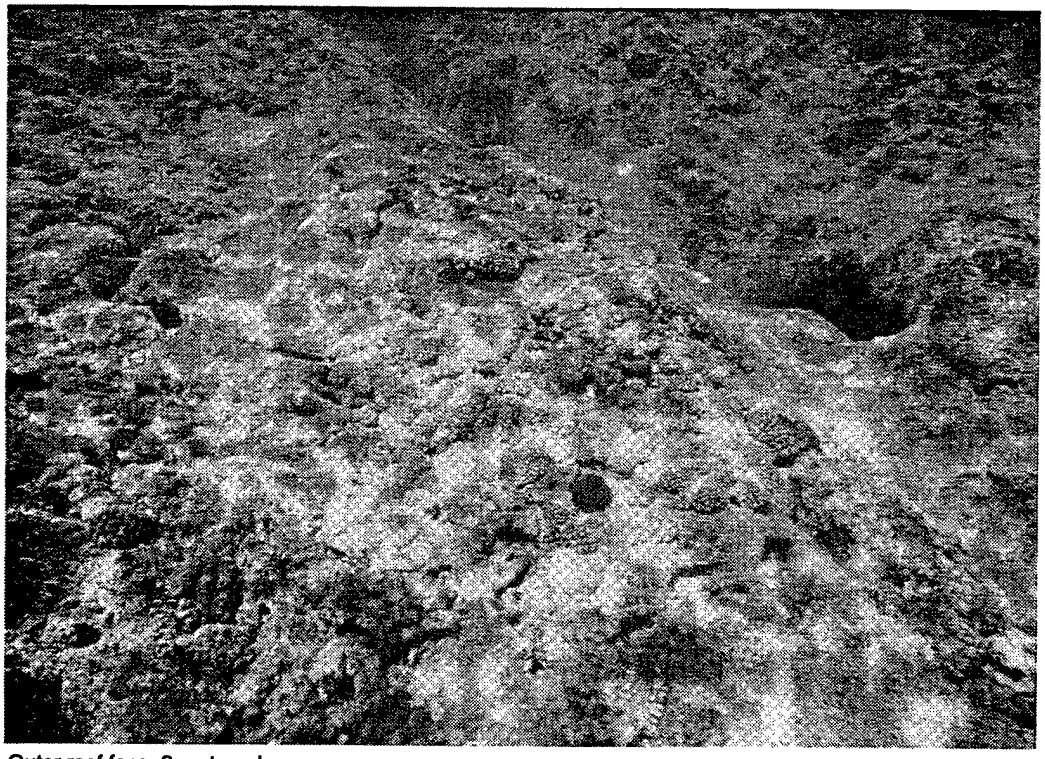
LEGEND

Archaeological survey performed

Figure 3-9
ANDERSEN AIR FORCE BASE/NCTAMS ARCHAEOLOGICAL SURVEYS
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



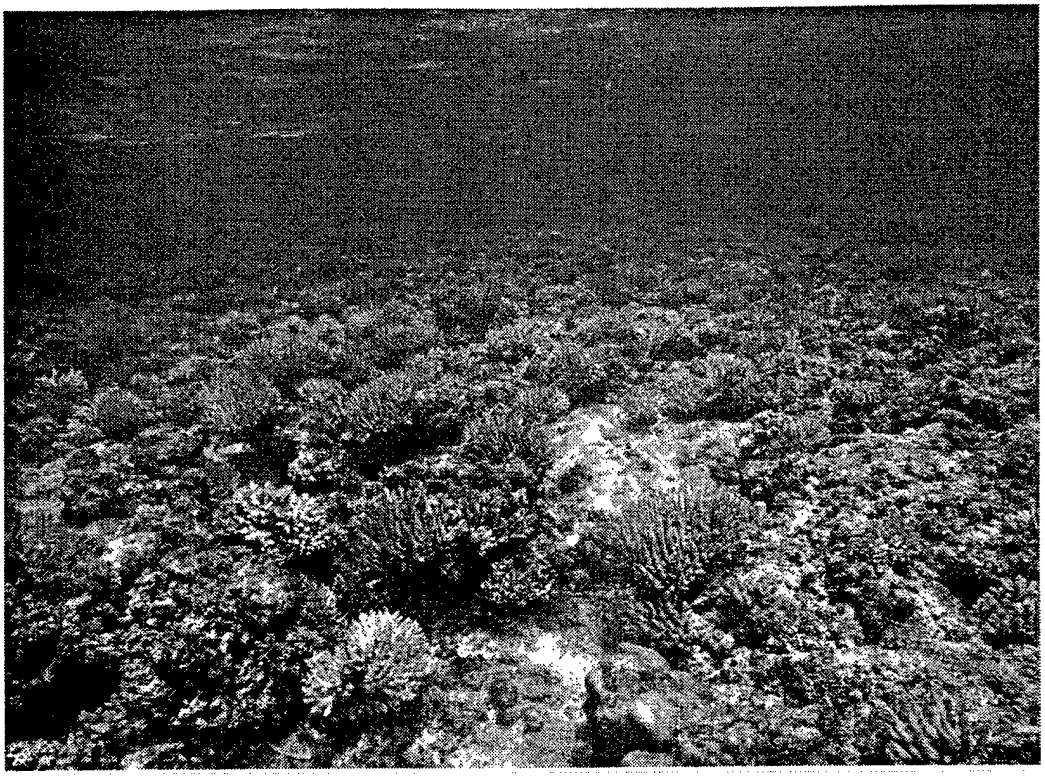
Reef flat: 0.3 meters deep



Outer reef face: 3 meters deep

Figure 4-1
UNAI BABUI CORAL COVER

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



South end of reef flat: 1 meter deep

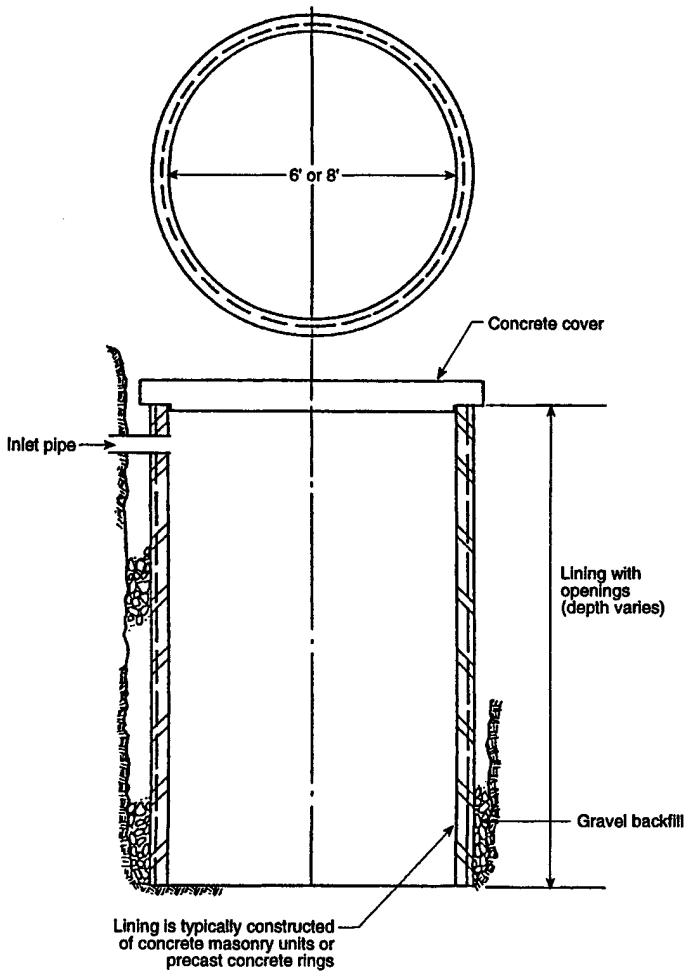


Reef front: 3 meters deep

Figure 4-2
UNAI CHULU CORAL COVER

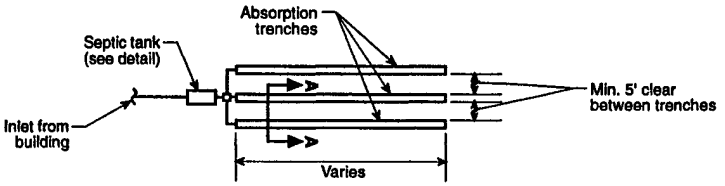
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

SCHEMATIC DRAWING OF A CESSPOOL

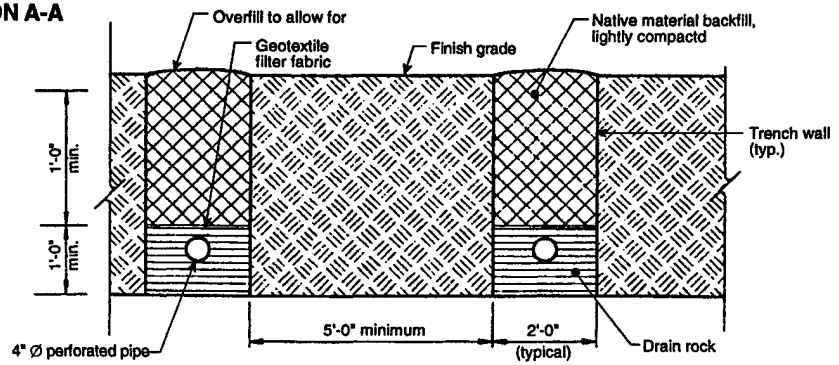


TYPICAL SEPTIC TANK SYSTEM

PLAN



SECTION A-A



SEPTIC TANK

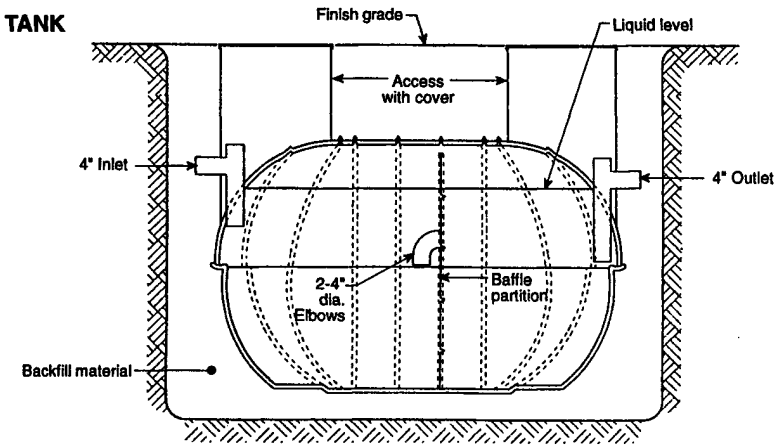
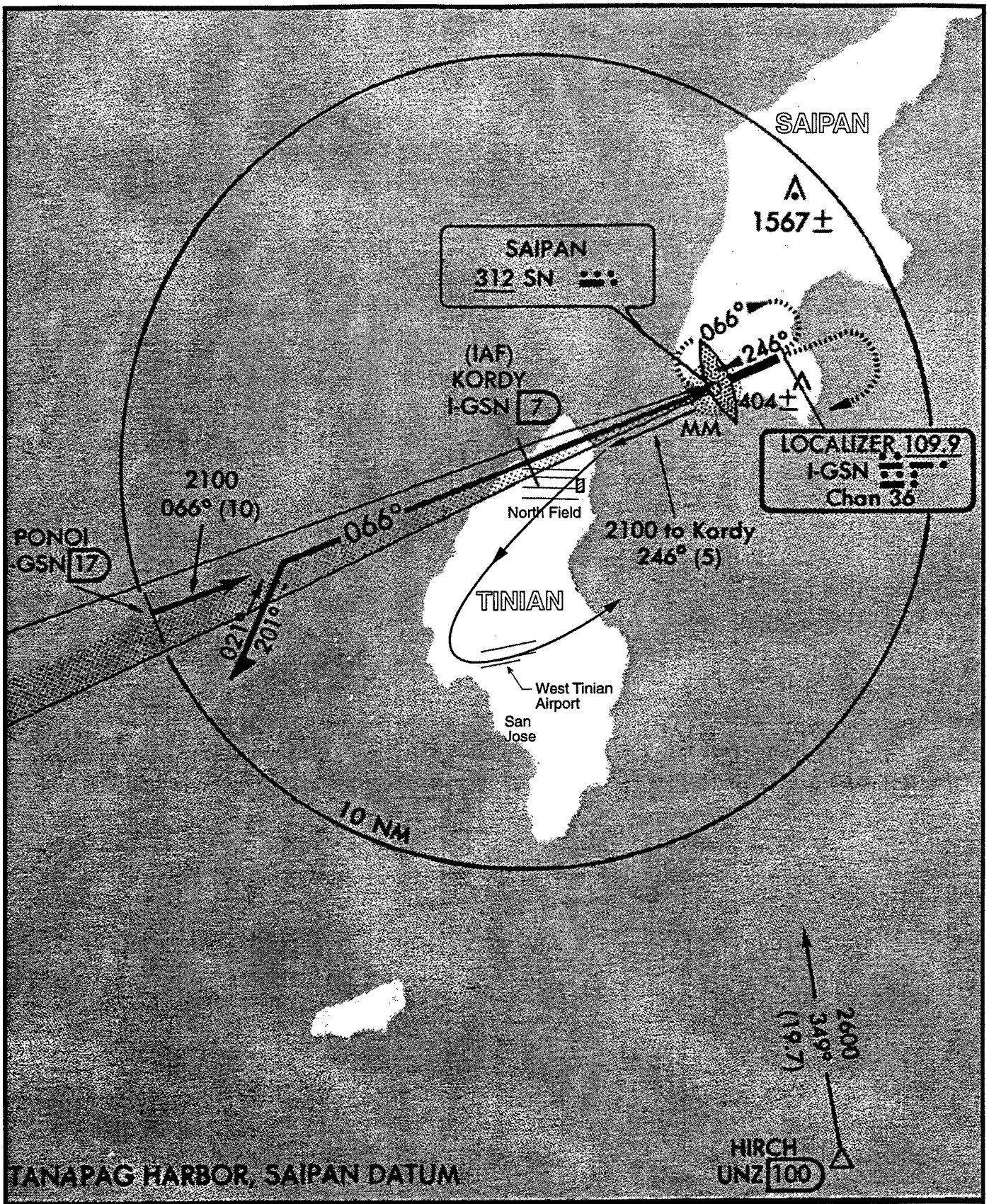


Figure 4-3
WASTEWATER DETAILS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: *High and Low Altitude Pacific, Australasia and Antarctica*, DOD Flight Information Publication (terminal), June 24, 1993

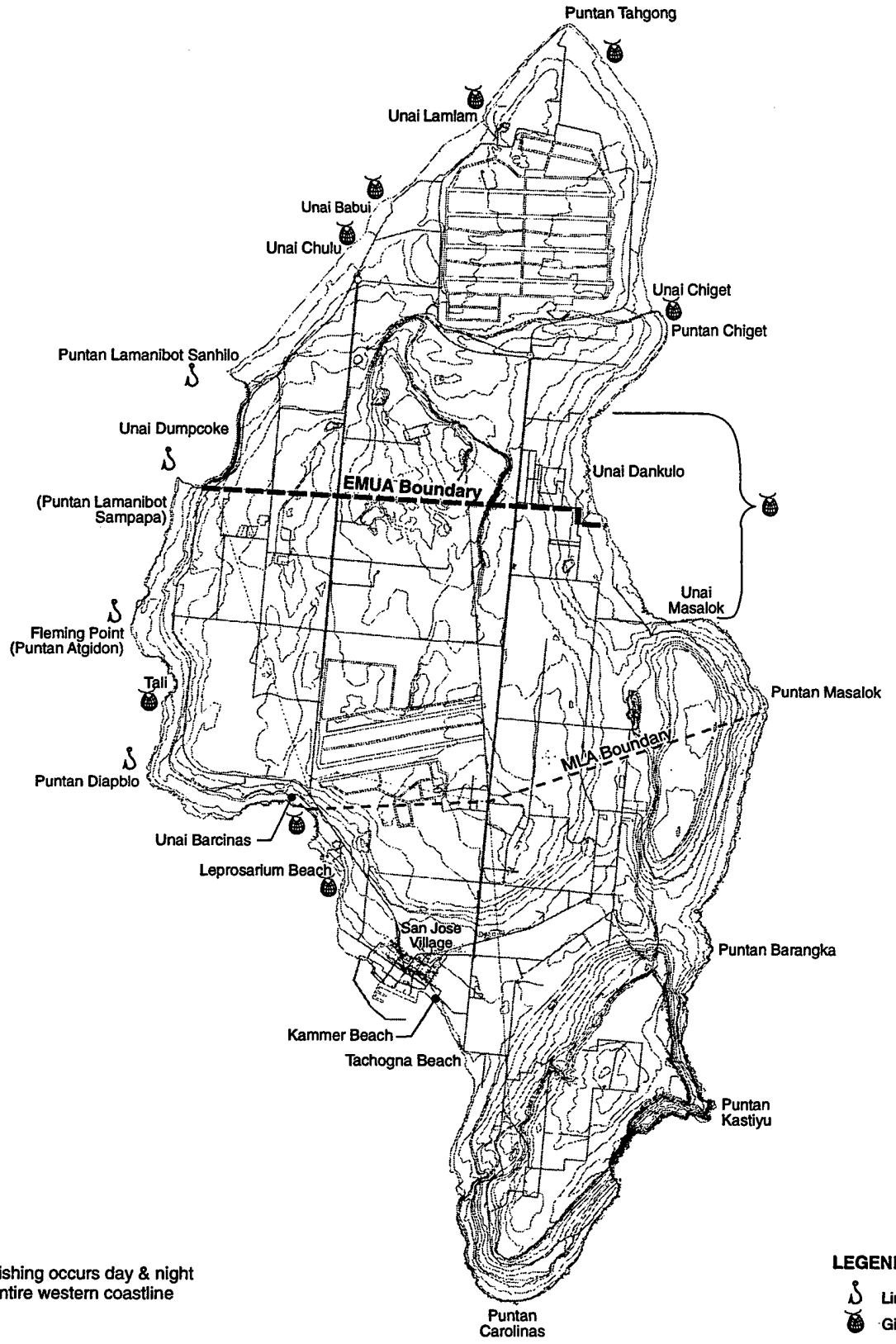
NOT TO SCALE

LEGEND

Approximate track of Saipan-Tinian commuter flights

Proposed firing range

Figure 4-4
SAIPAN FLIGHT APPROACHES AND DEPARTURES
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Source: Tinian Division of Fish and Wildlife

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 4-5
FISHING AREAS ON TINIAN

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

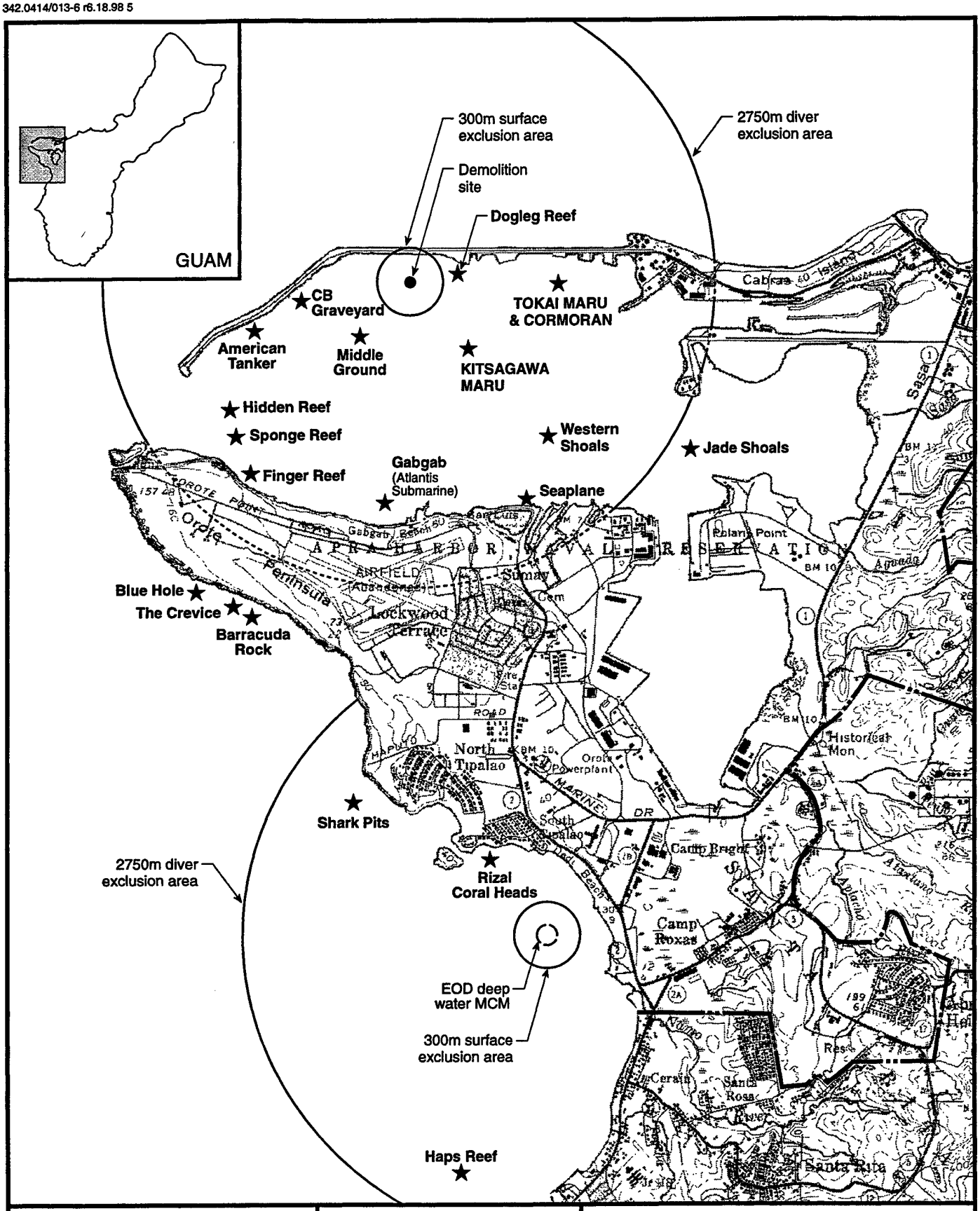
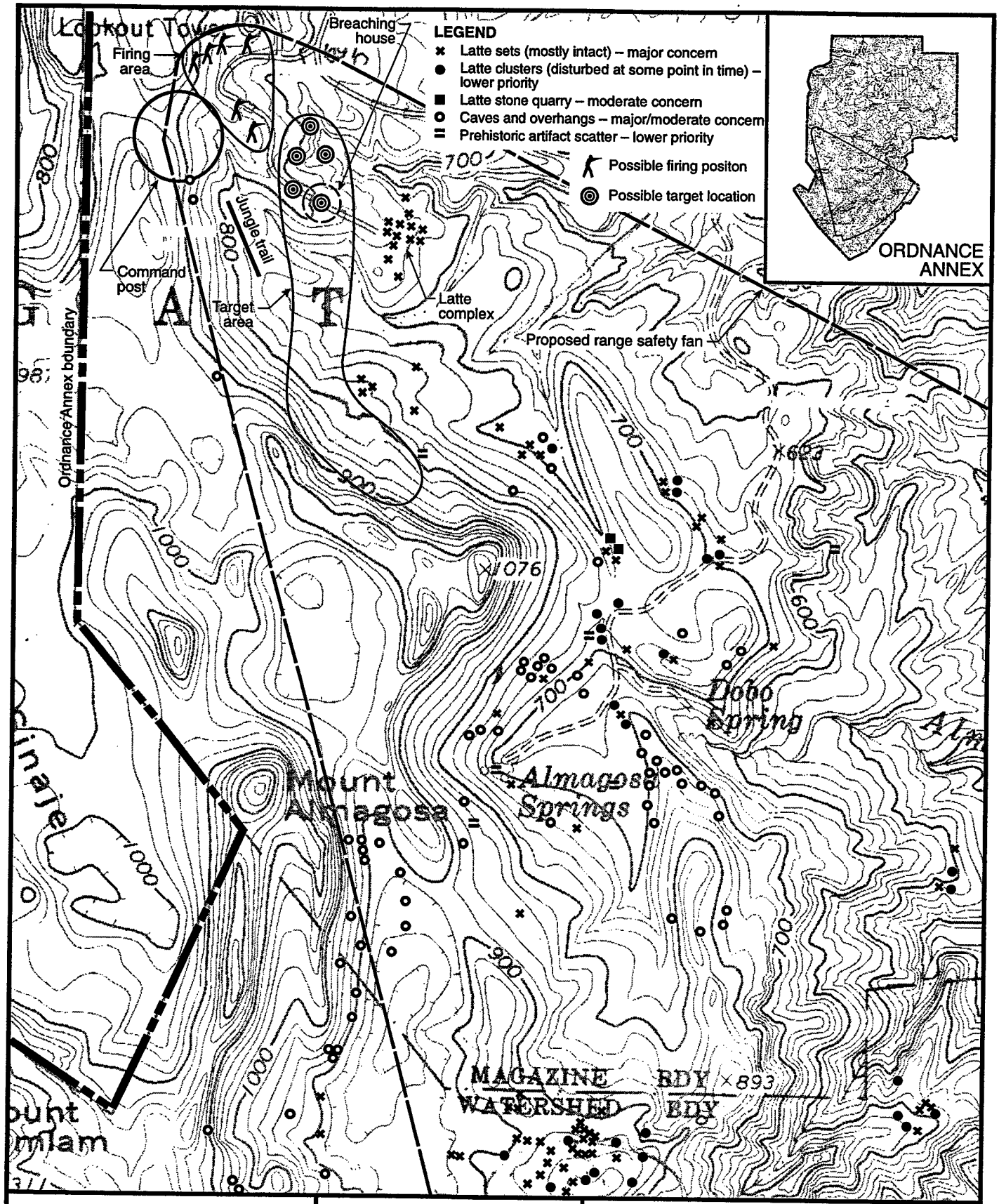


Figure 4-6
DIVE SITES AND DEEPWATER MCM TRAINING SITES AT APRA HARBOR
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



NORTH

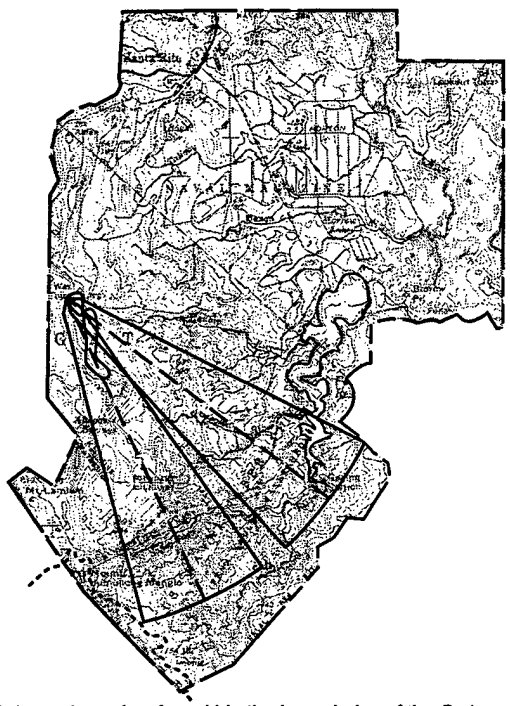
0 125 250 (Meters)

0 500 1000 (Feet)

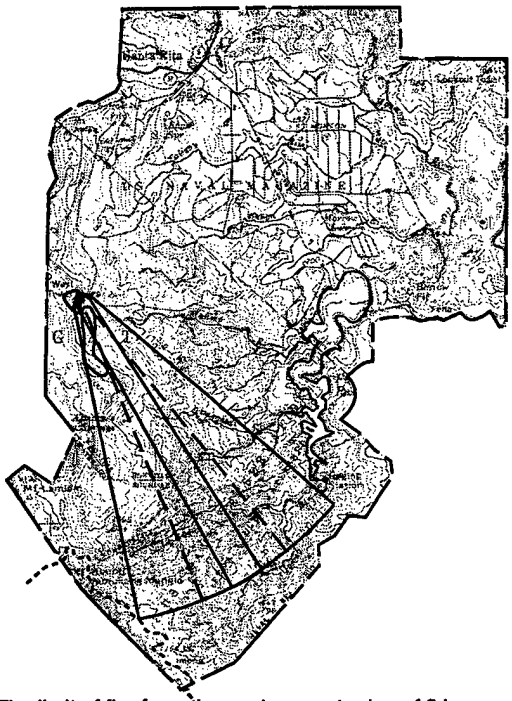
Source: Compiled by IARII from Paul H. Rosendahl, Ph.D., Inc. (1996) *Prefinal Report: Phase I Archaeological Survey and Subsurface Testing, U.S. Naval Activities Ordnance Annex, Guam*

Figure 4-7
PROPOSED SNIPER RANGE DETAILS

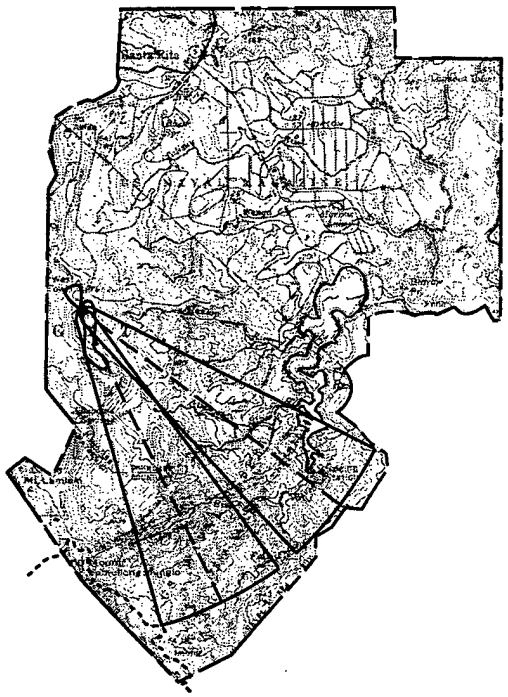
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



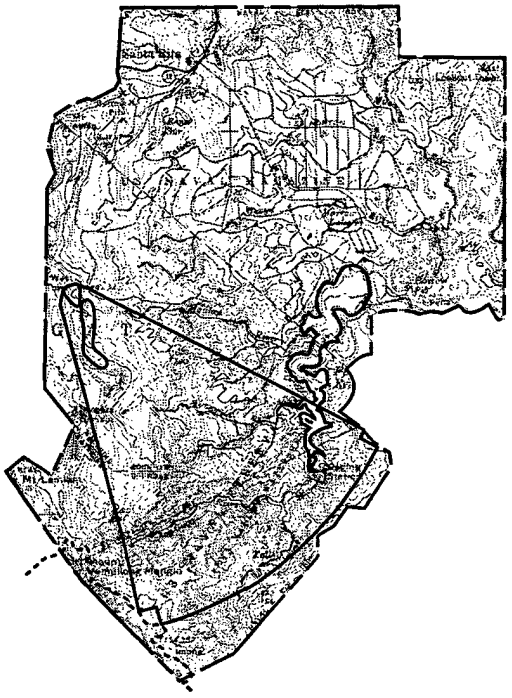
A. To keep the safety fan within the boundaries of the Ordnance Annex and off the hiking trail, the limit of fire from the westernmost edge of the firing area is restricted to an approximate direction of 128° to 156° east of north.



B. The limit of fire from the easternmost edge of firing area is restricted to an approximate direction of 142° to 169° east of north.



C. The limit of fire from the southernmost edge of the firing area is restricted to an approximate direction of 129° to 156° east of north.



D. This is a composite of all the safety fans.

Source: Marianas Training Plan Briefing Booklet

NORTH

0 1000 2000 (Meters)

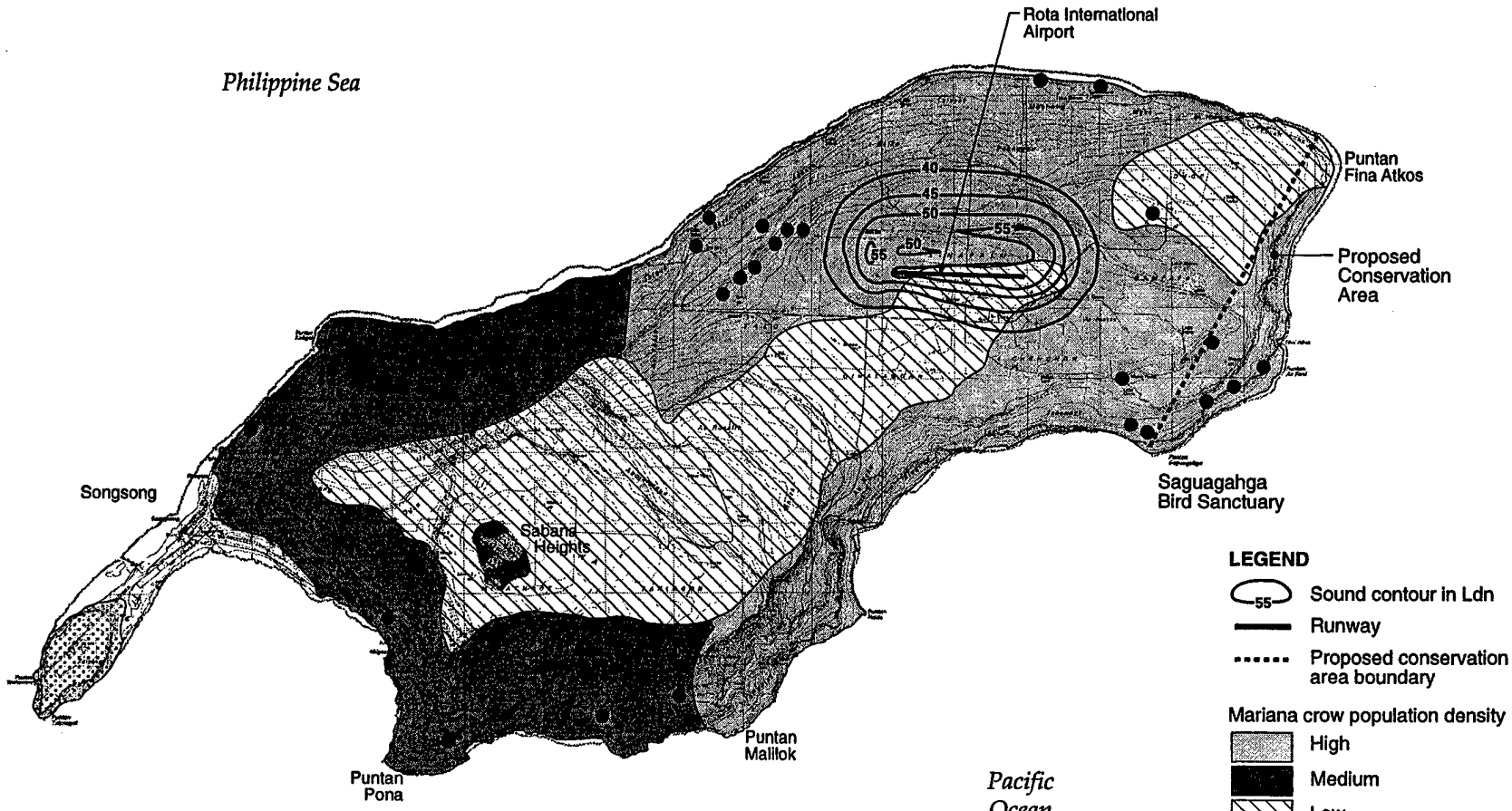
0 4000 8000 (Feet)

LEGEND

- Safety fan boundary
- Limit of fire
- Hiking trail

Figure 4-8
SAFETY FAN LIMITS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



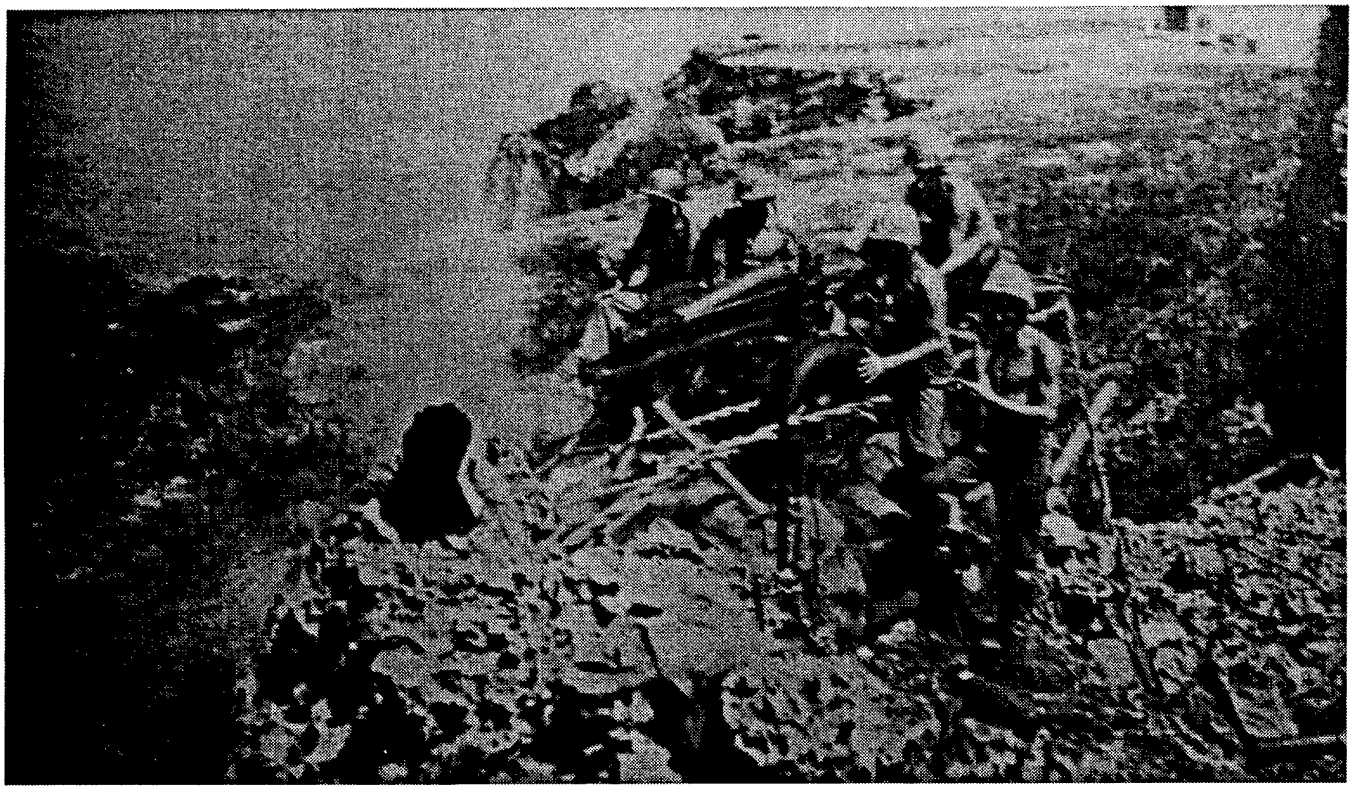
Source: Darby & Associates (1996), *HC-5 Helicopter Noise Study for Night Vision Goggle Training at Rota Airport, Rota, Mariana Islands*; Atlas of the Reefs and Beaches of Saipan, Tinian, and Rota; Personal communication with Michael Lusk, USFWS, November 1996

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 4-9
DAILY AVERAGE DNL CONTOURS FOR NVG TRAINING
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



Marines man 75mm Pack Howitzer on Tinian (National Archives at College Park)



Marines and tanks advance to south–Tinian (National Archives at College Park)

TABLES

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB		FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communi-cations Annexes	Main Base	Northwest Field	Andersen South			
EODMU FIVE	10	Inert Explosive Device Training	bimonthly						2		both						
200 Personnel; detachment of 8 is norm for training elements	8	Mixed Gas Scuba Diving	bimonthly						Dadi								
	24	Parachute Operations	bimonthly													Dandan	
	24	Helicopter Cast and Recovery (over water)	bimonthly														
	24	Helicopter Rope Suspension Training: Fast Rope, SPIE, Rappel	bimonthly													Dandan	
	12	Patrolling and Land Navigation	1 day/month														
	24	Small Arms Fire (9mm, M-16, M-203 Training Projectile)	4 days/month														
	12	Communications															
	6-8	Underwater Demolition Training 10-20# charges	monthly						Dadi								
	12	Recompression Operator Training (chamber is deployable)	monthly														
	14	Demolition pit training	3 days/month														
HELICOPTER COMBAT SUPPORT SQUADRON HC-5	10 jumpers	Lift for airborne ops (1-2 helos)	5 to 10/month													Dandan	
350 Personnel. 15 helos in squadron, 2-5 helos on home guard. Remaining helos deployed Navy ships	18 jumpers	Lift for airmobile ops (1-2 helos)	5 to 10/month														
	10 jumpers	Lift for fast rope/SPIE (1 helo)	5 to 10/month													Dandan	
	1 Helo	Night Vision Goggle training	8 nights/month														
	1 Helo	Firebucket trng w/ Fed Fire Dept.	quarterly							Fena spillway							
	1-2 Helos	Confined Area Landing/ Simulated LHA Landing	daily														
	1 Helo	Search-and-Rescue	1 flight/day													Tumon, Agana Bays	
NAVSPECWARUNIT ONE (NSWU-1) (SEALs)	20	Over-the-Beach boat and swimmer Insertions	3 days/quarter								Fin.						
Platoons of 16 augmented by boat crews	16	Shallow Water Mine Countermeasures	7 days/quarter														
	16	Land Navigation	10 days monthly														
	16	Field maneuvers (Blank Fire)	2 weeks/month								Fin.						

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB			FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communi-cations Annexes	Main Base	Northwest Field	Andersen South				
NSWU-1 (continued)	8-16	Patrolling	2 weeks/qtr								Fin.							
	16	Fire and Maneuver Range (KD)	3 weeks/qtr									X	X					
		KD Small Arms Requal. Range	5 days/month															
	16	7.62mm KD Sniper Range	5 days/month															
	16	7.62mm Unknown Distance Sniper Range	3 days/month															
	16	Jungle Trail (Fire and Maneuver Range)	1 week/month															
	16	Close Quarter Battle (TRUE)	1 week/month															
	16	Small Demolitions/Rope Inserts	2 days/month															
	16	Helicopter Insertions (Water DZs)	8 hours/month															
	16	Helicopter Insertions by Fastrope	20 hours/qtr															
	16	Short Field Runways for MC-130 Spec Ops A/C	10 hours/month															
	16-20	Combat Swimmer	2 weeks/qtr								Fin.							
	16-20	Live fire from RHIBs (40mm grenades,.50 cal machine guns)	1 day/qtr															
		Underwater demolition	7 days/mo															
	16-20	Riverine Training	7 days/mo															
	16-20	Forward Staging Base	7 days/month															West Harb.
NAVAL MOBILE CONSTRUCTION BATTALION (Seabees)	400	Battalion Field Exercise: Cmd/Cntrl/Communications,	two 10-day periods/year															
		Defensive Tactics, Convoys and Patrols, Construction Skills	daily						Cov'n									
		Small Arms Requalification	2 weeks/year															
COMNAVMARIANAS: SECURITY DEPT	220	Small Arms Requalification	semi-annual								Fin.							
216 Personnel plus 130+ auxiliary force		Security Alert Scenarios	3 scenarios monthly per three shifts						feasible at any installation locale									

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB		FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communications Annexes	Main Base	Northwest Field	Andersen South			
COMNAVMAR Security (continued)	130	Ground Defense Force	3 scenarios monthly per three shifts														
	20	Explosives Detection (Military Working Dogs)	twice weekly														
FEDERAL FIREFIGHTERS		Firefighting	monthly														
COMMANDER 7TH FLEET CARRIER BATTLE GROUPS, OTHER COM-	F/W sqdrns	Fleet Carrier Landing Practice	4-5 days/quarter														
BATANT SHIPS, ARG & MEU (SOC)		Air-to-Ground Ordnance Drops	5 days/quarter														
MEU = 1300+ personnel Ground forces can train in small increments of 4, 13, 25 persons, companies of 150, or as a reinforced battalion of 500 or more. Aviation element consists of helicopter and VSTOL aircraft		Naval Gunfire	monthly														
	150-500	Amphibious Assaults	2-3 yearly, max 3 wks each														
	500	Small Unit Tactics	"								Fin.						
	150-500	Small Arms Live-Fire	"								Fin.						
	70	Artillery Crew Drill/Live Fire	"														
	60	Mortar Crew Drill/Live Fire	"														
	60	Cliff assaults/Insertions/Rappel	"								Fin.						
	12	Tactical Air Control	"														
	25	LCAC Landings	"	Chulu, Dankulo		Tachogna	Toy-land	Pol Pt. Drydk	Dadi, Tipalao								
	250	AAV Landings	"	Babui		Kammer	Toy-land	Pol Pt, Drydk, Sumay	Tipalao								
		LCU Landings				Tin Harbor	Toy-land	Pol,Dd, Sumay, fuel pier									
	140	TRUE Training	"														
	150	TRAP	"														
	150-175	Airfield Seizure	"														
	250	NEO	"														
	800	Bivouac	"														
	175	Logistic Operations	"														

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB		FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communi-cations Annexes	Main Base	Northwest Field	Andersen South			
MEU (continued)	60	Scuba Training	"														
	60	Parachute Operations	"														
USAF 36 ABW	100+	Attack Response Exercise (ARE)	semi-annual														
	100+	Major Accident Response Exercise (MARE)	monthly														
USAF 36 CES	100+	Construct Beddown Sites and Def Position	annual														
	100+	Security and Ground Defense	annual														
	100+	Weapons Training	annual														
		Rapid Runway Repair															
	25	NBC Defense	quarterly														
USAF 36 SG (Medical)	50	Mass Casualty Exercise	quarterly														
36 CES/EOD FLGHT		MK Tool Set (1,2,3 Mod 5, 31,32)															
		Detonation and Burning Operations															
		Landmines and Booby Traps															
		Base Recovery															
		Ground Burst Simulation															
		Access and Recovery of UXO															
		MDM landmine Locator															
		Tape and Line Procedures															
PACAF Special Ops		MC-130 Airdrops	5 yearly w/10 aircraft														
353 SOG		Combined Force Aircraft Exercise	5 yearly w/150 aircraft														
		Assault Zone Training							DZ								
		CCT Team Training															

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB				
				TINIAN EMUA	TINIAN MIA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communications Annexes	Main Base	Northwest Field	Andersen South	FDM	Guam Non-DoD Land	Rota Non-DoD Land
353 SOG (continued)		Broken Arrow Procedures															
		Night Vision Goggle	10 to 12 weeks														
374th Airlift Squadron & 36th Airlift Squadron	C-141s	Joint Airlift/Air Transportability	1 to 2 monthly														
Supporting: EODMU-5, NSWU-1, 633 OSS, 374 AW/OSS, 353 SOG (Kadena), 6 ID (Light), USARG, and USAR-M Supporting: EODMU-5, NSWU-1, 633 OSS, 374 AW/OSS, 353 SOG (Kadena), 6 ID (Light), USARG, and USAR-M (continued)	C-130s	(JA/ATT) including:															
	24	Static Line Jumps															
	16	HALO Jumps															
		CRRC Drops															
	20-120	CDS Drops															
	600	Airmobile Delivery															
	75-185	Infiltration/Exfiltration															
		Small Arms Weapons Qualifications	annual														
36 SPS	4	Air Base Defense/Jungle Patrolling	semi-annual														
		Military Working Dog Training															
17th Spec Ops Squadron		CADS/LAPES Cargo Deliveries															
		HALO Support to SEALs															
ACC (5 Bomber Wings)	2-B52s	Strategic Bombing	quarterly														
USAR-MARIANAS	75-185	Small Arms Weapons Fire/Quals	semi-annual														
HHC-USAR M, 368 MP Co, E Co 442 In, 297th Eng Co (Hvy) (In general, weekend training once per month and 2 wks active training duty each year.)	80	Demolitions															
	185	Ind Field Training: Day & Night Land Navigation, Map reading & Compass exercises	5 weekends per year														
	130	EPW/CI Operations	6 days														
	130	Battle Circulation and Control															

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB			FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner - Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Orchance Annex	Communi-cations Annexes	Main Base	Northwest Field	Andersen South				
USAR-M (continued)	185	Area Security (Offense and Defense)		■					■									
	75-185	Battle Drills		■					■									
	80-185	NBC	2 days	■					■									
	40	Heavy Engineer Equipment							■				■					
	80	Drownproofing	biannual					■										
	185	Adventure Training	biannual							■								
	12-24	Parachute Operations															Dandan	
	80	River Crossing	biannual				■											
GUARNG	520	Academic Courses	one weekend per month and two weeks ATD annually								■							
1st Bn 294th Inf (L)-450, HHC-2 Letter Cos, Service Det (Inf), Trans Sqd, Signal Plt (50 persons), 294th MI Det (5), 909th QM Det (16), 1224th Eng Det (54), (Util/Construction) (In general, weekend training once per month and two weeks active training duty each year.)	520	Small Unit tactics, Land Nav, and Scouting & Patrolling		■					■	■	■							
	450	Battalion-sized Field Exercises		■					■		■							
	100	Group/Bde Command Post		■					■		■							
	50	Mobilization Processing Training									■							
	100	Primary Leadership Development		■					■	■	■							
		Water Purification/ROWPU							■		■							
		Field Engineering							■		■							
		Demolition								■								
	12 to 24	Parachute Operations															■	
		Small Arms Live-Fire							■									
GUAM AIR NATL GUARD 254 CE SVCS FLT		Base Construction and Repair										■						
Future Units Requested: Weather Recon/SAR Sqds		*(Future) Typhoon Prediction*										■						
		(Future) In Flight Refueling										■						

Table 1-1: Training Requirements and Frequency

TRAINING UNIT AND AUTHORIZED STRENGTH	TYPICAL TRAINING UNIT	TRAINING EVENTS	ANNUAL TRAINING FREQUENCY (note 1)	TINIAN			COMNAVMAR						AAFB		FDM	Guam Non-DoD Land	Rota Non-DoD Land
				TINIAN EMUA	TINIAN MLA	Tinian Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula & Camp Covington	Ordnance Annex	Communications Annexes	Main Base	Northwest Field	Andersen South			
GUAM ANG (continued)		*(Future) Search and Rescue*															
25th ID(L) and 6th ID(L)		Small Unit Tactics	every 2 years														
Tandem Thrust Exercise Participating Units		Force-on-Force Maneuvers															
		Bivouacs															
		Logistic Operations															
		Noncombatant Evacuation															
		Operations															

Notes:

1. Training frequency is total, i.e., the total amount of training would be divided among the available sites. IED training uses inert devices to deactivate explosive devices, and can be conducted at any location within government installations.

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Table 1-2 Military-Controlled Lands Used for Training

LOCALE	LAND AREA (km^2)	PRIMARY FUNCTION
Leaseback Area (Tinian)	36.92	Military training
EMUA (Tinian)	30.66	Military training
Ordnance Annex	35.78	Ordnance storage, operations, administration, training, and support
Waterfront Annex	18.13	Houses various activities and entities which fulfill the support role for Naval operations on Guam
AAFB Main Base	44.72	Aviation support for military operations in the Western Pacific
AAFB Northwest Field	17.72	Ground and aviation training
Andersen South	9.79	Contingency dormitories and training area
Communications Annex Finegayan	11.95	Receiver facility and communication center
Communications Annex Barrigada	7.48	Transmitter facility
Farallon de Medinilla	0.9	Aerial bombardment and naval gunfire training

Table 1-3 Screening Process to Identify Significant Issues

GENERAL TOPIC	POTENTIAL ISSUE	IS ISSUE SIGNIFICANT DUE TO TRAINING ACTIVITIES?
I. BIOLOGICAL FACTORS		
Threatened or endangered species, migratory birds	Will training activities affect the population of threatened or endangered species? Yes.	**Yes** (Issue 1). May disturb or take individuals; may transport BTS to CNMI, Hawaii, or the continental U.S.
Wetlands, reefs, & habitat	Will training activities adversely affect wetlands, reefs, and habitat? Yes.	**Yes** (Issue 1). May damage coral reef or habitat.
Wilderness resources	Will training activities affect the islands' wilderness resources? No.	No. No change from existing conditions.
Insects and disease	Will training activities introduce any new/noxious insects to the islands? No.	No. Managed by existing quarantine procedures.
II. CULTURAL RESOURCES		
Archaeological features, historic structures, National Landmarks	Will training activities affect archaeological/historic resources? Yes.	**Yes** (Issue 2). May cause damage/loss/destruction of significant resources or resources listed in National Register of Historic Places.
Cultural Practices	Will training activities interfere with traditional cultural practices? Maybe on Guam; not elsewhere.	**Yes** (Issue 6). Guam: May expose public to range safety fan during traditional cultural practice.
Visual resources	Will training activities affect visual resources? No.	No. No substantial change from existing conditions.
III. PHYSICAL FACTORS		
Air quality	Will training activities affect air quality? No.	No. No change from existing conditions.
Climate	Will training activities alter the climate? No.	No. No change from existing conditions. (Weather conditions affect training schedules and construction criteria for training support facilities.)
Geology	Will training activities alter unique landforms? No.	No. No change from existing conditions.
	Will proposed activities generate new hazards associated with earthquakes or flooding? No.	No. No change from existing conditions.
	Will training activities increase erosion? No.	No. No substantial change from existing conditions. Construction has the potential to cause localized erosion, which will be mitigated by routine erosion control practices.
Surface water quality (marine and fresh)	Will training activities affect the drainage of surface water? No.	No. No change from existing conditions.
	Will training activities contaminate surface water resources? No.	No. Potential effects mitigated by routine compliance with SOPs and environmental regulations.

Table 1-3 *(continued)*

GENERAL TOPIC	POTENTIAL ISSUE	IS ISSUE SIGNIFICANT DUE TO TRAINING ACTIVITIES?
Flooding	Will training activities reduce existing flood storage area? No.	No. No change from existing conditions.
	Will proposed action expose facilities or personnel to flood hazards? No.	No. No change from existing conditions.
Groundwater	Will training activities affect groundwater quality? No.	No. No substantial change from existing conditions. Most potential effects will be mitigated by routine compliance with SOPs and environmental regulations. (See Section 4.3 for discussion of wastewater disposal on Tinian.)
Noise	Will noise levels increase enough to disturb nesting threatened or endangered bird species and/or civilians? Yes.	**Yes** (Issues 1 & 5). May disturb Mariana crow and fruit bat habitats may disturb Rota homeowners.
IV. MAN-MADE HAZARDS AND CONSTRAINTS		
Airfield approach and departure	Will training activities interfere with existing airfield approach and departure patterns? Maybe on Tinian; not elsewhere.	**Yes** (Issue 5). May interfere with approaching/departing aircraft.
	Will training activities affect health and safety at and near airfields? Maybe on Tinian; not elsewhere.	**Yes** (Issue 5). May pose hazards to civilians on the ground in areas accessible to the public.
Firing ranges	Will proposed weapons training affect public health and safety? Maybe.	**Yes.** (Issue 6). Has potential to interfere with civilian aviation, generate new surface danger zone (SDZ), or generate additional UXO within existing UXO hazard area.
Electromagnetic radiation (EMR)	Will training activities increase EMR exposure? No.	No. No change from existing conditions. Training personnel will not enter EMR hazard zone to be generated by future VOA transmitter on Tinian.
Hazardous materials (HM) storage	Will training activities increase HM exposure? No.	No. No change from existing conditions.
Contaminated land and water	Will training activities expose the public to contaminated media? No.	No. No change from existing conditions.
Fire	Will training activities increase the number of wildfires? Maybe.	**Yes** (Issues 1 & 6). Demolition, pyrotechnics, and tracers have potential to ignite fires in relatively remote areas.
V. INFRASTRUCTURE		
Potable water supply	Will training activities affect the supply of potable water? No.	No. Demand on Tinian will be sporadic; public water supply has accommodated Tandem Thrust (TT) in the past.
Waste collection and disposal (stormwater, wastewater, solid & hazardous wastea)	Will training activities affect waste collection and disposal? Yes on Tinian; not elsewhere.	Tinian: **Yes** (Issue 4). No EPA-approved disposal facilities exist on Tinian; solid waste will be returned to Guam for disposal.
	Will the waste produced by training activities have adverse effects on the population? No.	No. No change from existing conditions.

Table 1-3 *(continued)*

GENERAL TOPIC	POTENTIAL ISSUE	IS ISSUE SIGNIFICANT DUE TO TRAINING ACTIVITIES?
Floodwater storage	Will training activities affect existing floodwater storage area? No.	No. No change from existing conditions.
Electricity and communications	Will training activities affect electricity and communications? No.	No. No change from existing conditions.
Airports	Will training activities affect airport operations? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in aircraft at West Tinian Airport during TT; need to establish communication protocol with civilian authorities.
Harbors	Will training activities affect harbor operations? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in vessels in harbor during TT; need to establish communication protocol with civilian authorities.
Roadways and traffic	Will training activities affect roadways and traffic? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in road traffic during TT; need to establish communication protocol with civilian authorities.
Public services	Will training activities affect the availability of public services? Maybe.	**Yes** (Issue 7). Potential forest or grass fire may require substantial use of public firefighting equipment; certain proposed activities may require periodic agency consultations and/or additional customs/immigration effort.
VI. SOCIAL ENVIRONMENT		
Land use	Will training activities affect present land use? No.	No. No change from existing conditions.
Socioeconomic conditions	Will training activities affect present socioeconomic conditions? Maybe.	Tinian: **Yes** (Issue 7). Possible interference with civilian plans for tourist development and with continued tourist access to destinations in EMUA. Guam: Yes (Issue 8). Temporary Apra Harbor closure affects recreational access to dive sites.
Environmental justice	Will training activities affect separate segments of the population differently? No.	No. No change from existing conditions. Tinian: Socioeconomic study did not find that the population is disadvantaged in comparison to the rest of the CNMI population.

Table 2-1 Tinian Sites for Amphibious Vehicle Landings

BEACH	USABLE AREA, PHYSICAL FEATURES	TRAINING FEATURES & SUITABILITY	ENVIRONMENTAL FEATURES & LAND USE CONSTRAINTS
Military Lease Area			
Unai Babui	Narrow rocky beach, shallow reef extends 100 m from shore, poor coral development, ±heavy surf	Fair beach trafficability; direct road access to land maneuver area **Recommend AAV; possible ±CRRC, ±swimmer**	2 % live coral on reef flat ± turtle nests
Unai Chulu	Broad sandy level beach, shallow reef extends 150 m from shore, moderate coral development, ±heavy surf	Good beach trafficability; direct access to land maneuver area **Recommend LCAC, possible ±swimmers**	Turtle nests, 25 to 35% (northern region) and 50 to 60% (southern region) live coral on reef flat, major archaeological resources adjacent to beach
Unai Dankulo	Series of sandy level beaches, high reef crest, frequently heavy surf, excellent coral development	Difficult reef and surf, very good beach & water trafficability; direct access to land maneuver area **Recommend LCAC**	Turtle nests, 50 to 70% live coral on reef flat
Non-DoD Land Areas			
Kammer Beach	±15m x 130m; broad sandy level beach, protected water	Very good beach & sheltered water, good trafficability but picnic shelters & trees limit movement; 10 km on public roads to land maneuver area **Recommend LCAC, AAV, LCU, CRRC**	Reef offshore of eastern half; inland area developed for public use (picnic pavilions), high recreational usage
Tachogna Beach	Shallow nearshore reef, extensive strand vegetation, steep beach gradient	Fair beach traffic feasibility, large vehicle assembly areas nearby, road network through Tinian to EMUA **Recommend LCAC**	Well-developed reef
Tinian Harbor	Boat ramp	**Recommend LCU**	Commercial port

Notes:
1. Source: Naval Special Warfare Unit ONE (14 April 94) Memorandum "Post-Operations Report for Tinian Island Training Conducted from 20-25 Mar 94" in Belt Collins & Associates (1994) Environmental Assessment: Military Exercise, Island of Tinian: Tandem Thrust 95.
2. Beaches feasible only for small boat (CRRC and RHIB) landings are not compared here.

Table 2-2 Waterfront Annex Sites for Amphibious Vehicle Landings

BEACH	USABLE AREA, PHYSICAL FEATURES	TRAINING FEATURES & SUITABILITY	ENVIRONMENTAL FEATURES & LAND USE CONSTRAINTS
Dadi Beach	Shallow reef 75 to 100 m out Sandy low- to moderate angle beach with room for 5 LCACs Access to roadway for offloaded vehicles Slight masking by hill on right flank will reduce LCAC prop/thruster wash	Good beach trafficability. No accessible land maneuver area Reef would damage LCU **Recommend LCAC only**	Nearshore reef, turtle nests, beach strand vegetation, archaeological resources on beach, family housing nearby
Tipalao Beach	Shallow reef strewn with visible boulders and metal debris; no live coral Adjacent fenced athletic field large enough to park 4 LCACs No road network from beach except through family housing	Good beach trafficability if debris is removed No adjacent maneuver area Reef & riprap would damage LCU, CRRC & RHIB **Recommend LCAC & AAV**	Family housing adjacent to beach Athletic field fence will require removal
Polaris Point	No reef; sandy bottom Recreation beach with 1.2 m sea wall Level, grassy field to right of beach large enough for 2 LCACs	Good beach trafficability, if swim buoys removed Limited access to paved roads No accessible land maneuver area **Recommend LCAC & LCU** **Possible AAV, CRRC & RHIB**	Developed for human recreation (picnic shelters, volleyball court)
Drydock Island	No reef; sandy bottom approaching Recreation beach Gently sloping grassy field behind beach large enough for 1 LCAC	Excellent trafficability and access to paved roads and highways No accessible land maneuver area **Recommend LCAC, LCU & AAV** **Possible CRRC, RHIB**	Recreation beach occasionally open to public Near Reserve Craft Beach, Navy refueling pier, deep draft anchorage Relatively remote; former temporary support structures removed after typhoon damage
WWII Refueling Pier (FISC Beach)	Nearshore area filled with riprap Remnants of concrete and metal sea wall Relatively abrupt bank accesses road between harbor and wetland	Satisfactory trafficability if nearshore area cleared and sea wall modified to allow ramp to be lowered for vehicle offload **Recommend LCU**	Access road borders a wetland Access road paving will not support tracked vehicles Will require inspection and repair for seawall area erosion
Sumay Cove Marina	Man-made cove with steep walls and a concrete boat ramp wide enough for LCU and AAV	Sheltered landing site, excellent trafficability No accessible land maneuver area **Recommend LCU and AAV using marina boat ramp**	Recreational boat marina adjacent to boat ramp Green sea turtles may be present in cove

Table 2-2 *(continued)*

BEACH	USABLE AREA, PHYSICAL FEATURES	TRAINING FEATURES & SUITABILITY	ENVIRONMENTAL FEATURES & LAND USE CONSTRAINTS
Toyland Beach	Nearshore area flat with clean bottom Nearshore area flat with clean bottom Gentle, sloping to flat grassy field suitable for vehicle offload and staging	Satisfactory trafficability, if 2 to 3 scrub trees and boulders are removed No accessible land maneuver area but immediate access to Highway 1 Activities visible from public highway, beach 200 m away **Recommend LCU, AAV and LCAC**	Small trees and boulders to remove
Atantano River	Remote waterbody with surrounding mangrove suitable for small-boat activities	Suitable for Navy SEALs boat ambush drills along both banks Recommend CRRC and RHIB	Mangroves at mouth of river Nearby moorhen habitat

Notes:
1. Source: On-site surveys by COMNAVMARIANAS, ACU-5/NBG (September 1997), and Naval Special Warfare Unit ONE Beach Reports (December 1992).
2. Beaches feasible only for small boat (CRRC and RHIB) landings are not compared here.

Table 2-3 Waterfront Annex Sites for Demolition Training

SITE	ACCESS-IBILITY	DEPTH AND SUBSTRATE	WEATHER PROTECTION	SECURITY CONSIDERATIONS	ENVIRONMENTAL FEATURES AND LAND USE CONFLICTS
EOD Deepwater Mine Countermeasures					
Outer Apra Harbor	Good	Suitable (38 m, sandy, no live coral)	Good	Excellent site observation	Recreational dive sites within safety radius
Dadi Beach (offshore)	Good	Suitable (13 to 30 m, sandy, no live coral)	Exposed from south and west	Clear of commercial activities and excellent site observation	Nearest dive site is 2 km away Marine mammals have been sited in general vicinity
SEALs Shallow Water Obstacle and Mine Countermeasures					
Glass Breakwater	Good	Suitable	Good	Good. Clear of ship channel Excellent site observation Temporary restrictions to commercial dive activities	
Spanish Steps	Good	Suitable	Good	Good. Clear of ship channel. No interference to commercial dive activities. Excellent site observation.	
Gabgab Beach	Good	Suitable	Good	Unsuitable. Recreation Beach often closed when ammunition transportation activities occurring at Kilo Wharf.	Abundant live coral
Polaris Point	Good	Suitable	Good	Readily secured, but conflicts with adjacent recreation beach.	
Drydock Island	Good	Suitable	Good	Readily secured, but may conflict with recreation and ship refueling activities.	
Dadi Beach	Good	Too shallow (<2 m)	Exposed from south and west	Fair. May conflict with recreation or be too close to base boundary.	Shallow reef with abundant coral
Tipalao Cove	Good	Suitable	Exposed from south and west	Good. Beach and water approaches easily secured and monitored. No interference with commercial activities.	

Table 2-4 Constraints on Training Land Use

LAND AREA	APPROXIMATE PERCENT RESTRICTED FROM FULL TRAINING USE
Tinian EMUA	40
Waterfront Annex	20
Waterfront Annex: Outer Apra Harbor	5
Ordnance Annex	50
AAFB	42
NCTAMS Finegayan	10

Table 2-5 Comparison of Tinian Alternatives

IMPACTS	NO LAND USE	REDUCED LAND USE	NO NEW ACTION	PREFERRED ALTERNATIVE	MAXIMUM LAND USE
Meets training needs for battalion-size maneuvers, amphibious assaults, joint exercises?	no—training cannot be duplicated on Guam	no—training cannot be duplicated on Guam	meets all needs except for AAV amphibious assaults	yes	yes
Could result in BTS import?	no	yes (any training on Tinian requires transport, usually from Guam)	yes (any training on Tinian requires transport, usually from Guam)	reduced risk–presence of logistics support camp would reduce need to ship vehicles and equipment for individual exercises	reduced risk–presence of logistics support camp would reduce need to ship vehicles and equipment for individual exercises
Will take endangered species?	absence of protection afforded by military lease could result in development and takes	no	no	no	possibly–by forest fire from mortar shells and projectile ricochets
Will destroy any wetlands, coral, or endangered species habitat?	absence of protection afforded by military lease could result in development and destruction	no	no	yes–24 m^2 coral at U. Babui	yes–substantial coral at U. Babui and U. Chulu
Expected to reduce species reproductive success from noise or other major disturbance?	absence of protection afforded by military lease could result in development and more continual noise disturbance	no	no	no	no
Potential to destroy historically significant cultural resources?	absence of protection and investigations afforded by military lease could result in site development and destruction	no	mitigated	mitigated	mitigated
Exposes public to safety hazards?	Yes; existing UXO contamination cannot be fully eliminated, and Navy oversight would be lost	mitigated by management actions	mitigated by management actions	mitigated by management actions	cannot be fully mitigated
Closes commercial access to tourist destinations?	no	possibly	yes	yes	yes
Reduces civilian jobs on Tinian?	no, but coordination by local officials would no longer be required	no	no	no	no

NOTES: 1.. Preferred Alternerative evaluated assuming it incorporates mitigation proposed in this DEIS

Table 2-6 Comparison of Waterfront Annex Alternatives

IMPACTS	NO LAND USE	REDUCED LAND USE	NO NEW ACTION	PREFERRED ALTERNATIVE	MAXIMUM LAND USE
Meets training needs for live fire, inwater and underwater training, amphibious landings on Guam?	no—only live fire is available elsewhere on Guam	no—only live fire is available elsewhere on Guam	meets all needs except fire & maneuver, AAV landings	yes	yes
Will take endangered species?	no	no	underwater demolition impacts mitigated by preblast surveys of Apra Harbor site	underwater demolition impacts at Apra Harbor mitigated by avoidance (preferential use of Dadi Beach site) and by preblast surveys	no
Will destroy any wetlands, coral, or endangered species habitat?	no	no	no	mitigated by restricting LCACs to certain landing conditions at Dadi Beach	yes—AAVs landing at former Fuel Pier could harm or disturb species in adjacent wetland
Will destroy historically significant cultural resources?	no	no	no	mitigated by restricting LCAC landing location at Dadi Beach	no
Closes commercial access to tourist destinations?	no	no, if underwater demolition eliminated	yes—4 hours/month (<1%) during underwater demolition in Outer Apra Harbor	mitigated by preferential use of Dadi Beach site instead of Apra Harbor site	yes—mitigated by preferential use of demolition site offshore of Dadi Beach
Reduces civilian jobs or income?	yes—no land use available for training would decrease military presence on Guam and reduce civilian jobs	no, if underwater demolition eliminated	yes—commercial dives are restricted 4 hrs/month in Outer Apra Harbor	mitigated by preferential use of demolition site offshore of Dadi Beach	mitigated by preferential use of demolition site offshore of Dadi Beach

NOTES: 1.. Preferred Alternerative evaluated assuming it incorporates mitigation proposed in this DEIS

Table 2-7 Comparison of Ordnance Annex Alternatives

IMPACTS	NO LAND USE	REDUCED LAND USE	NO NEW ACTION	PREFERRED ALTERNATIVE	MAXIMUM LAND USE
Meets training needs for sniper range, ground maneuvers, bivouac on Guam?	no (sniper range), yes but limited (ground maneuvers, bivouac)	[depends on "reduction"]	no (sniper range), yes (other)	yes	[same as preferred, but with no limits to sniper range or aviation]
Will take endangered species?	no	no	no **[snails: unknown]**	no **[snails: unknown]**	without altitude restrictions, some aviation might harass endangered species
Will destroy any wetlands or endangered species habitat?	no	no	no [snails: unknown]	no [snails: unknown]	no [snails: unknown]
Will destroy historically significant cultural resources?	no	no	no	no	no
Closes access to hiking trails?	no	no	no	no	yes
Disproportionately affects minorities?	no	no	no	no	no

NOTES: 1.. Preferred Alternerative evaluated assuming it incorporates mitigation proposed in this DEIS

Table 2-8 Comparison of AAFB and Communications Annex Alternatives

IMPACTS	NO LAND USE	REDUCED LAND USE	NO NEW ACTION	PREFERRED ALTERNATIVE	MAXIMUM LAND USE
Meets training needs for aviation units, rapid runway repair, and small unit ground maneuvers on Guam?	no—there is no alternative aviation training area on Guam	no—there is no alternative aviation training area on Guam	yes—rapid runway repair may be possible at Waterfront Annex	yes	[same as Preferred Alternative]
Will aircraft noise disturb endangered species?	no	no	no—flight tracks avoid crow territories	no—flight tracks avoid crow territories	[same as Preferred Alternative]
Will training at Haputo Beach harm rare tree snails?	no	no	no—personnel do not stray from established trail	no—personnel do not stray from established trail	[same as Preferred Alternative]
Will destroy any wetlands, coral, or endangered species habitat?	no	no	no	no	[same as Preferred Alternative]
Will destroy historically significant cultural resources?	no	no	no	no—rapid runway repair on nonhistoric taxiway, not potentially historic runway	[same as Preferred Alternative]

NOTES: 1.. Preferred Alternerative evaluated assuming it incorporates mitigation proposed in this DEIS

Table 2-9 Comparison of FDM Alternatives

IMPACTS	NO LAND USE	REDUCED LAND USE	NO NEW ACTION	PREFERRED ALTERNATIVE	MAXIMUM LAND USE[2]
Meets training needs for aerial bombardment range in Pacific Ocean?	no	no	yes	same as No New Action but more frequent	yes
Meets training needs for crew-served weapons fire in Marianas?	no	no	no	no	yes
Will take endangered species?	no	yes, if megapodes are present	yes, if megapodes are present	yes, if megapodes are present	yes, if megapodes are present
Will kill seabirds nesting on island?	no	yes	yes	yes	yes
Will destroy any wetlands, coral, or endangered species habitat?	no	yes, if megapodes are present [preferred habitat may be burned]	yes, if megapodes are present [preferred habitat may be burned]	yes, if megapodes are present [preferred habitat may be burned]	yes, if megapodes are present [preferred habitat may be burned]
Will destroy historically significant cultural resources?	no	none present	none present	none present	none present
Closes commercial access to fishing grounds?	no	temporarily closes small area (3 mile radius) to civilian vessels	temporarily closes small area (3 mile radius) to civilian vessels	temporarily closes small area (3 mile radius) to civilian vessels	temporarily closes small area (3 mile radius) to civilian vessels
Reduces civilian jobs or income?	no	no—nearest productive fishing grounds outside exclusion area	no—nearest productive fishing grounds outside exclusion area	no—nearest productive fishing grounds outside exclusion area	no—nearest productive fishing grounds outside exclusion area

NOTES: 1. Preferred Alternerative evaluated assuming it incorporates mitigation proposed in this DEIS
2. Maximum Land Use Alternative would require presence of anti-tank missile, artillery and mortar crews on the ground missile at FDM, which is not permitted by COMNAVMARIANAS due to the presence of cluster bombs scattered over the entire island.

Table 2-10 Preferred Alternative Training Land Use[1]

	TINIAN			COMNAVMAR TRAINING AREAS					AAFB			NON-DOD LAND		FDM
MAJOR TRAINING ACTIVITIES	EMUA	MLA	Non-DoD Land	Apra Inner Harbor	Apra Outer Harbor	Orote Peninsula /Camp Covington	Ordnance Annex	NCTAMS Finegayan/ Barrigada	Andersen Main	Andersen NW Field	Andersen South	Guam	Rota	
1. Field Maneuvers and Logistics Support			harbor					both						
2. Aviation Training														
Helicopter												Dandan		
Fixed-wing														
Paradrops												Dandan		
3. Amphibious Landings Using:														
Assault amphibian vehicles (AAV)	Babui		Kammer	Toyland	note 2	Tipalao								
Inflatable assault craft (CRRC/RHIB)								Finegayan					Songsong	
Air Cushion Landing Craft (LCAC)	Chulu, Dankulo		achogna	Toyland	note 2	Tipalao								
Displacement Hull Landing Craft (LCU)			Kammer	Toyland										
4. Live Fire Training														
Pistol and submachine gun(9mm)							Jungle trail	Finegayan						
Rifle and SAW (5.56mm)							Jungle trail	Finegayan						
Light machine gun (7.62mm)								Finegayan						
Sniper rifle (7.62 mm)														
Sniper rifle (.50 cal)														Note 3
Heavy machine gun (.50 cal)														Note 3

Table 2-10 *(continued)*:

	TINIAN			COMNAVMAR TRAINING AREAS					AAFB			NON DOD LAND		FDM
MAJOR TRAINING ACTIVITIES	**EMUA**	**MLA**	**Non-DoD Land**	**Apra Inner Harbor**	**Apra Outer Harbor**	**Orote Peninsula /Camp Covington**	**Ordnance Annex**	**Comm. Annex Finegayan/ Barrigada**	**Andersen Main**	**Andersen NW Field**	**Andersen South**	**Guam**	**Rota**	
40mm grenade														note 3
40mm rifle grenade launcher (training projectiles only)														
TRUE: Shooting/breaching house														
Artillery crew live fire														
60mm mortar (M766 training projectile only)														
60mm, 81mm mortar crew live fire														
Anti-tank missile fire														AT-4 from offshore Note 3
5. Underwater Demolitions														
Deepwater MCM (EODMU-5)				<= 5lb		Dadi								
Shallow water MCM (SEALs)						Tipalao								
6. Naval gun fire														
7. Aerial bombardment														

Notes:

1. See Figures 2-1 through 2-6 for detailed locations.
2. Outer Harbor Landings — AAV at Drydock Island, Polaris Point, Sumay Cove Marina; LCAC: Drydock Island, Polaris Point; LCU at Drydock Island, Polaris Point, WW II fuel pier, Sumay Cove Marina
3. SEALs embarked in RHIBs may fire from offshore to the same impact areas designated for naval gunfire on the west flank of FDM.

Table 2-11 Potential Impacts and Proposed Mitigation

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources				
Vegetation	Fire damage	Y, if it destroys habitat for endangerd species	Restrict use of open fires and aerial pyrotechnics to paved or low-fire hazard areas only.	Y
			Curtail use of fire-causing objects during periods when fire hazard is high.	
			Brief troops on potential for fire and contingency reactions.	
			Have appropriate firefighting equipment readily available for response at tent camps, firing ranges, landing zones, airfields, and vehicle maintenance and refueling areas.	
			Plan camp layouts with fire lanes; provide fire extinguishers in accordance with regulations.	
			Incorporate firefighting response drills into area security plan.	
			Prohibit use of tracer rounds at proposed Tinian and Ordnance Annex ranges.	
			Maintain crash-fire-rescue equipment near flight lines for large exercises.	
	Deplete vegetation by clearing for tactical exercises and bivouacs	Y, if it destroys habitat for endangered species	Restrict seasons of major clearing events in designated areas, to avoid physical disturbance of nests	Y
			Select already cleared areas for administrative camp sites.	
			Use and maintain established, surveyed DZs and LZs only.	
			Cut no vegetation larger than wrist size.	
			Minimize degree of vegetation clearing when preparing fighting positions and firing lanes.	
	Tinian: Deplete vegetation by clearing for new small arms and mortar ranges	Y (Tinian monarch habitat)	Replant 21 ha of tangantangan elsewhere in EMUA to mitigate for small arms range clearing, if monarch is still protected at the time of range construction.	Y
			MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE	
	Introduce allen weedy plant species	N	Comply with standard practice of checking clothing and boots for seeds, cleaning equipment before loading up for exercises, and inspecting impacted construction materials for the presence of noxious weeds.	N/A
	Salt spray from amphibious vehicles may harm terrestrial species	N	Impact is less common and of shorter duration than salt spray generated by typhoons, to which ecosystems are adapted.	N/A

Table 2-11 (*continued*):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources *(continued)*:				
Vegetation *(continued)*:	Amphibious vehicles or offloaded vehicles may disturb strand vegetation	N	Select beach ingress and egress routes to minimize vegetation impacts.	N/A
Wetlands	Loss of wetland function	Y	Restrict training access within wetlands.	Y
			Designate certain wetlands NT (No Training) or NWD (No Wildlife Disturbance), as necessary.	
	Guam: Harm mangrove roots by hiking during riverine training	N	Designate mangrove swamp at mouth of Atantano River NT.	N/A
Protected birds, bats, and terrestrial species	Introduce brown tree snake (BTS) or other invasive animal species to Tinian, Rota, FDM, Hawaii, or continental U.S. from Guam	Y	COMNAVMARIANAS or AAFB notify USDA of any exercise including transport from Guam to the CNMI, Hawaii, or CONUS. USDA erect temporary barriers, set snake traps, establish snake-sterile zones, steam clean all vehicles to dislodge BTS, inspect all cargo and MIL VANS with dogs, prohibit transport of material without "inspected" sticker, perform secondary inspection upon arrival at destination. Inspect all shipments leaving Guam for Hawaii or CONUS upon completion of exercise.	Y
			Update Navy and AAFB BTS control protocols as new control measures are adopted.	
	Disturb protected bird and bat species by noise or physical interference from aircraft, off road vehicles (including vegetation clearing), and blasting RRR sites	Y	Restrict training seasons and times of day in designated areas to avoid loud noises or physical disturbance of nests by vehicles, aircraft, or personnel during breeding seasons.	Y
			Guam: Observe altitude restrictions at AAFB and Ordnance Annex.	
			Designate primary habitat and nesting sites NT or NWD, as necessary.	
			Direct personnel to avoid collecting or disturbing wildlife for any reason.	
	Guam: Disturb endangered Mariana moorhens with blank firing in Atantano marshlands	Y, if birds are present in brackish waters	Avoid disturbing any birds or nests observed. (Moorhens are not expected to be in area used for training.)	Y
	Guam: Disturb tree snails at Haputo adjacent to hiking trail	N	Personnel will remain on established trail.	N/A
	Rota: Disturb endangered Mariana crows with noise from NVG helicopter flight training	Y, if birds nest near runways	NVG HELO TRAINING ON ROTA IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	Y

Table 2-11 (*continued*):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Natural Resources (*continued*):				
Protected birds, bats, and terrestrial species *(continued)*:	**FDM:** Harm or kill migratory seabirds or endangered Micronesian megapodes with naval gunfire or aerial bombardment	Y	Limit naval gunfire to western cliffs, minimizing impacts to eastern cliff.	N
			Limit aerial bombardment target areas to central portions of island, avoiding eastern cliffs and central isthmus.	N
			Enhance megapode habitat on Sarigan Island (compensatory mitigation).	N
	Guam: Injury to moorhens at Fena Reservoir from sniper rifles	N	Moorhens are protected from bullets by intervening terrain.	N/A
Terrestrial wildlife	**Guam:** Injury to carabao in Ordnance Annex from sniper rifles	N	Snipers are trained to notice movement and will be directed to avoid shooting carabao.	N/A
Protected marine species	Mortality of sea turtles from landing vehicles crushing nests or hatchlings on beaches, or inability of hatchlings to scale tire or track ruts in beach sand	Y	Survey landing beaches $\leq$ 6 hrs before landings, and flag areas free of nests. Landing vehicles and offloaded vehicles will remain in flagged nest-free areas. Biologist must be present during night landings, to watch for turtles.	Y
			Smooth out beach after amphibious vehicle landings.	
	Guam: Harm or kill sea turtles, marine mammals, or fish due to shock wave from deepwater MCM	Y (sea turtles only)	Survey blast area to 1000 m radius prior to exercise to identify marine animals. If protected species are encountered, halt training until the animals have left the area.	Y
			Use Dadi Beach site instead of Apra Harbor site, when weather permits.	
			Use only 10-lb charges at Apra Harbor site, as long as Dadi Beach site is available for 20-lb charges.	
			Conduct post-blast surveys to identify number of fish kills and any sea turtles killed or injured; reevaluate protocol after 2 years.	
	FDM: Harm or kill sea turtles or whales in nearshore waters during naval gunfire or aerial bombardment	Y	Sea turtles have not commonly been observed near FDM. Areas will be surveyed for sea turtles and whales prior to exercises; if animals are observed, the exercise will be postponed until such have left the impact area.	Y

Table 2-11 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? Y/N	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? Y/N
Natural Resources *(continued)*:				
	Guam: Harm or kill sea turtles or whales in nearshore waters during floating mine neutralization	N	Survey area for protected marine animals prior to exercise.	N/A
Coral reef and sand beach	AAVs crush coral in water <1.8 m deep	Y	AAV LANDINGS AT UNAI CHULU AND UNAI DANKULO ARE NOT INCLUDED IN PREFERRED ALTERNATIVE.	N
			Tinian: Restrict AAV landings in EMUA to Unai Babui. Limit approach to single permanently marked lane 22 m wide. Do not conduct landings at low tide.	
			Tinian: Monitor effects by surveying Unai Babui before and after AAV landings (or at least twice per year) for % coral cover, topography, turbidity, sedimentation rates, fish assemblage. Unai Lamlam will also be surveyed, as a control site.	
			Guam: Restrict AAV landings to areas with no live coral reef.	Y
	Bow wave generated by LCACs at low speeds may break coral on shallow reef flats	Y	**Unai Chulu, Unai Dankulo, Dadi Beach:** Only cross reef flat fully on-cushion, slowing down or turning only over land.	Y
			Avoid turning LCAC in shallow waters over reef flats.	
			Survey landing beaches <1 week prior to exercise ; avoid landings on beaches with >6° slope (which would cause LCAC to slide out over shallow water at low speed).	
			Tinian: Monitor effects by surveying Unai Chulu before and after LCAC landings (or at least twice per year) for % coral cover, topography, turbidity, sedimentation rates, fish assemblage. Unai Lamlam will also be surveyed, as a control site.	
	Guam: Damage to coral structure from shock waves generated by deepwater MCM	Y	Avoid underwater demolition within 100 m of reef.	Y
	Guam: Damage to reef flats from shallow water MCM	Y	Restrict use of live charges to offshore areas with no live coral in waters 3 to 8 m deep, i.e., Breakwater, Tipalao, and Spanish Steps beaches.	Y
			SHALLOW WATER MCM AT GABGAB BEACH IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	Y
	FDM: Damage to coral from UXO or from bomb explosions at water surface	N	(No evidence of such impacts was observed in recent marine surveys.)	N/A

Table 2-11 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? Y/N	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? Y/N
Natural Resources *(continued):*				
Coral reef and sand beach *(continued):*	Landing vehicles and offloaded vehicles disturb beach vegetation and sand	N	Select beach ingress and egress routes to minimize vegetation impacts.	N/A
			Use beach matting, where necessary, to reduce erosion and rutting caused by disembarking vehicles traversing soft sand.	
			Restore beach topography upon completion of exercise.	
			Avoid engineered modifications of beaches (e.g., regrading other than for restoration of original topography).	
Insects and diseases	Introduce new/noxious insects or diseases	N	Adhere to existing quarantine procedures for cargo and equipment inspections.	Y
			Transport all solid waste (SW) from Tinian in containers designed for steam sterilizing, and sterilize according to standard procedures upon arrival on Guam.	Y
Cultural Resources				
Historically significant archaeological resources, historic structures, National Historic Landmarks	Programmatic: Damage or data loss from ground disturbance by offroad vehicles, construction, rapid runway repair, or excavation of fighting positions or latrines	Y	Designate areas NT or NCRD (no cultural resources disturbance), as appropriate.	Y
			Physically mark NT boundaries so they can be identified both day and night in areas lacking naturally recognizable boundaries.	
			Publish information and maps identifying known historic and cultural areas for exercise planning.	
			No digging within 1 meter of historic structures with concrete walls or in any cave.	
			Monitor training activities for adherence to restrictions, as needed.	
			If cultural resources are encountered, cease any disturbance and notify COMNAVMARIANAS Enviromental Division.	

Table 2-11 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Cultural Resources *(continued)*:				
Historically significant archaeological resources or historic structures, National Historic Landmarks *(continued)*:	Programmatic: Damage or data loss from ground disturbance by offroad vehicles, construction, rapid runway repair, or excavation of fighting positions or latrines *(continued)*:		**Tinian:** Install signs or flagging, as needed, to remind trainees of NCRD areas. **Tinian:** Complete data recovery to enable more offroad vehicle travel.	
	Damage or data loss from vandalism	Y	Brief troops on history and significance of resources. Provide educational handouts for exercise participants to understand and protect resources prior to training.	Y
	Tinian: Projectile impacts on walls of former Japanese Command Post from TRUE training	Y	Photo-document condition before and after use of proposed temporary bullet traps; cease live fire training if damage to walls occurs.	Y
	Tinian: Disturbance of Unai Chulu prehistoric complex by offroad vehicles, especially in high grass	Y	Designate entire archaeological site NCRD.	Y
	Tinian: Disturbance of Unai Babui burials and prehistoric deposits by AAVs	Y	Designate vicinity NCRD.	Y
	Guam: Disturbance of Dadi Beach cave sites by vehicles disembarking LCACs	Y	Designate LCAC landing zone that avoids vicinity of cave sites.	Y
	Guam: Defacement of latte villages in Ordnance Annex by sniper rifle projectile impacts	Y	Site targets so that lattes are protected by topographic features (hills). Do not use range and jungle trail until COMNAVMARIANAS Cultural Resources Manager has approved target locations.	Y
	Guam: Damage to historic runways at Northwest Field from RRR cratering	Y	RRR is proposed for a former taxiway, not a historic runway. Minimize damage by creating 3 permanent craters for repetitive use.	Y
	Guam: Damage to submerged historic resources in Apra Harbor from shock waves generated by deepwater MCM	Y	No damage is likely. Reduce use of this site in favor of Dadi Beach site, weather permitting.	Y
Visual resources	Damage to scenic resources (tourist sites) from demolition or weapons fire	N	Avoid demolition and weapons training in proximity to scenic areas.	N/A

Table 2-11 *(continued)*:

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Environmental Quality				
Air quality	Increased amounts of smoke and dust generated by training	N	Do not use smoke or tear gas in areas with civilians present or downwind.	N/A
			Use sanitary waste burn cans in locations downwind of camps and visitor locations.	
Climate	Increased potential for fire within training areas during droughts (cumulative with other sources of sparks)	Y	Curtail training as necessary during droughts, particularly in areas with rudimentary or nonexistent firefighting capabilities.	Y
Geologic features	**Tinian:** Cratering in impact area	N	MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	N/A
Groundwater and soil	Contamination from improper field sanitation or improper disposal of portable toilet waste	N	Comply with field sanitation SOP; remove and dispose of solid wastes, gray and black water.	N/A
			Ensure contractors dispose of portable toilet wastes appropriately.	N/A
	Contamination from accidental release of fuel during vehicle/aircraft refueling, maintenance, or repair activities or at temporary hazardous materials/hazardous waste storage area(s)	N	Comply with existing regulations and SOPs regarding fuel and haz mat/haz waste handling, transportation, and spill control.	N/A
			Avoid performing scheduled maintenance during field exercises.	
			Refuel only on paved surfaces and using standard spill containment measures.	
			Avoid overfilling vehicle fuel tanks to allow for fuel expansion.	
	Soil erosion and rutting from ground excavation, construction activities, gray water disposal to ground, amphibious vehicles traversing beaches, or projectile impacts at firing ranges	N	Restore training areas to original grade and revegetate, as necessary, upon completion of training activities.	N/A
	ROWPU effluent disposal could affect groundwater	N	ROWPU effluent will be discharged only to an infiltration trench or septic system.	
Surface water quality (marine and fresh)	Increased siltation and/or turbidity due to erosion from amphibious landings, beachside offloading of vehicles and cargo, riverine training	N	Do not land vehicles on silty (vs. sandy) shorelines, or use matting to minimize vehicle effects on soil.	N/A
	FDM: Increased erosion due to cliffside bomb impacts	N	(There is no evidence that bombing has greatly augmented the naturally dramatic erosion process on FDM.) Avoid targeting eastern cliffs.	N/A

Table 2-11 (continued):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Environmental Quality *(continued)*:				
Surface water quality (marine and fresh)	Contamination from accidental release of fuel during vehicle/aircraft refuehighling, maintenance, or repair activities	N	Avoid performing scheduled maintenance during field exercises.	N/A
			Refuel only on paved surfaces and using standard spill containment measures.	N/A
			Avoid overfilling vehicle fuel tanks, to allow for fuel expansion.	N/A
	Degradation from runoff of gray water or ROWPU effluent	N	Direct gray water or ROWPU effluent away from surface water bodies, in accordance with SOPs.	N/A
	Potential heavy metal contamination from lead bullets in over-water SDZs	N	Construct/maintain dirt berms/bullet stops behind targets.	N/A
Flooding	None		None required.	N/A
Noise	**Rota:** Disturb nearby populated areas and avifaunal from rotary-wing landings and takeoff at night	N	NVG FLIGHT CREW TRAINING ON ROTA IS NOT INCLUDED IN PREFERRED ALTERNATIVE.	N/A
	Guam: Disturbances to Tipalao residents from LCAC landings at Dadi and Tipalao Beaches	N	Perform landings during daylight hours only.	N/A
Man-made Hazards and Constraints				
Commercial aviation facilities and traffic	**Tinian:** Interference with Tinian-Saipan commuter flights and international flights in/out of Saipan International Airport	Y	Coordinate with FAA during planning and have direct communication with air traffic control officials during military flights, in accordance with SOPs and FAA regulations.	Y
			Issue NOTAM for use of North Field.	
	Tinian: Interference of airborne and airmobile operations at West Tinian Airport with flight operations	Y	Coordinate with civilian authorities at least one week prior to military landings at West Tinian Airport.	Y
			Move military aircraft out of active runway areas as quickly as possible.	
			Maintain lateral safety clearances from active runways and landing zones; avoid conflicts between training activities and accident potential zones at ends of runways.	
			Restrict training dates/times to avoid major holidays, when heavier tourist traffic is expected.	

Table 2-11 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued)*				
Commercial aviation facilities and traffic *(continued):*	**Tinian:** Interference of airborne and airmobile operations at West Tinian Airport with flight operations *(continued):*		Publish NOTAM for parachute drops east of West Tinian Airport.	
			Restrict flight tracks/hours, as needed.	
			Have crash, fire, rescue equipment readily available.	
	Tinian: (Mortar rounds trajectory intersecting civilian flight tracks)	Y	MORTAR RANGE IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	Y
	FDM: Interference of bomber aircraft with civilian air traffic.	Y	Publish NOTAMS and notify FAA, warning civilian aircraft out of 4.3-km-radius restricted airspace.	Y
Civilian and military fuel storage facilities	**Tinian:** EMR hazards to fuel (HERF) and personnel (HERP)	N	Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, and fueling operations.	N/A
			Publish VOA frequencies and EMR zones in training instructions for Tinian (COMNAVMARIANAS INSTR 5440.1C).	
Public health & safety	Safety hazards to civilians on historic trails adjacent to small arms ranges (EMUA and Waterfront Annex)	N	Publish specific range regulations and distribute to all units planning training activities.	
			Adhere to all safety requirements prior to and during live-fire and demolition activities, particularly required range area sweeps and surveillance to ensure no danger to others. Curtail firing if anyone enters range area.	
			Guam: Close portions of historic trail to visitors during range use.	
			Tinian: Erect temporary security gates, closing EMUA during range use.	
	Safety hazards to boaters and divers in small arms range over-water SDZs	N	Publish NOTAMs and NOTMARs.	N/A
			Maintain observation of water SDZ during range use.	
			Mount and use warning signs, flags, or strobe lights on shore during range use.	
			Mark SDZs on local navigation charts.	
			Cease firing if boat enters SDZ.	

Table 2-11 (continued):

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued)*				
Public health & safety *(continued)*:	**Guam:** Safety hazards from sniper rifles to hikers on trail passing through Ordnance Annex	Y	Range will be designed so that SDZ does not intersect hiking trail.	Y
	Guam: Safety hazards to boaters and divers near deepwater MCM site.	Y	EOD personnel clear site and exclusion zone prior to exercise.	Y
	Guam: Safety hazards to civilian divers from potential sympathetic detonation of depth charges on TOKAI MARU	N	[Sympathetic detonation is unlikely to result from explosion of 10- and 20-lb charges over 1 km from TOKAI MARU. No mitigation proposed.]	N/A
	Tinian: Safety hazards to tourists encroaching UXO impact area for proposed mortar range.	N	MORTAR RANGE IS NOT INCLUDED IN THE PREFERRED ALTERNATIVE.	N/A
	Tinian: Electromagnetic radiation (EMR) hazards to personnel (HERP) from communications equipment used in training	N	Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, fueling, and ordnance operations. Provide EMR hazard overlays to training units as necessary.	N/A
Airports	**Tinian:** Military aircraft may interfere with civilian air traffic at West Tinian Airport	Y	Communicate/coordinate with FAA and civil authorities 30 days in advance of any exercise.	Y
			Issue NOTAMs and NOTMARs 72 hours prior to any exercise.	
			Plan military helicopter activity avoid commercial flight tracks and Saipan approach and departure altitudes, whenever possible.	
			Avoid parking ramp tie ups by military aircraft.	
	Increased demands on local customs and immigration services	N	Notify local authorities 30 days before large exercises. Identify time frames and locations for customs and immigration support in advance of the exercise.	N/A
Harbors	Interference with civilian ports of entry	N	Schedule shipments in advance. Coordinate with civilian authorities 30 days in advance of any exercise using harbor.	N/A
			Minimize time necessary to be alongside in port.	
	Increased demands on customs and immigration services	N	Notify local authorities 30 days before large exercises.	N/A

Table 2-11 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Man-made Hazards and Constraints *(continued):*				
Roadways and traffic	Road damage by tracked vehicles	N	Inspect tracked vehicles for serviceable track pads.	N/A
			Allow only rubber-padded track-laying vehicles on roads.	
			Avoid neutral steer/pivot turns on paved roads.	
			Use equipment haulers for tracked vehicles with all-steel tracks.	
	Interference with civilian traffic	N	Establish military traffic control and security within training areas accessible to others.	N/A
			Notify local authorities 7 days in advance of troop transport on public roads.	
Public services	**Tinian:** Increased demands on public safety authorities	N	Coordinate with the local fire and police departments; augment civilian forces as appropriate.	N/A
Infrastructure				
Potable water supply	**Tinian:** Depletion of local water supply during large exercises	N	Conduct advance planning with municipality to identify requirement, times, and places for issue.	N/A
Wastewater disposal systems	Chronically overload Tinian's municipal septic system capacity	Y	Delay emptying portable toilet waste, if large functions are occurring at Field House.	N
			Direct waste to proposed base camp septic system, once it has been built.	
	Increased cumulative demand for public wastewater treatment system if tourism greatly increases	N	Secure agreement from municipality to allow portable toilet waste disposal to public treatment system (if one is built).	N/A
			Direct waste to proposed base camp septic system, once it has been built.	
Solid and hazardous waste collection and disposal facilities	**Tinian:** Absence of RCRA-approved SW disposal facility for exercise-generated waste	Y	Backhaul SW to DoD facility on Guam for proper disposal.	Y
	Guam: Depletion of GovGuam or private landfill capacity	N	Do not use GovGuam or private landfill. Dispose SW in DoD landfill at Apra Harbor.	N/A
	Interference with civilian need for shipping capacity due to transport of SW from Tinian to Guam	N	Coordinate with local shipping companies and ensure adequate shipping capacity prior to large exercises. Delay shipping SW, if necessary, until adequate ships are available.	N/A

Table 2-11 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Infrastructure *(continued)*				
Solid and hazardous waste collection and disposal facilities (continued)	Disposal of ships' waste nearshore	N	Comply with COMNAVMARIANAS/C7F directives and federal regulations not to dispose of SW within 25 nautical miles of shore.	N/A
	Tinian: Absence of RCRA-approved hazardous waste (HW) disposal facility in CNMI or Guam	Y	Ship HW to DoD facility or continental U.S. for proper disposal.	Y
Floodwater storage	None	N/A	None required.	N/A
Electricity and communication	**Tinian:** Temporary increased demand for electricity	N	Communicate and coordinate with appropriate local agencies prior to exercise. Supplement commercial power with field generators.	N/A
Social Environment				
Land use	Interference with/encroachment on neighboring land use/property	N	Monitor activity within training area to identify and avoid potential encroachments.	N/A
	Safety risks to neighboring areas and inhabitants from use of firing ranges and established EOD sites	Y	Establish buffer zones, traffic control, and area monitors/umpires, as necessary, to eliminate civillian encroachment into range areas.	Y
	Conflicts with civilian activities	N	Schedule/coordinate potentially conflicting activities with appropriate local agencies 30 days prior to exercise. Publish NOTAMs and NOTMARs.	N/A
	Noise disturbance by aircraft near residential areas	N	Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAMs and NOTMARs.	N/A
	Danger to civilians from training on non-DoD lands (paradrops only)	N	Obtain permission from property owner prior to exercise.	N/A
	Disfigurement of publicly accessible land areas by littering or effects of bivouacs and logistics support activities	N	Clean and inspect all training areas. Do not bury paper trash or other training residue. ("Pack It In; Pack It Out")	N/A
	Tinian: Longterm UXO contamination of proposed mortar range impact area	Y	MORTAR RANGE IS NOT INCLUDED IN PREFERRED ALTERNATIVE	Y
	Guam: Aggravation of ongoing dispute over control of Apra Harbor	N	Continue efforts to resolve dispute.	N/A

Table 2-11 *(continued):*

RESOURCE	POSSIBLE IMPACT	IS ISSUE SIGNIFICANT AND IMPACT LIKELY? (Y/N)	PROPOSED MITIGATION	WILL MITIGATION REDUCE TO NON-SIGNIFICANCE? (Y/N)
Social Environment *(continued)*				
Commercial enterprises	Increased demand on various commodities	N	Give notice to local officials and merchants so they can prepare for increase in demand and avoid shortages.	N/A
			Contract locally for required services.	
	Tinian: Closure of EMUA to tour companies and tourists due to small arms range use	Y	Give 30 days' advance notice before curtailing access to tourist sites within EMUA.	Y
	Tinian: Closure of EMUA to subsistence fishers due to small arms range use	N	Establish an access corridor to accommodate civilian visitors, when possible.	
	Guam: Closure of portions of Apra Harbor to commercial boat and diving operations for 4 hours once per month	Y	Reduce use of this site in favor of Dadi Beach site, weather permitting.	Y
Tinian government and agencies	Inconvenience regarding joint use of civilian facilities (West Tinian Airport, field house)		Notify Mayor's office at least 30 days prior to exercises.	N/A
Environmental justice	Disappropriate hardship on local minority or economically disadvantaged population	N	Design training activities to eliminate conflict, promote mutual understanding, and enhance local economy.	N/A

Table 3-1 Rare and Protected Native Species in the Marianas

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
BIRDS							
Acrocephalus luscinia	nightingale reed-warbler	E	√	*			
Actitis hypoleucos	common sandpiper	M,R(G)		X			
Aerodramus vanikorensis bartschi	island swiftlet	E		X	*	*	
Anas acuta	northern pintail	M,R(G)		X	X		
Anas crecca	green-winged teal	M,R(G,T)		X	X		
Anas oustaleti	Mariana mallard	E	√	*	*		
Anas penelope	Eurasian widgeon	M,R(G,T)		X	X		
Anas querquedula	garganey	M,R(G,T)		X	X		
Anas strepera	gadwall	M,R(G,T)		X	X		
Aplonis opacas guami	Micronesian starling	GE		X	X	X	X
Ardeola speciosa	Chinese pond heron	M,R(G)		X			
Arenaria interpres	ruddy turnstone	M		X	X	X	X
Aythya ferina	common pochard	M,R(G)		X			
Aythya fuligula	tufted duck	M,R(T)		X	X		
Bubulcus ibis	cattle egret	M		X	X	X	X
Buteo sp.	buteo	M,R(G)		X			
Calidris ferruginea	curlew sandpiper	M,R(G)		X			
Charadrius mongolus	Mongolian plover	M,R(T)		X	X		
Chlidonias leucopterus	white-winged tern	M,R(G,T)		X	X		
Corvus kubaryi	Mariana crow	E	√	X		X	
Egretta garzetta	little egret	M,R(G)		X			
Egretta intermedia	intermediate egret	M,R(G,T)		X	X		
Gallicolumba x. xanthonura	white-throated ground dove	GE		*	X	X	X
Gallinago sp.	snipe	M,R (G,T)		X	X		
Gallinula chloropus guami	Mariana common moorhen	E	√	X	X	X	
Halcyon c. cinnamomina	Micronesian kingfisher	E		▲			
Heteroscelus bervipes	gray-tailed tattler	M		X			
Heteroscelus incanus	wandering tattler	M		X	X		
Himantopus himantopus	black-winged stilt	M,R(G)		X			
Megapodius laperous	Micronesian megapode	E	√	*	X	*	X

GE Listed as endangered by Guam government
E Federally listed as endangered
T Federally listed as threatened
S Species of concern (may be deserving of federal endangered status, but listed yet)
C Candidate for federal listing
R Rare or uncommon
P Protected locally (through hunting laws)
M Migratory

(G) on Guam
(R) on Rota
(T) on Tinian
(F) on FDM

X present
* presumed extinct on this island
▲ in captive breeding program (no longer found in the wild)
√ if endemic

Table 3-1 *(continued):*

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
BIRDS *(continued):*							
Milvus migrans	black kite	M,R(G)		X			
Monarcha takatsukasae	Tinian monarch	T	√		X		
Motacilla cinerea	gray wagtail	M,R(G)		X			
Myiagra freycineti	Guam flycatcher	E	√	*			
Myzomela rubrata saffordi	cardinal honeyeater	GE		*	X	X	
Numenius phaeopus	whimbrel	M,R(T)		X	X	X	X
Numenius tahitiensis	bristle-thighed curlew	M,S		X			X
Pluvialis fulva	Pacific golden plover	M		X	X	X	X
Pluvialis squatarola	black-bellied plover	M,R(G)		X			
Porzana cinerea	white-browed crake	GE		*			
Ptilinopus roseicapilla	Mariana fruit-dove	GE	√	*	X	X	
Puffinus pacificus	wedge-tailed shearwater	GE		*	X		
Rallus owstoni	Guam rail	E		▲			
Rhipidura rufifrons	rufous fantail	GE		*	X	X	
Sula dactylatra	masked booby	R(T)			X		X
Sula leucogaster	brown booby			X	X	X	X
Sula sula	red-footed booby					X	X
Tringa glareola	wood sandpiper	M,R(T)		X	X		
Tringa nebularia	common greenshank	M,R(G)		X			
Tringa stagnatilis	marsh sandpiper	M,R(G,T)		X	X		
Zosterops c. conspicillatus	Guam bridled white-eye	E		*			
Zosterops conspicillatus rotensis	Rota bridled white-eye	C(R)	√			X	
MAMMALS							
Emballonura semicaudata	sheath-tailed bat	GE		*		*	
Pteropus mariannus mariannus	Mariana fruit bat	E(G), S(T,R)		X	X	X	X
Pteropus tokudae	little Mariana fruit bat	E	√	*			
REPTILES							
Chelonia mydas	green sea turtle	T		X	X	X	X
Cryptoblepharus poecilopleurus	snake-eyed skink	GE		X			
Emoia astrocasteta	tide-pool skink	GE		X			
Emoia cyanura	azure-tailed skink	GE		X			
Emoia slevini	Slevin's skink	GE	√	X			
Eretmochelys imbricata	hawksbill sea turtle	E		X	X		
Gehyra oceanica	oceanic gecko	GE		X			
Lipinia noctua	moth skink	GE		X			
Nactus pelagicus	Pacific slender-toed skink	GE		X		X	
Perocinis ateles	Micronesian gecko	GE		*			

Table 3-1 *(continued):*

LATIN NAME	COMMON NAME	STATUS	ENDEMIC	LOCATION			
				GUAM	TINIAN	ROTA	FDM
INVERTEBRATES							
Birgus latro	coconut crab	P(T)		X	X		X
Catacanthus sp.	bronze boonie bug	R(G)		X			
Euploea eleutho	Marianas euploea butterfly	C(G,R)		*		*	
Hypolimnas octocula marianensis	Marianas eight-spot butterfly	R(G)		X			
Isabelloscia sp.	Almagosa cave isopod	R(G)		X			
Melita sp.	Almagosa cave amphipod	R(G)		X			
Partula gibba	Mariana Islands tree snail	GE, C (G,R)		X		X	
Partula radiolata	Pacific tree snail	GE, C (G)		X			
Partula salifana	Guam tree snail	GE,S		*			
Salomona guamensis	Guam karst cricket	R(G)		X			
Samoana fragilis	Mariana Islands fragile tree snail	GE, C (G,R)		X		X	
Succinea guamensis	Guam tree snail	S		*			
Succinea piratarum	Guam tree snail	S		X			
Succinea quadrasi	Guam tree snail	S		X			
PLANTS							
Callicarpa lamii	no common name	R(T)		X	X	X	
Canthium odoratum	no common name	R(T)		X	X	X	
Coelogyne guamensis	orchid	S(G,R)		X		X	
Cyanthea lunulata	tree fern	GE		X			
Digitaria gaudichaudii	bunch grass	R(F)	√		X		X
Enhalus acoroides	no common name	R(T)			X		
Euphorbia sparrmannii	seagrass	R(T)		X	X		
Gossypium hirsutum	seaside cotton	R(F)			X		X
Heritiera longipetiolata	ufa tree	GE		X	X		
Lycopodium phlegmaria	club moss	S(G,R)		X		X	
Nervilia jacksoniae	no common name	S(G,R)		X		X	
Nesogenes rotensis	no common name	C(R)				X	
Osmoxylon mariannense	no common name	C(R)				X	
Serianthes nelsonii	fire tree	E(G,R)		X		X	
Tabernaemontana rotensis	no common name	C(G,R)		*		X	

Note: Information obtained from the Status and Distribution of Marine Turtles on Tinian Report; the Micronesian Forest Bird Survey; the USFWS table of listed, proposed, and candidate species; the Guam Natural Resource Management Plans; the Ornithological and Mammalian Surveys for Tinian; the Final EIS for FDM; the Final Report for Flora and Fauna Survey of Tinian; the Botanical Survey of FDM, the Avifaunal Survey Report of FDM, and a personal communication with USFWS (December 10, 1996).

Table 4–1 Evaluation Criteria for Side Effects Which Could Result in Reduced Species Survival or Recovery

ACTIVITY SIDE EFFECT	PARAMETER	SIGNIFICANT IF
BTS introduction	Transport from Guam	Population is established at a new location
Loud noise generation	Unexpectedness, especially during times of heightened sensitivity: -Breeding season for Mariana crows -Night (foraging time for Mariana fruit bats)	During an atypical time of day OR By an atypical source at a sensitive location and time
Visual disturbance	Appearance	Threatening enough to trigger nest abandonment (Mariana crow)
Vegetative clearing	Loss of habitat	More than 10% of the population is affected OR No substitute of equivalent function available
Substrate disturbance	Land: Destruction of eggs, nests, or young Water: Destruction of coral	Land: Ground-nesting species known to be present in nesting habitat Water: Greater than 1% total island coral reef is impacted and coral covers at least 5% of substrate.
Fire	Likelihood of occurrence	Ignition source is present in habitat areas AND Source of tinder is dry and present in habitat areas AND Means to extinguish is not present or a plan is not in place
Projectile impact and explosion	Area of effect Presence of protected species or habitat	Takes of listed species or habitat modification are likely
Underwater shock wave	Charge size, depth, and distance	Impulse greater than 2 psf-ms* and overpressure greater than 50 psi affect marine resources of intrinsic importance
Explosion	Effective casualty radius AND dud rate	Occurs in critical or other important habitat

Notes: * Pounds per square foot per millisecond.

Table 4-2 Evaluation Criteria for Potential Impacts on Cultural Resources

RESOURCE	EFFECT OF TRAINING ACTIVITIES	SIGNIFICANT IF
Historically "significant" resources and National Historic Landmarks	Ground disturbance/damage to resources	Mechanical vegetation clearing activities are planned.
		Vehicles used off established roads.
		Subsurface excavation activities are planned.
		Large numbers of personnel are present.
	Direct impact of projectile/ ricochets	Live fire is used and resources are in line of fire.
	Vandalism (includes removal, defacement, and movement of resources)	Activities require movement of resources.
		Large numbers of personnel are present.

Table 4-3 Evaluation Criteria for Potential Impacts of Wastewater Disposal

WASTEWATER TREATMENT SYSTEM	PARAMETERS	SIGNIFICANT IF
Existing municipal septic systems	Capacity	Addition of military wastewater* would cause one or more overflow or surfacing events
		Addition of military wastewater* would increase maintenance requirements by 10%
	Toxicity	Addition of PT wastewater would damage/destroy tank microorganisms
Future municipal wastewater treatment plant (if constructed)	Capacity	Addition of military wastewater* would cause one or more overflow of surfacing events
	Toxicity	Addition of military wastewater* would increase maintenance requirements by 10%
Future DoD septic system	Impacts on groundwater	Contaminants could leach to drinking water source
Field disposal	Impacts on groundwater	Contaminants could leach to drinking water source

NOTES: 1. I.e., the combination of PT wastewater and "direct addition" by military use of showers and toilets at Field House.

Table 4-4 Evaluation Criteria for Potential Impacts of Solid and Hazardous Wastes Generated on Tinian

CRITERION	PARAMETER	SIGNIFICANT IF
SW transportation	Presence	No commercial or military vessels available to transport SW containers between Guam and CNMI
	Means of controlling pest/disease import	No protocols and associated infrastructure established
	Import from CNMI to Guam	Prohibited by law
SW disposal facility	Presence	No RCRA-compliant facilities available within Guam/CNMI region (per 40 CFR 257 and 258)
	Landfill service life	SW from Tinian would shorten service life by 5% or more
HW and HM transportation	Presence	No DOT-compliant commercial or military aircraft or vessels available (per 49 CFR 257 and 258)
	Import from CNMI to Guam or continental U.S.	Prohibited by law
Permitted HW TSDF	Presence	No RCRA-permitted facilities available within Marianas (per 40 CFR 171-173)
HW Storage	Presence	No temporary (<90 day) storage facility or permitted HW TSDF in Guam or CNMI (per 40 CFR 261 and 262)
HW, HM, used oil handling and storage	Means of preventing and controlling spills	No SOPs and associated infrastructure are established or present

Table 4-5 Evaluation Criteria for Potentially Significant Effects of Live-Fire Training

ACTIVITY SIDE EFFECT	PARAMETER	SIGNIFICANT IF
Personnel safety	Risk of injury to personnel in range area, surface danger zones, nearby roads and trails, and adjacent waters	Lack of range SOP, range and SDZ safety observers, communications, and positive range control to keep all unauthorized personnel clear of the ranges
		Lack of ability to inspect a range (range sweep) for UXO prior to using a range for training, and prior to departing a range after training
		Lack of standard public notifications (NOTMAR, maps, press releases, etc.)
		Lack of roadblocks and sentries to stop vehicular traffic through the range area
	Risk of injury by UXO	Lack of means to clear UXO caused by training activities
Aviation safety	Risk of damage to aircraft by aloft munitions	Lack of NOTAM publication and direct communication with FAA to coordinate mortar training and commercial/military flight activity
Damage to roads	Risk of mortar round impacts on public thoroughfares	Lack of immediate road repair capability

Table 4-6 Evaluation Criteria for Potential Aviation Training Impacts on Public Safety

ACTIVITY SIDE EFFECTS	PARAMETER	SIGNIFICANT IF
Personnel safety at airfields	Interference with civilian aircraft activities	Communication with FAA is non-existent AND Absence of established public notification (NOTAM) and area clearance protocol AND Military and/or civilian flights do not follow established flight tracks
	Hazards to civilians on ground	Civilians have access to airfield during military air operations
Shared airspace	Damage to civilian aircraft	Lack of NOTAM publication and FAA notification in advance AND Lack of "no-fly zone" for area above mortar range
Activated landing zones and drop zones in airfield operating areas	Interference with/interference by civilian aircraft	Civilian aircraft overfly these training areas AND Absence of established public notification (NOTAM) and area clearance protocol

Table 4-7 Evaluation Criteria for Potential Socioeconomic Impacts

RESOURCE	ACTIVITY	SIGNIFICANT IF
Tourism revenues	Access to EMUA or Apra Harbor dive sites	Area closed with less than 7 days' prior notice OR Area closed for more than 10% of each year (36 days) OR EMUA closed for more than 5 days sequentially without one month's prior notice
	Military aircraft landing and parking at West Tinian Airport	Requires cancellation of civilian flights
Local authorities (Tinian Mayor's Office, Commonwealth Port Authority, Emergency Management Office [Saipan], FAA [Saipan])	Agency oversight and coordination	Notice not provided 7 days prior to exercise

Table 4-8 Underwater Demolition: Range of Effects

CHARGE	CHARGE DEPTH	EFFECT CRITERION	VALUE OF CRITERIA	RANGE OF EFFECT
1 lb	3 m	Fish 10% mortality	40 to 70 psi (depending on fish size)	103 m for 1 oz fish 55 m for 1 lb fish 27 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	(note 2)
10 lb	38 m	Fish 10% mortality	40 to 70 psi (depending on fish size)	200 m for 1 oz fish 129 m for 1 lb fish 79 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	272 m (@ surface) 2,174 m (@ 28 m deep)
20 lb	19 m	Fish 10% mortality	40 to 70 psi (depending on fish size)	261 m for 1 oz fish 169 m for 1 lb fish 106 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressue of 2 psi-ms & 100 psi	247 m (@ surface) 1,691 m (@ 19 m deep)
20 lb	38 m	Fish 10% mortality	40-70 psi (depending on fish size)	283 m for 1 oz fish 182 m for 1 lb fish 111 m for 30 lb fish
		Non-injury range for swimmer	Impulse and peak over pressure of 2 psi-ms & 100 psi	343 m (surface) 2739 (@ 28 m deep)
		Small risk injury range for swimmer	Impulse and peak overpressure of 10 psi-ms	972 m (@ 28 m deep)

Notes:
1. NAVSEA SWO61-AA-MMA-010; Technical Manual; "Use of Explosives in Underwater Salvage"; January 1994.
2. N/A. Shallow water detonations are not covered in safety distance tables. Energy is lost to the atmosphere so reduced proportions of blast energy are propagated into underwater shock waves.

Table 4-9 Underwater Demolition Effects on Submerged Resources

SUBMERGED RESOURCES	DISTANCE TO APRA HARBOR DEEPWATER MCM SITE	EFFECT
TOKAI MARU	1511 m	Minor peak overpressure
Nearest shipwrecks	630 m	Unsafe for swimmers; no fish effects
Dive site "bomber"	950 m	Unsafe for swimmers; no fish effects
Dive site "junk yard"	1825 m	Unsafe for swimmers, no fish effects
Middle ground	±950 m	Unsafe for swimmers, no fish effects

Appendix A
NEPA Documentation

A-1: Notice of Intent
A-2: Distribution List for Notice of Intent
A-3: Announcement of Scoping Meetings
A-4: Scoping Meeting Attendance Records
A-5: Scoping Meeting Group Memory
A-6: Written Scoping Comments
A-7: Distribution List for DEIS
A-8: Agency Comment Letters & Responses

Appendix A-1
Notice of Intent

rvice Corps, what can the Corporation do to further the mission, vision, and goals that engage Americans of all ages and backgrounds in community-based rvice?

2. Price of national service—How can we deliver national service in a way that costs less but that is as, or more, effective? For instance, for AmeriCorps programs, think in light of common aspects such as direct service, living allowance and benefits, education award, diversity, community-driven partnerships, non-federal match, and national identity.

3. Increasing the non-federal share of the budget—What functions and activities might be the most attractive to outside funders? What kinds of incentives might be necessary? What is a realistic time table for increasing the percentage of funds from the private and independent sectors?

4. Corporation structure—What is an effective and efficient field structure? What are the appropriate roles for state commissions and the Corporation, including the state offices?

5. Politicization—How can we guard against the politicization of national service? Are there any aspects of current Corporation programs and practices that create a perception of politicization?

6. Partnership relations—What products, assistance, information do you need from the Corporation? What services would make the partnerships more effective?

In order to contribute in a timely manner to the discussions concerning the reauthorization of the Corporation and its programs, the Corporation invites public commentary on any aspect of the Corporation for National Service, its policies, and its programs, including the issues presented above. Specific statutory references are preferred, but are not necessary to the submission of comments. All comments will be considered but the Corporation will not be able to reply individually to each submitter.

Dated: November 22, 1995.

Terry Russell,

General Counsel, Corporation for National and Community Service.

[FR Doc. 95-29045 Filed 11-27-95; 8:45 am]

BILLING CODE [illegible]

DEPARTMENT OF DEFENSE

Office of the Secretary

Notice of Intent To Prepare an Environmental Impact Statement for Proposed Military Training in the Territory of Guam and Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands

AGENCY: U.S. Pacific Command, DOD.

ACTION: Notice of intent.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR parts 1500–1508), the U.S. Pacific Command announces its intent to prepare an Environmental Impact Statement (EIS) for proposed military training in the Territory of Guam on the Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands (CNMI).

The actions to be covered in the EIS consist of training activities required to maintain military combat readiness. The EIS will analyze reasonable alternatives to meet this objective and assess their separate and cumulative environmental impacts. The U.S. Pacific Command will initiate a scoping process to identify significant related issues for study in the EIS and to identify and notify parties interested in and affected by the EIS.

The meetings will open with a short presentation of the purpose of the proposed action and alternatives to be evaluated, followed by a period for public comment. It is important that interested agencies, individuals, and organizations take this opportunity to identify environmental concerns that should be addressed in the EIS. To allow time for all views to be shared, each speaker will be limited to five minutes for oral comments.

Interested parties are also invited and encouraged to provide written comments in addition to, or in lieu of, oral comments at the public meetings. Scoping comments should clearly describe specific issues or topics that the EIS should address.

DATES: Three public scoping meetings will be held.

Guam: December 4, 1995, 7–10 pm.
Rota: December 6, 1995, 7–10 pm.
Tinian: December 7, 1995, 7–10 pm.

ADDRESSES: The scoping meetings will be held in the following locations:

Agana, Guam: Governor's Cabinet Room, Adelup Complex.
Sinj Song Village, Rota, CNMI: The Round House.
San Jose, Tinian, CNMI: Tinian School Cafeteria.

FOR FURTHER INFORMATION CONTACT: Written statements and/or questions regarding the scoping process should be mailed no later than December 22, 1995 to Mr. Fred Minato (Code 230), Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860–7300; telephone (808) 471–9338; fax (808) 474–4990.

SUPPLEMENTARY INFORMATION: The proposed action consists of future military training activities in Guam and CNMI within existing military installations, public lands, and waters, including large-scale joint military exercises. Training will involve organizations from the U.S. Army, U.S. Marine Corps, U.S. Navy, U.S. Air Force, U.S. Army Reserve, Guam Army National Guard, and allied nations. Federal and Guamanian law enforcement agencies also train on these lands. The proposed training will take place on Tinian, primarily in the Military Lease Area, on Rota, primarily at Sand Island and the public airport, and on Guam, primarily at Andersen Air Force Base, Naval Activities Guam Ordnance Annex, and Apra Harbor. The proposed action also includes continued use of the island of Farallon de Medinilla for naval gunfire training and aerial bombardment.

Proposed training activities include tactical maneuver on foot and by wheeled and tracked vehicles, beach landings with hoist-, air-cushioned landing craft, and tracked amphibian vehicles, parachute, fixed- and rotary-wing aircraft operations, underwater explosive ordnance training, military weapons and munitions training, and various logistical support activities.

Alternatives consist of: (1) The no action alternative, (2) the limited training activities alternative, (3) the proposed training activities alternative, and (4) alternate training locations. The "no action" alternative consists of continuing present training activities under present conditions, with no adjustment to planned future military needs. The "limited training activities" alternative consists of a sub-set of proposed training activities, based on constraints including the limitation of certain activities to avoid significant impacts to the environment. The "proposed training activities" alternative consists of implementing all proposed activities at the designated training locations. The use of alternate training locations is not applicable to this project.

Environmental issues to be addressed will include, but not be limited to: effects on cultural resources, terrestrial and aquatic habitats, threatened or endangered species, water quality, infrastructure, traffic, noise, and socioeconomic environment. Direct, indirect, and cumulative impacts will be analyzed, and mitigation measures will be developed as required.

Dated: November 22, 1995.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 95-29003 Filed 11-27-95; 8:45 am]

BILLING CODE 5000-04-M

Dated: November 14, 1995.

Patricia L. Toppings,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

Department of the Air Force

Privacy Act of 1974; Amend and Delete Systems of Records.

AGENCY: Department of the Air Force, DOD.

ACTION: Amend and delete systems of records.

SUMMARY: The Department of the Air Force proposes to delete one and amend two systems of records notices in its inventory of systems of records notices subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended.

DATES: The deletion is effective November 28, 1995. The amendments will be effective on December 28, 1995, unless comments are received that would result in a contrary determination.

ADDRESSES: Send comments to the Assistant Air Force Access Programs Officer, SAF/AAIQ, 1610 Air Force Pentagon, Washington, DC 20330–1610.

FOR FURTHER INFORMATION CONTACT: Mr. Jim Gibson at (703) 697–3491 or DSN 227–3491.

SUPPLEMENTARY INFORMATION: The complete inventory of Department of the Air Force system of records notices subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended, have been published in the Federal Register and are available from the address above.

The deletion and amendments are not within the purview of subsection (r) of the Privacy Act (5 U.S.C. 552a), as amended, which requires the submission of an altered system report. The specific changes to the systems of records notices are set forth below followed by the systems notices, as amended, published in their entirety.

DELETION

F168 ACC A

SYSTEM NAME:

Physician Retention Program *(March 11, 1993, 58 FR 13460).*

Reason: System is no longer needed and was discontinued in 1993. There are no plans to reinstate this system in the future. Records maintained in the system have been destroyed.

* * * * *

AMENDMENT

F050 ACC S

SYSTEM NAME:

Instructional Systems Development (ISD) Evaluation *(March 11, 1993, 58 FR 13454).*

CHANGES:

SYSTEM NAME:

Delete entry and replace with 'Operations Training Development Evaluation'.

SYSTEM LOCATION:

Delete entry and replace with 'Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.'

CATEGORIES OF INDIVIDUALS COVERED BY THE SYSTEM:

Delete entry and replace with 'Air Combat Command aircrew members, pilots, copilots, navigators, radar navigators, electronic warfare officers, who are attending, or have attended a course of instruction conducted by the 11 Bomb Squadron, Barksdale Air Force Base, LA 7110–3000.'

CATEGORIES OF RECORDS IN THE SYSTEM:

Delete entry and replace with 'Computerized information file compiled from questionnaires about training accomplished while attending a course of instruction; to include the responder's name, Social Security Number, base of assignment and subjective assessment of the training received.'

AUTHORITY FOR MAINTENANCE OF THE SYSTEM:

Delete entry and replace with '10 U.S.C. 8013, Secretary of the Air Force: powers and duties; delegation by; Air Force Manual 36–92234, Instructional Systems Development; Air Combat Command Instruction 36–92250, Operations Training Development Program, and E.O. 9397.'

* * * * *

SYSTEM MANAGER(S) AND ADDRESS:

Delete entry and replace with 'Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.'

NOTIFICATION PROCEDURE:

Delete entry and replace with 'Individuals seeking to determine whether this system of records contains information on themselves should address inquiries to the Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

Requests to determine existence of record should include full name, and grade, Social Security Number and approximate dates individual attended a course of instruction.'

RECORD ACCESS PROCEDURES:

Delete entry and replace with 'Individuals seeking to access records about themselves contained in this system should address requests to the Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

Requests should include full name, and grade, Social Security Number and approximate dates individual attended a course of instruction.'

* * * * *

F050 ACC S

SYSTEM NAME:

Operations Training Development Evaluation.

SYSTEM LOCATION:

Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

CATEGORIES OF INDIVIDUALS COVERED BY THE SYSTEM:

Air Combat Command aircrew members, pilots, copilots, navigators, radar navigators, electronic warfare officers, who are attending, or have attended a course of instruction conducted by the 11 Bomb Squadron Barksdale Air Force Base, LA 7110–3000.

Appendix A-2
Distribution List for Notice of Intent

MILITARY TRAINING IN THE MARIANAS EIS
DISTRIBUTION LIST FOR THE NOTICE OF INTENT

Attn: G-3t
Commanding General
III Marine Expeditionary Force FMF
Unit 35601
FPO AP 96606-5601

Attn: S-3
Commanding Officer
31st Marine Expeditionary Unit FMF
Unit 35821
FPO AP 96606-5621

Attn: N45
Commander
Naval Forces Marianas
FPO AP 96536-0051

Commanding Officer
U. S. Naval Station Guam
PSC 456 Box 152
FPO AP96540-1000

Commanding Officer
Explosive Ordnance Disposal Mobile Unit Five
Unit NR 25499
FPO AP96601-4591

Commanding Officer
Navy Special Warfare Unit One
PSC 455 Box 182
FPO AP96540-1182

Commanding Officer
U.S. Naval Mobile Construction Battalion 40
Unit 25306
FPO AP96601-4981

Commanding Officer
U.S. Naval Computer and Telecommunications
Area Master Station
WESTPAC
PSC 488 Box 101
FPO AP96540-5039

Attn: CES/CEX/SG/OSS
Commanding Officer
36th Air Base Wing PACAF
Unit 14003
APO AP 96543-4003

Attn: LGTX-CME
Commanding Officer
374th Trans
Unit 5120
APO AP 96328-5120

Attn: DOT/CEV
Commanding General
Headquarters Pacific Air Force
Hickam Air Force Base, Hawaii 96853-5001

Attn: APIX-EN
Commanding General
IX Corps (RINF) 9th Army Reserve Command
2058 Maluhia Road Fort DeRussy
Honolulu, Hawaii 96815-1997

Lt. Commander James Loeffler
CINCPACFLT Code N328
250 Makalapa Drive
Pearl Harbor, Hawaii 96860-7000

Commanding Officer
Headquarters 1st Battalion 24th Infantry (Light)
Guam Army National Guard
622 East Harmon Industrial Park Road
Fort Juan Muña, Tamuning, Guam 96911-4421

Attn: GU-ARO-T
Commander
Guam Territorial Area Command
Guam Army National Guard
622 East Harmon Industrial Park Road
Fort Juan Muña, Tamuning, Guam 96911-4421

Commanding General
Headquarters U.S. Army Pacific
APOP-TR
Fort Shafter, Hawaii 96858-5100

Mr. Robert Andersen and Mr. Robert Beck
Division of Aquatic and Wildlife Resources
Deparment of Agriculture
Government of Guam
P.O. Box 2950
Agana, Guam 96910

Guam EPA
D-107 Harmon Plaza
130 Rojas Street
Harmon, Guam 96911

USEPA
Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Attn: Brooks Harper
U.S. Department of the Interior
Fish and Wildlife Service
300 Ala Moana Boulevard, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

Division of Fish and Wildlife
Deparment of Natural Resources
CNMI Government
Saipan, MP 96950

Attn: Dennis Geiser
CNMI
Division of Environmental Quality
P.O. Box 1304
Saipan, MP 96950

Director Elizabeth Sala-Balajadia
Government of the Northern Mariana Islands
Officer of the Director
Department of Public Works
Lower Base
Saipan, MP 96950

Officer of the Lieutenant Governor
Commonwealth of the Northern Mariana Islands
Capitol Hill
Saipan, MP 96950

George Baldwin
Coastal Resources Management
CNMI
Morgen Building 2nd Floor
San Jose Village
Saipan, MP 96950

CWO-2 Dave Koegel
NSWU-1 PSC 455
FPO AP96540-1182

R 30215
Commanding Officer
EODMU-5
Unit NR 25491
FPO AP96601-4591

Lt. Chris Fassero
NCTAMS
PSC 488
Box 107
FPO AP96537-1805

Richard K. Boice
Ernst & Young
Orlean Pacific Plaza , Suite B 201
865 South Marine Drive
Tamuning, Guam 96911

Mark O. Rudo
Archaeologist
National Park Service: Western Region
600 Harrison Street, Suite 600
San Francisco, CA 94107-1372

Carmen Sanchez
Tinian Historic Preservation
Office of the Mayor of Tinian & Aguigan
San Jose Tinian, MP 96952

Edwin M. Hofschneider
Tinian Coastal Resources Management
P.O. Box 108
San Jose Tinian, MP 96952

Attn: Deborah Clark
Department of Land & Natural Resources
Division of Public Land
San Jose Village Tinian, MP 96952

Attn: Heidi Hirsh
Andersen AFB
36 CES/CEV
Unit 14007
APO AP 96543-4007

Attn: Timothy Villagomez
CNMI Commonwealth Utility Commission (CUC)
P.O. Box 1220 Lower Base
Saipan, MP 96950

Department Head
CNMI Deparment of Fish & Wildlife
Lower Base
Saipan, MP 96950

Ike Cabrera, Acting Chief
CNMI Division of Environmental Quality
P.O. Box 1304 (Morgan Building) 3rd Floor
Saipan, MP 96950

Attn: Scott Russell
CNMI Division of Historic Preservation
Department of Community & Cultural Affairs
Office of The Governor
Saipan, MP 96950

Attn: Elizabeth (Liz) Salas-Balajadia PE
CNMI DPW
Government of The Northern Mariana Islands
Office of The Director Dpw
Lower Base Saipan, MP 96950

Attn: Ron Barrineau
CNMI Council for the Humanities
AAA 3394 Box 10001
Saipan, MP 96950

Ben Sablan
Director
CNMI Department of Natural Resources
Lower Base Saipan, MP 96950

Attn: Connie Fleming-Power
Office of the Mayor
Women's Affairs Office
P.O. Box 59
Tinian, MP 96952

Attn: R. Jeffery Schorr
U.S. Department of the Interior
Territorial & International Affairs
P.O. Box 2622 Saipan, MP 96950

Stephen Stouter
Environmental Coordinator
Naval Station Guam
PSC 455 Box 152
FPO AP96540-1000

Randel Sablan
Planner Environmental Review
Guam Environmental Protection Agency
Harmon Plaza Complex Unit D-107
130 Rojas Street
Harmon, Guam 96911

Pedro Dela Cruz
Director
Department of Commerce & Labor
CNMI
Capitol Hill
Saipan, MP 96950

Mike Fitzgerald
Tinian Mayor's Office
San Jose Village
Tinian, MP 96952

John S. Sanchez
U.S. Fish & Wildlife Service
P.O. Box 8134 MOU-3
Dededo, Guam 96912

Daniel S. Yeatts
USGS Water Resources Division
P.O. Box 59
Tinian, MP 96952

Richard Davis
Historic Preservation Officer
Deparment of Parks & Recreation
Historic Resources Division
490 Chalan Palasyo
Agana Heights, Guam 96919

Michael Ham
Administrator
Guam Coastal Management Program
Bureau of Planning
P.O. Box 2950
Agana, Guam 96910

Mike Pitzler
District Supervisor/Wildlife Biologist
USDA Aphis Animal Damage Control
1060 Route 16 Suite 103C
Barrigada Heights, Guam 96921

Priscilla Dela Cruz
Deputy Managing Director
Marianas Visitors Bureau
P.O. Box 861
Saipan, MP 96950

Commanding Officer
Headquarters Headquarters Company
USAR Marianas
56 Ammon Avenue
Barrigada Heights, Guam 96913

Deparment of Parks & Recreation
Historic Resources Division
P.O. Box 2950
Agana, Guam 96910

Commander
SOCPAC
Box 64046
Camp H.M. Smith, Hawaii 96861-4046

Lt. Harshburger or Lt. Commander S. Jean Dumlao-Hurst
Commander POC
PSC 489 Box 6
FPO AP96536-0051

Jeff Barr
CNMI Commonwealth Utility Corp (CUC)
P.O. Box 431
Tinian, MP 96952

Herman Guerrero
CNMI Office of The Governor
Executive Assistant
P.O. Box 10007
Saipan, MP 96950

Senator Hope A. Cristobal
Chairperson
Committee on Federal and Foreign Affairs
Suite 210 Quan Building
326 West Soledad Avenue
Agana, Guam 96910

Senator Don Parkinson
Speaker/Chairman
Committee Electrical Power & Consumer Protection
Suite 222 Julale Shopping Center
424 West Obrien Drive
Agana, Guam 96910

Mayor's Council of Guam
Adelup Complex
P.O. Box 786
Agana, Guam 96910

Mr. Eugene Nitta
Protected Species Program Coordinator
National Marine Fisheries Service
U.S. Deparment of Commerce
2570 Dole Street
Honolulu, Hawaii 96822

Ms. Machelle Leon Guerrero
Chief Planner
Bureau of Planning
P.O. Box 2950
Agana, Guam 96910

Mr. Joseph M. Borja
Administrative Director
Chamorro Land Trust Commission
P.O. Box 2950
Agana, Guam 96910

Mr. Juan B. Rosario
Director
Civil Defense/Guam Emergency Service Office
P.O. Box 2877
Agana, Guam 96910

Mr. John M. Quinata
Director
Customs & Quarantine
1503 Central Avenue
Tiya,n Guam 96913

Mr. Michael W. Kuhlmann
Director
Deparment of Agriculture
192 Dairy Road
Mangilao, Guam 96923

Ms. Gayle Hendricks
Interim Director
Deparment of Education
P.O. Box DE
Agana, Guam 96910

Mr. J.A. Martinez
Director of Land Management
P.O. Box 2950
Agana, Guam 96910

Mr. A.J. Shelton
Director
Deparment of Parks and Recreation
Building 13-8
Tiyan, Guam 96913

Mr. Dennis Rodriguez
Director
Deparment of Public Health and Social Services
P.O. Box 2816
Agana, Guam 96910

M.r Gil A. Shinohara
Director
Deparment of Public Works
542 North Marine Drive
Tamuning, Guam 96911

Mr. Darryl Taggerty
Director
Disaster Recovery Office
P.O. Box 2950
Agana, Guam 96910

Mr. Ricky Reynolds
Executive Manager
Guam Airport Authority
P.O. Box 8770
Tamuning, Guam 96931

Mr Joe C. Cruz
Administrator
Guam Environmental Protection Agency
P.O. Box 22439
GMF Guam 96921

Mr. Gil P. Reyes
Acting Fire Chief
Guam Fire Department
P.O. Box 2950
Agana, Guam 96910

Mr. Ramon Q. Sudo
Adjutant General
Guam National Guard
622 East Harmon Industrial Park Road
Tamuning, Guam 96911-4421

Mr. Jack S. Shimizu
Chief of Police
Guam Police Department
P.O. Box 23909
GMF Guam 96921

Mr. Richard Young
General Manager
Guam Power Authority
P.O. Box 2977
Agana, Guam 96910

Ms. Christine Scott-Smith
Director
Guam Public Library
254 Martyr Street
Agana, Guam 96910

Mr. Vicente M. Camacho
General Manager
Guam Telephone Authority
P.O. Box 9008
Tamuning, Guam 96931

Mr. Eulogio C. Bermudes
General Manager
Port Authority of Guam
1026 Cabras Highway, Suite 201
Piti, Guam 96925

Mr. Richard Quintanilla
Chief Officer
Public Utility Agency of Guam
P.O. Box 3010
Agana, Guam 96910

Mr. Frank Camacho
Executive Assistant
Territorial Planning Council
101 N Street
Tiyan, Guam 96913

Mr. Richard Underwood
Superintendent
Tiyan Reuse Authority
BEQ Building Seagull Avenue
Tiyan, Guam 96913

Office of the Governor
Executive Chambers Adelup
P.O. Box 2950
Agana, Guam 96910

Mr. Vince Leon Guerrero
District Director
Guam District Office
U.S. House of Representatives
Rep. Robert A. Underwood
Suite 107 Capitol Plaza
Father Duenas Avenue
Agana, Guam 96910

Ms. Teresita P. Schroeder
Administrative Assistant
Washington Office
U.S. House of Representatives
Rep.. Robert A Underwood
424 Cannon Hob
Washington, D. C. 20515

Guam Project Office
U.S. Army Corps of Engineers
PAC Daily News Building. Suite 905
238 Ohara Street
Agana, Guam 96910

Superintendent
War in the Pacific
National Historic Park
P.O. Box FA
Agana, Guam 96910

Executive Director
Advisory Council On Historic Preservation
1100 Pennsylvania N. W., Room 809
Washington, D. C. 20004

Director
Western Office Project Review
Advisory Council on Historic Preservation
730 Simms Street, Room 450
Golden, CO 80401

A-3
Announcement of Scoping Meetings

Published in Pacific Daily News November 18, 19, & 20, 1995

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DEPARTMENT OF DEFENSE

Office of the Secretary

Notice of Intent to prepare an Environmental Impact Statement for Proposed Military Training in the Territory of Guam and Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands.

AGENCY: U.S. Pacific Command

ACTION: Notice of Intent

SUMMARY: Pursuant to Section 102 (2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500-1508), the U.S. Pacific Command announces its intent to prepare an Environmental Impact Statement (EIS) for proposed military training in the Territory of Guam and on the islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands (CNMI).

The actions to be covered in the EIS consist of training activities required to maintain military combat readiness. The EIS will analyze reasonable alternatives to meet this objective and assess their separate and cumulative environmental impacts.

The U.S. Pacific Command will initiate a scoping process to identify significant related issues for study in the EIS and to identify and notify parties interested in and affected by the EIS.

The meetings will open with a short presentation of the purpose of the proposed action and alternatives to be evaluated, followed by a period for public comment. It is important that interested agencies, individuals, and organizations take this opportunity to identify environmental concerns that should be addressed in the EIS. To allow time for all views to be shared, each speaker will be limited to five minutes for oral comments.

Interested parties are also invited and encouraged to provide written comments in addition to, or in lieu of, oral comments at the public meetings. Scoping comments should clearly describe specific issues or topics that the EIS should address.

DATES: Three public scoping meetings will be held.
Guam: December 4, 1995, 7:00-10:00 PM
Rota: December 6, 1995, 7:00-10:00 PM
Tinian: December 7, 1995, 7:00-10:00 PM

ADDRESSES: The scoping meetings will be held in the following locations:
Agana, Guam: Governor's Cabinet Room, Adelup Complex
Sing Song Village, Rota, CNMI: The Round House
San Jose, Tinian, CNMI: Tinian School Cafeteria

FOR FURTHER INFORMATION CONTACT: Written statements and/or questions regarding the scoping process should be mailed no later than December 22, 1995 to Mr. Fred Minato (Code 238), Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860-7300; telephone (808) 471-9338; (808) 474-4890.

SUPPLEMENTARY INFORMATION: The proposed action consists of future military training activities in Guam and CNMI within existing military installations, public lands, and waters, including large-scale joint military training exercises. Training will involve organizations from the U.S. Army, U.S. Marine Corps, U.S. Navy, U.S. Air Force, U.S. Army Reserve, Guam Army National Guard, and allied nations. Federal and Guamanian law enforcement agencies also train on these lands. The proposed training will take place on Tinian, primarily in the Military Lease Area, on Rota, primarily at Sand Island and the public airport, and on Guam, primarily at Andersen Air Force Base, Naval Activities Guam Ordnance Annex, and Apra Harbor. The proposed action also includes continued use of the island of Farallon de Medinilla for naval gunfire training and aerial bombardment.

Proposed training activities include tactical maneuver on foot and by wheeled and tracked vehicles, beach landings with boats, air-cushioned landing craft, and tracked amphibian vehicles, paradrops, fixed- and rotary-wing aircraft operations, underwater explosive ordnance training, military weapons and munitions training, and various logistical support activities.

Alternatives consist of: 1) the no action alternative, 2) the limited training activities alternative, 3) the proposed training activities alternative, and 4) alternate training locations. The "no action" alternative consists of continuing present training activities under present conditions, with no adjustment to planned future military needs. The "limited training activities" alternative consists of a sub-set of proposed training activities, constraints including the limitation of certain activities to avoid significant impacts to the environment. The "proposed training activities" alternative consists of implementing all proposed activities at the designated training locations. The use of alternate training locations is not applicable to this project.

Environmental issues to be addressed will include, but not be limited to, effects on cultural resources, terrestrial and aquatic habitats, threatened or endangered species, water quality, infrastructure, traffic, noise, and the socioeconomic environment. Direct, indirect, and cumulative impacts will be analyzed, and mitigation measures will be developed as required.

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IN THE SUPERIOR COURT OF GUAM TERRITORY OF GUAM

IN THE MATTER OF THE ESTATE OF DAVID JOSEPH PEREDA PEREZ, Deceased.
PROBATE CASE NO. PR0069-95
NOTICE TO CREDITORS

notice is hereby given by the undersigned, Administrator of the ESTATE OF DAVID JOSEPH PEREDA PEREZ, Deceased, to the creditors of, and all persons having claims against the said estate or against said deceased, that within two (2) months after the first publication of this notice, they either file them with the necessary vouchers in the office of the Clerk of the Superior Court of Guam, or exhibit them with necessary vouchers to the Law offices of Cabot & Perez, Suite 109, Capitol Plaza, 120 Father Duenas Avenue, Agana, Guam, 96910, the same being the place for the transaction of the said estate.

Dated this 15th day of November, 1995.

/s/Gregory J. Perez
GREGORY J. PEREZ

StayWell Seeks

A-4
Scoping Meeting Attendance Records

ATTENDANCE RECORDS for Three Public Scoping Meetings and one CNMI Government Meeting:

1. ADELUP, GUAM — DECEMBER 4, 1995

Edward Chargualaf	Fort San Juan Muna 622 E. Harmon Ind Park Road Tamuning, Guam 96911-4421	Guam Army National Guard
Robert D. Anderson	Dept of Agriculture P.O. Box 2950, Agana 96910 735-3979	Division of Aquatic and Wildlife Res.
Stan Kot	Guam National Wildlife Refuge 355-5096	National Biological Survey
Thomas R. Sharp	Guam National Wildlife Refuge 355-5096	National Biological Survey
Richard K. Boice	865 S. Marine Dr. Suite B 201 Tamuning, Guam 96911 671-649-3700	Ernst and Young
Mike Linnell	1060 Rte 16, Ste 103C Barrigada Heights Guam 96921 635-4407	USDA-Animal Damage Control
Steve Bellrichard	Tamaning Guam 96521 646-2591	
John Morton	P.O. Box 8134, Dedeo, Guam 96921	USFWS, MOU-3
Frank Chibrera	647-7882	PUAG
Ken Aguilar	120 FT R (indecipherable) Agana 96910	Delegate Robt Underwood's Office
Andrew Torres	PO Box 2950 Agana 96910 735-3986	DAWR-Fisheries Section
Melissa Finney		KUAM
Michael Ritter	PO Box 8134, MOU-3 355-5096/92	USFWS
Bryant Burnett	Tygan 477-9394	GEPA
Bob Beck	PO Box 2950 Agana 96910 735-3992	DAWR-Wildlife
Willis Cannon	PO Box 1055, Saipan 96950	CNMI CPA (FAA)
Larry Toves	PO Box 23821 477-5931 Ext 256	PAG

Senator Hope Alvarey Cristobal	Committee on Federal nd Foreign Affairs, Guam Bldg, Suite 201, 326 W. Soledad Ave., Agana 96910 472-3581/2/3 Fax (671) 472-3585	Chairperson (Did not sign in. Address and title obtained from C/S COMNAVMAR)
Mike Gawel	101 N. Saliyan Gu 96929	TPC
Jordan Kaye	472-8863	GEPA
Michael Cruz	Box 2950 Agana 477-5931 Ext 256	BRAC 95 Steering Committee (Provided a Prepared Statement)
Government (DOD) Representatives: Lt Jean Dumlao Hurst	COMNAVMAR N-45	CNM
Roy Tsutsui	COMNAVMAR N-451	CNM
Lt Greg Harshberger	COMNAVMAR N-45 349-5241	CNM
LtComdr Carole Gaasch	CINCPACFLT (N465), 250 Makalapa, Pearl Harbor, 808-471-4951	CPF Legal
Karen A. Verkennes	CINPACFLT (N4654) 471-5455	CPF Conservation
Frederick A. Minato	PACDIVNAVFACENGCOM 474-5914	PACDIV
David Stefansson	680 Ala Moana Blvd Honolulu HI 96813-5406 (808) 521-5361	Belt Collins Hawaii
Cheryl Vann	680 Ala Moana Blvd Honolulu HI 96813-5406 (808) 521-5361	Belt Collins Hawaii
Dee Dee Letts	220 S. King, Suite 1460 Honolulu (808) 537-6062	Resolutions, Hawaii
Peter Waddell	173 Aspinall, Suite 201, Agana 96910 (671) 472-8472	Peter G. Waddell A.V. Services

2. SONGSONG, ROTA — DECEMBER 6, 1995

Joseph Mundo Santos	PO Box 1356 Rota MP 96951-1356 670-532-9456 (O), 532-3426 (H)	Veterans Affairs/Rota U.S. Army Reserve 442 Radio Barrigada
Barry C. Toves	PO Box 1279 Rota MP (670) 532-9451-3, Fax (670) 532-9454	Mayor's Office
David S. Manglona	Rota MP 96951	Office of Personnel Mgmt
George Baldwin	Box 10007 Saipan MP 96950 670-234-6670/7320/3907	Coastal Resource Management
Mariano Sahlan	P.O. Box 949 Rota 532-9412	Public Works
Tim Bruce	P.O. Box 1506, Rota 532-0209	Mayor's Office
Andrew M. Ramos	P.O. Box 1277 Rota 532-0329	Mayor's Office
Fermina M. Atalig	P.O. Box 1045 Rota 532-4003 work /0578 Home	Dept of Labor and Immigration
Estanistro (Stan) M. Taisacar	P.O. Box 1381, Rota	DLNR Div of Fish and Wildlife
Dave Worthington	Box 1436 Rota 532-9095	
Kelly Brock	Box 27008, GMF Guam	
Richard K. Boice	See Guam Listing	Ernst and Young
William Pendergast		
Manases Manglona	532-0464	Coastal Resource Management Office
Representing DOD: Frederick M. Minato Lt Jean Dumlao Roy Tsutsui LtCmdr Carole Gaasch Karen Verkennes David Stefansson Cheryl Vann Dee Dee Letts Peter Waddell	See Guam Meeting	PACDIV COMNAVMAR COMNAVMAR CINCPACFLT CINCPACFLT Belt Collins Hawaii Belt Collins Hawaii Resolutions Inc Recorder

3. CNMI GOVERNMENT REPRESENTATIVES, SAN JOSE, SAIPAN, DECEMBER 7, 1995

George Baldwin	Box 10007	Coastal Resources Management CNMI
Eric Gilman	654-2238	Governor's Office
John Furey	234-6627	CRM
Peter Peshut	234-1011	DEQ
Pete Palacio	234-6114	DEQ
Chuck (Indecipherable)	234-6623	CRM
Joe Guerrero	664-2120	Historic Preservation Office
John Manglona	322-9627	DFW
David Meyers	322-9627	DFW
Representing DOD: Lt Jean Dumlao-Hurst LtCmdr Carole Gaasch Karen A. Verkennes David Stefansson Cheryl Vann Dee Dee Letts	See Guam Listing	See Guam Listing

4. SAN JOSE, TINIAN, DECEMBER 7, 1995

Ellen Ikehara	Box 209 Tinian 96952	Marianas Visitors Bureau
Benedicto Decena	Box 138	Customs Office
Mike Fitzgerald	Box 47	Mayor's Office
Connie Power	Box 10 433-0300	Tourism (Fleming Hotel Gift Ship proprietor)
Don Power	Box 10 433-0422	F.P.A. Pacific
Jarred Power	"	"
Paul Palmer	Box 281	Self (TCGCC)
Susan Cruz	San Jose Village 433-0973	Ampat Corp
George Baldwin	See Rota and Saipan List	CRM
Melvin Cruz	San Jose Village 433-0220	Historical Preservation (CCA)
Edwin M. Hofschneider	Tinian, 433-0494	CRMO
Carmen Dela Cruz Farrell	Tinian (670) 433-3082	Tinian Chamber of Commerce

Representing DOD: Lt Jean Dumlao-Hurst Karen Verkennes Lt Cmdr Carole Gaasch Frederick A. Minato David Stefansson Cheryl Vann Dee Dee Letts Peter Waddell	See Guam Listing	See Guam Listing

Appendix A-5
Scoping Meeting Group Memory

EIS Scoping Meeting
Marianas Training Activities
Guam, December 4, 1995

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Solid waste that may be generated by training activities needs to be properly disposed of. This has not been the case in the past as when bags of garbage drift ashore from ships.
- A serious assessment needs to be made regarding the suggested 20 lb size for explosives. Much smaller charges kill fish and this may be too large.
- When assessing socio-economic impact, Guam Government's ability to reuse the property after training needs to be assessed, not just the immediate impact on neighbors.
- Those areas identified for base closure should not be adversely impacted in a way that would limit the reuse.
- The notice mentioned "waived alternatives". This should not be used as a reason to not look at alternative areas/locations for identified training activities within the Marianas. For example, if a certain training type is suggested for area x, it should be evaluated through this process as to whether it is more appropriate in area y.
- When addressing mitigation measures they need to be assessed not just in the immediate time frame, but also as to the impact on the end user - whether through reuse or lease. This also needs to be looked at in relation to the scheduling question.
- The socio-economic impact of the implementation of BRAC '95 should be addressed in the EIS.
- The DEIS needs to look at impacts on the final landing approach at Saipan Airport of these training activities. There is a concern because this airport runs over 100,000 operations a year.
- Establishing a controlled firing area at North Field has been a problem in the past. This needs to be addressed if this training activity is going to occur in this area.
- The clean up of training areas needs to be addressed, especially as to costs and responsibility.
- There needs to be a discussion of by what authority the U.S. military has the right to conduct training activities in the Marianas.
- FDM has never had any major NEPA work done. There are major seabird colonies including nesting areas. Good baseline data needs to be collected and assessed in the DEIS. Inventory work should be done.
- The DEIS should look at moving all training activities off Rota so as to do away with the possible introduction of brown tree snakes to the island.
- DEIS needs a discussion as to why Rota was even considered as a training area.
- DEIS needs a discussion of surface danger zones and their impact on other activities that would take place in these areas (i.e. fishing).
- DEIS needs to address why any live fire is being considered.
- Need a discussion as to the destructive force of 20 lbs. of explosives.
- Look at the graving dock as a possible alternative area for demolition training activities.
- Recognize that this needs to be a dynamic document, that conditions will always be changing, so it needs an end point or a mandatory periodic review.
- There needs to be a full discussion on radiation hazards including laser, etc.
- There needs to be early and close coordination with the Guam Natural Wildlife Refuge.
- If you're talking actual landings at NW field, need to assess which runways and impacts.
- The DEIS should also address the training activities of the Guam National Guard, etc.
- Noise levels of activities need to be addressed, especially around schools during regular school hours.
- Individual agencies need to be met with during this process.
- The DEIS team should get together with the National Fish and Wildlife folks as soon as possible.
- What is "NBC"? Be sure to define your terms.

- Are the training activities proposed allowed in the continental USA? If they aren't, then why are they being proposed for Guam?

- FDM needs protected airspace and discussion of offshore use.

- Many offshore users of the proposed training areas are on Saipan. Please consider holding a meeting on Saipan next time public meetings are held. Besides government entities, fishermen need to be consulted.

Marianas Training Environmental Impact Statement
Scoping Meeting
December 6, 1995
Rota

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Consider doing engineering training over here to assist with local projects.

- Discuss size and type of training and whether or not based on the size and type it is appropriate for the area.

- In the interest of not introducing brown tree snakes to Rota bring your training missions here first instead of running them through Guam.

- Why is training being considered on Rota at all.

- The EIS needs a limit or timeframe to it. Things change over time and any discussions in the EIS concerning constraints, appropriateness, and mitigating measures would need to be reviewed or updated periodically.

- Noise considerations need to be looked at especially as concerns the impact on residential areas of the use of the airport and medivac activities.

- Impact on regular air traffic needs to be addressed.

- Frequency of training and public notification of training activities need to be addressed.

- Can other local agencies such as the local reserves, Department of Public Safety and the Fire Department use training facilities or participate in some training activities.

- Noise impact on fauna especially the Marianas Crow, the Fruit Bat and the entire Bird Sanctuary.

- An assessment of the impact of training activities on the tourism industry needs to be done.

- Assurance that the training activities will be limited to only those described.

- Can these training activities provide experiences for the Junior ROTC students from the High School.

- Need to take into account conditions where it is difficult to follow the rules and that they may not be followed at all times. Need to anticipate and mitigate this if possible.

- More social events need to happen between the military and the local population.

- Need a discussion on what the airport approaches are and the need to minimize them over populated areas.

- Need to see a risk assessment for introduction of the brown tree snake through navy SEAL activities. If the assessment shows a high risk then these activities should be moved.

- Public needs adequate notice of activities - no surprises.

- Military should leave behind some civil works projects in exchange for training opportunities.

- Discussion of mitigation plans for any potential environmental damage.

- Can the military help with the restoration and maintenance of the veteran memorial park on Rota.

- Consider diverting an engineering unit from Guam to Rota and using it to build a road around the Island and other projects.

- If inspection of activities or clean up after activities is required by non-military personnel then the military should pay these costs.

- Military needs to pick up the cost of customs and immigration overtime as a result of their activities.

- There should be a discussion of why we need military training.

Notes
Meeting with CNMI
Saipan 12/7/95

- Commonwealth should be consulted for agency review as the DEIS moves forward especially Environment, Fish and Wildlife, Historic Preservation and Coastal Program.

- Look at and use the Tandem Thrust document - it was pretty good for Tinian.

- Need to discussion on length of time the EIS will be valid - will there be periodic reviews, updates and process for amending the document.

- Individual exercises in the future might deviate from the DEIS if so separate them out and write them up don't try to cover them with the document if it is not appropriate.

- Develop a protocol for coordinating with local agencies for each exercise so as to avoid potential sensitivities such as landing exercises when green sea turtles are nesting.

- Advance notice of and an opportunity to participate in the monitoring and evaluation of training activities.

- Evaluation should be done pre and post training activities to monitor effects - we need advance notice for this.

- This should be set up so that we can learn for the future what real impacts are if they differ from those identified.

- Coral reef sensitivity needs to be recognized.

- DEIS should be aware of possible marine sanctuary area at Tachogna Beach. This beach should be out of consideration. Talk to Dr. Mike Crosby at NOAA and co-ordinate with the American Coral Reef Initiative.

- Rota is a marine protected area and fish reserve these need to be discussed.

- CNMI is currently in a habitat conservation process for Rota. It is a 2 year project which is just starting and will be working with Fish and Wildlife and local community groups.

- How does training impact on the port improvement project on Rota which includes dredging and expansion. Some permits have been obtained others are pending.

- Navy SEAL operations are seen as having minimal impact on an area.

- Is one of the goals of this DEIS to have a Commonwealth consistency determination or will it stay individual.

- A changing condition should trigger a new EA or other action the only time this document should cover is if conditions stay the same as those described in the document.

- The Commonwealth would like pre-notice of each action requested.

- CZM consistency is it the intent to look for a way to handle this all at one time under a general consistency and to amend or change only the exercise deviates from the EIS or conditions change.

- If Tachogna Beach is considered the channel would have to be marked and strand vegetation concerns would have to be addressed.

- Training must avoid wetland areas and Lake Hoyoi.

- Kitchen waste and shower run off need to be addressed for ground water protection.

- Public notice of training activities needs to be provided for commercial fishermen.

- Rapid runway repairs have not been satisfactory in the past, i.e. bomb holes have been left on Tinian. Need to make sure this doesn't happen in the future.

- Proposed amphibious landings on WWII landing sites we need to have more detail on these as these sites are also cultural sites on Tinian.

- Need to know the status of section 106 on Tinian - also the status of the ongoing archeological studies on Tinian.

- Need to see a discussion on forward fueling exercises.

- Solid waste disposal needs a thorough discussion.

- All agencies should have a copy of the document sent directly to them.

- Restrictions need to be in place that insure that no Brown Tree Snakes come with training exercises. This can be addressed through vehicle storage, dogs, etc..

- Look at DLNR's current restriction on Brown Tree Snakes.

- Junk cargo coming in from Guam may be a bigger problem then the military because there is no inspection of such shipments.

- Can the Navy assist in developing a Brown Tree Snake control program for the Islands as a whole - or at least put some pressure on politically to speed up the implementation of controls on the civilian side.

- Some suggestions would be to put a quarantine on cargo for seven days and double ring the area with traps - use sniffer dogs when containers are opened or look at an air capsulation project.

Marianas Training Environmental Impact Statement
Scoping Meeting
December 7, 1995
Tinian

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Be sure to discuss and take into account the U.S. History with Tinian especially the WWII impacts.
- The military already has control of two thirds of Tinian - this in itself may be too much but why are you now looking at public beach areas.
- Need to see a discussion as to whether the military can prohibit access to the areas of the Island they control by local people and visitors. This is not something we want to see happen.
- Discussion on the sensitivity training exercise must pay to turtle nesting times and feeding areas.
- Consider assisting with the development of an environmentally acceptable dumpsite that both the military and community can use. Preferably located in the military area of the Island.
- Impacts on vegetation in general both land and marine with special attention to medicinal plants.
- Provide assistance to the community in building and maintaining roads.
- Who will be responsible for the upkeep and maintenance of the trails and cultural sites identified in the military area.
- A brochure on military sites has been produced by Belt Collins will access to this sites still be allowed if training takes place or will there be times when access is denied?
- What is the military's position on upkeep in the exclusive area.
- Discussion of upkeep, identification and protection of cultural sites within the military area.
- If the military is going to use our port facilities can they improve these areas and clean them up.
- Discussion of the status on the latest Latte Village discovery.
- Discussion of post training environmental and clean up concerns.
- Discussion of impact on natural wildlife.
- Look at social issues, including communication on what is taking place before it happens.
- Improve economic rewards to Tinian of training activities, i.e. procure services such as meals etc. supplied here by local businessmen.
- A discussion on types of exercises i.e. medical and educational that could be jointly done between the military and the community.
- Provide medivac services to Tinian.
- Discuss impact of training activities on growing tourist industry.
- Discuss impact on growing gaming activity.
- Discussion of any radiation impacts of any training activities.
- Get us copies of the DEIS at least 1 month before the meeting - this should be true of any information.
- Since Tinian doesn't have a newspaper can the military find a way to involve us in all federal bidding activities.
- The community appreciates the military's presence in the area.
- The DEIS should identify problems and proposed solutions for us to review.
- The document must recognize that cleanup and protection of vegetation and wildlife are important.
- Reassess the use of public beach areas as mentioned before it is too much.
- Anticipate and prevent the introduction of all alien species not just the brown tree snake.
- Discussion of safety issues on refueling and transporting fuel.

- Impact on roads of military vehicles especially tanks or track vehicles.

Appendix A-6
Written Scoping Comments

BRAC '95 STEERING COMMITTEE
GOVERNMENT OF GUAM
AGANA, GUAM 96910

COMMENTS ON THE NOTICE OF INTENT
TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT
FOR PROPOSED MILITARY TRAINING

December 4, 1995

My name is Michael J. Cruz and I am the Acting Executive Director of the BRAC '95 Steering Committee, established by Governor Carl T. C. Gutierrez to oversee and develop plans for the reuse of military properties affected by the Base Realignment and Closure Commission's 1995 decision. The comments I am providing tonight should be considered as preliminary comments as they were developed in advance of knowing specifically where the military plans to conduct training activities, the nature of these activities and their effects on GovGuam's ability to reuse areas for economic recovery. After this scoping meeting, I expect that the BRAC '95 Steering Committee Chairman, Governor Carl Gutierrez, will transmit formal comments to the address listed in the notice published in the Pacific Daily News.

The following preliminary comments are submitted:

- I recognize the need to ensure military combat readiness through the provision of sites for military training. However, use of training sites within the Apra Harbor Complex will have significant impacts on the socioeconomic environment which must be thoroughly addressed in the draft EIS. Given the specific nature of these training activities, they will either prevent civilian reuse of training areas or they would adversely affect civilian operations. The draft EIS must address these concerns.

- The Notice indicates that "The use of alternate training locations is not applicable to this project". Please clarify this statement. If it means that no other locations on Guam possess the site characteristics of the selected training sites, the draft EIS must justify this statement by comparing site characteristics, costs and benefits of other possible locations on Guam.

- Mitigation measures that may be proposed in the draft EIS to accommodate civilian reuse needs must be evaluated in terms of the additional cost burden transferred to the civilian users of the property. Scheduling of training activities may be a viable option however, scheduling will incur additional costs. Such costs and benefits to both the military and civilian users must be evaluated in the draft EIS.

- The socioeconomic environment assessed in the draft EIS must be the environment that will exist after the BRACC '95 decision is fully implemented and not the environment that exists at the time the draft EIS is developed. In obtaining Presidential and Congressional approval of the BRACC recommendation, there was recognition that the BRACC recommendation would result in certain costs and savings. The fact that the BRACC decision has yet to be fully implemented should not deter the military from using this information in the draft EIS.

In my view, the proposed training plan will have significant adverse impact on the prospect for Guam's economic recovery. Therefore, an EIS must be developed by the military and submitted for public review and comment. In this fashion, we can ensure that both military and civilian needs for Apra Harbor can be accommodated.

Thank you for the opportunity to provide preliminary comments.

MICHAEL J. CRUZ

Public Comment Mail-In Form

This form offers a convenient way for you to provide comments on the scope of the environmental impact statement being developed for military training activity in the Marianas. Write your comments, and mail or fax this form to the address below (must be postmarked by January 7, 1996).

To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern: We are concerned with several aspects of the EIS process on this project. Because of the variety of types of training and number of sites to be used, it seems unlikely that all particular environmental concerns can be adequately addressed for each training exercise in a single document. Perhaps the best thing to do is to make the EIS a broad document and to fill in the minor details later as each exercise is in the initial stages of planning. Secondly, a thorough inventory of the natural resources on Farallon de Medinilla has never been done. This needs to be done as part of the EIS process for this particular island.

Signed: Jan M. Sharkey
Date: 8 December 1995

Name and Address (please print): JAN M. Sharkey
MARIANAS AUDUBON SOCIETY
PO BOX 4425
AGANA, GU 96910

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

PRIORLAN C. TENORIO
Governor

JESUS C. BORJA
Lt. Governor

Caller Box 10007
Saipan, MP 96950
Telephone: (670) 664-2200
Fax: (670) 664-2211

DEC 13 1995

Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

Thank you for holding the informational meeting on Saipan on 7 December concerning the planned Environmental Impact Statement on military training exercises in the Marianas. I would like to offer three comments.

Please send separate copies of the DEIS and FEIS to Eric Gilman at the Governor's Office, the Division of Environmental Quality, Coastal Resources Management Office, Division of Fish and Wildlife, and the Historic Preservation Office. In the past, you provided only one copy of the Tandem Thrust FEIS for review by all of the Commonwealth of the Northern Mariana Islands' (CNMI's) resource agencies.

Considering the CNMI's priority of avoiding the introduction of the Brown Tree Snake, the military should prepare separate Brown Tree Snake interdiction plans for each proposed exercise. The Division of Fish and Wildlife and U.S. Fish and Wildlife Service should be provided with the opportunity to comment on draft interdiction plans.

The EIS should make an explicit provision for coordinating with CNMI natural resource agencies during planning and implementation stages for each individual training exercise. The military should not only provide advanced notifications, but should meet with representatives of CNMI natural resource agencies to solicit specific comments and recommendations for conducing each exercise.

Thank you for the opportunity to provide input at this incipient stage.

Sincerely,

FROILAN C. TENORIO

cc: CNMI Director, CRM
CNMI Director, DFW
CNMI Director, DEQ
CNMI Director, HPO
Brooks Harper, USFWS

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Public Comment Mail-In Form

This form offers a convenient way for you to provide comments on the scope of the environmental impact statement being developed for military training activity in the Marianas. Write your comments, and mail or fax this form to the address below (must be postmarked by January 7, 1996).

To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern:

Interested in the use and impacts on the three protected areas at:

1. Haputo Ecological Reserve
2. Orote Ecological Reserve
3. Pati Point Nature Preserve

Signed: D. T. Lotz

Date: 12/18/95

Name and Address (please print): DAVID T. LOTZ, Parks Administrator
Department of Parks and Recreation
P.O. Box 2950
Agana, GU 96910

Commonwealth of the Northern Mariana Islands
Department of Lands & Natural Resources
Coastal Resources Management
Culler Box 10007 2nd Floor Morgen Building,
San Jose, Saipan MP 96950
FACSIMILE

CABLE ADDRESS:
GOV.NMI SAIPAN
TELX. (670) 234-64237330
FAX: (670) 234-0007

December 22, 1995

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300
Telephone: (808) 471-9338
Facsimile: (808) 474-4890

Dear Mr. Minato:

Please refer to the Director of Environmental Planning Division, Mr. Melvin N. Kaku's facsimile (11010 Ser 23/5454) of November 15th concerning public scoping meetings and comments for the preparation of an Environmental Impact Statement for future military exercises in the Territory of Guam and the Commonwealth of the Northern Mariana Islands.

We have no comments to express pertaining to future military operations within the Territory of Guam. We have already commented extensively during the public scoping meetings on Rota and Tinian and during meetings with United States military personnel here on Saipan.

In our opinion, you already have a good base for beginning your Environmental Impact Statement in the "ENVIRONMENTAL ASSESSMENT, Military Exercise, Island of Tinian: Tandem Thrust 95" prepared for the Commander, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii (Contract: N62742-93-D-0028) which was appeared by Belt Collins in November, 1994.

I am sending you via facsimile the first two pages of Chapter 1 of the "COASTAL RESOURCES MANAGEMENT PROGRAM FEDERAL CONSISTENCY DETERMINATION, Voice of America, Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands" which was prepared by the United States Information Agency, Voice of America, Washington, D.C. 20547 in August, 1995 and submitted to the Division of Coastal Resources Management.

These two pages give a good summary of the Federal and Commonwealth laws, rules and regulations, and procedures for the preparation of a Federal Consistency Determination.

The primary concerns of the Division of Coastal Resources Management are:

That you follow proper laws, rules, and regulations in the preparation of your Environmental Impact Statement (EIS) and Federal Consistency Determination (FCD);

That you and your consultants coordinate with both our agency and other relevant Commonwealth agencies during the preparation of the EIS and FCD;

That your EIS and FCD address ALL concerns we have expressed in the public scoping meetings and meetings here on Saipan.;

That your EIS and FCD provide a process for coordination and cooperation with Commonwealth agencies;

That your EIS and FCD provide a process for changing, amending, and even rewriting of the entire documents over time to meet changing conditions, etc.;

That your EIS and FCD provide a process for the Division of Coastal Resources Management and other relevant Commonwealth agencies to have a voice in the decision as to when and how the EIS and FCD should be changed, amended, or rewritten;

That the Division of Coastal Resources Management and other relevant Commonwealth agencies be provided with detailed information on all proposed military activities or exercises within the Commonwealth in a timely manner, so we can determine if the activities or exercises are consistent with the EIS and FCD;

That any military activity or exercise carried out within the Commonwealth which is not entirely consistent with the EIS and FCD be either made consistent with those documents or that the United States military prepare an Environmental Assessment (EA) and/or a Federal Consistency Determination for the activity or exercise;

That your EIS and FCD provide a process for preparing an EA and/or a FCD for activities or exercises that are not consistent with those two documents.

We have noticed that the Department of Defense, the U.S. Navy, the U.S. Army, and other military commands have certainly improved their cooperation and coordination with the government of the Commonwealth of the Northern Mariana Islands, and we appreciate that.

Thank you for the opportunity to provide comments on the preparation of your Environmental Impact Statement. If we can be of further assistance, please feel free to contact us at any time.

Sincerely yours,

for: MANUEL C. SABLAN
Director

xc: Ombudsman

CHAPTER 1

INTRODUCTION

1.1 Consistency Determination

1. In accordance with the Federal Coastal Management Act of 1972, as amended, the National Oceanic Atmospheric Administration implementing regulations contained within 15 CFR Part 930, and the Coastal Resources Management Office Rules and Regulations, as amended through September 8, 1994, the United States Information Agency Voice of America (VOA) finds that the proposed action, construction and operation of the Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands (CNMI), is consistent with and will be conducted in a manner which is consistent to the maximum extent practicable with the CNMI Coastal Resources Management (CRM) Program, as amended.

2. The required environmental documentation has been prepared for the Mariana Relay Station project by the Department of the Army, Pacific Ocean Division, Corps of Engineers in accordance with the Council on Environmental Quality Regulations (40 CFR 1500-1508) and the Department of the Army Regulation (AR) 200-2.

1.2 Purpose

1. A Federal Consistency Determination is required for Federal activities in accordance with the Federal Coastal Zone Management (CZM) Act of 1972, as amended, Section 307(c)(1), and with the National Oceanic Atmospheric Administration (NOAA) Regulations set forth in the Code of Federal Regulations (CFR) Part 930. Under the CZM Act and CFR Part 930, Federal agencies are required to ensure that their activities, including development projects, directly affecting the coastal zone are undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management plan. The CNMI Coastal Zone Management Program and the establishment of the CNMI coastal zone, have been approved by NOAA.

2. The purpose of this Federal Consistency Document is to determine the consistency of the VOA Mariana Relay Station project with the CNMI Coastal Zone Management Plan, as amended.

1.3 Scope

1. The CZM Act of 1972, as amended, defines the coastal zone as the coastal waters and adjacent shorelands strongly influenced by each other and in proximity to the shorelines of coastal states. The coastal zone extends inland from the shoreline only to the extent necessary to control shorelands, the uses of which have a direct and significant impact to coastal waters.

2. The CZM Act defines the CNMI as a coastal state. In the CNMI, the coastal zone inlcudes all land and water areas of the Commonwealth extending seaward to the extent of the territorial waters, execpt for Federally-owned lands as defined by the U.S. Coastal Zone Management Act of 1972, as amended. The Relay Station project site is located within lands leased by the U.S. Government for defense purposes. However, notwithstanding the exclusion of Federal government lands, the CNMI Coastal Resources Management (CRM) program provides that proposed projects on Federally excluded lands which have a direct and significant impact on areas subject to the CRM program shall be consistent with the CRM Rules and Regulations and applicable Federal and CNMI laws.

1.4 Organization

1. The contents of this Consistency Determination have been prepared in compliance with requirements of 15 CFR Section 930.39, Content of a Consistency Determination, and Coastal Resources Management Office Rules and Regulations, Section 21, Federal Consistency, and Section 21 C., Federal Activities and Development Projects. CRM Office Rules and Regulation Section 21 C. states, the Consistency Determinations must include:

(a) a detailed description of the proposed project;
(b) the project's associated facilities;
(c) the combined, cumulative coastal effect of the project; and
(d) data and information sufficient to support the Federal agency's conclusion.

2. In compliance with these requirements, this Consistency Determination contains the requisite information and is organized as follows:

1.0 Introduction, Consistency Determination
2.0 Detailed Description of the Proposed Project
3.0 The Project's Associated Facilities
4.0 The Combined, Cumulative Coastal Effect of the Project
5.0 Data and Information Sufficient to Support the Federal Agency's Conclusion
6.0 References

Public Comment Mail-In Form

This form offers a convenient way for you to provide comments on the scope of the environmental impact statement being developed for military training activity in the Marianas. Write your comments, and mail or fax this form to the address below (must be postmarked by January 7, 1996).

To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern: 1. Operations at the North Tinian Airport lie directly under the ILS final approach course to Runway 7 at Saipan International Airport. Traffic crosses over the airport at 2100 descending. Operations should be conducted below 1100 feet whenever possible.
Combat Control Teams or similar units should establish and maintain contact with Saipan Tower preferably on local control frequency 256.9 mHz and they should have a back up cellular phone contact number in order to coordinate with both Saipan Tower and Guam CERAP.

2. As a matter of information there are about 95,000 aircraft operations annually in the vicinity of North Tinian. Many of these are single engine aircraft that must fly the shortest over water distances for safety reasons. They cannot wander out over the ocean to avoid North Field.

3. Any weapons activity other than R-7201, that is planned must be handled as a Controlled Firing ARea and meet the requirements of FAA Order 7400.2D, Chapter 33.

4. Notice to Airman and Mariners must be issued in sufficient time to allow for dissemination to the public. Suggest at least 72 hours in advance.

5. All activity involving airspace must be coordinated with the IFR control facility, FAA Guam CERAP.

Signed: Willis S. Cannon, Jr.
Date:

Name and Address (please print):
WILLIS S. CANNON, JR.
Air Traffic Manager
Commonwealth Ports Authority
Saipan Air Traffic Control Tower
P.O. Box 1055
Saipan, MP 96950

Carl T.C. Gutierrez
Governor

Madeleine Z. Bordallo
Lt. Governor

DEPARTMENT OF PARKS AND RECREATION

GOVERNMENT OF GUAM
BUILDING 13-8, TIYAN
Post Office Box 2950
Agana, Guam 96910
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Facsimile: (671) 472-9626

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BELT COLLINS HAWAII

A.J. Sonny Shelton
Director

Franklin J. Gutierrez
Deputy Director

FEB 07 1996

Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard, 1st Floor
Honolulu, Hi 96813

Dear Ms. Sheridan:

Thank you for the opportunity to comment on the proposed military training activities in the Marianas. The Environmental Impact Statement for this undertaking will cover Guam, Rota, Tinian, and Saipan but our comments will specifically concern Guam and not the Northern Marianas.

At this planning stage of the undertaking we have very little information on the project. We do not know the areas and sizes of land being proposed for use in military training activities. However, as you may already know, cultural resources should be an important part of an EIS. I would like to advise ahead of time that before any archaeological work is conducted to fulfill the requirement for an EIS, consultation with the Guam State Historic Preservation Officer should be arranged. Appropirate identification efforts may vary substantially, depending on the proposed alternative areas of potential effect. Scope of work for the survey should be prepared and submitted for comment prior to any field work.

Until we know more about this undertaking, our comments will be very general. If we can be of further assistance, please write or call at (671) 475-6290/91.

Thank you.

Sincerely,

Richard D. Davis

RICHARD D. DAVIS
State Historic Preservation Officer

The Way Forward!

Appendix A-7
Distribution List for DEIS

MILITARY TRAINING IN THE MARIANAS EIS
DISTRIBUTION LIST FOR THE DEIS

HAWAII AND MAINLAND MILITARY

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BOX 64046
CAMP HM SMITH HI 96861-4046

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SPECIAL OPERATIONS COMMAND PACIFIC
BOX 64046
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BOX 64118
CAMP HM SMITH HI 96861-5025

COMMANDER
ATTN APEN
USARPAC
FORT SHAFTER HI 96858-5100

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ATTN APOP EX
USARPAC
FORT SHAFTER HI 96858-5100

COMMANDER
ATTN APOP TR
USARPAC
FORT SHAFTER HI 96858-5100

COMMANDER IN CHIEF
ATTN FLEET ENVIRONMENTAL OFFICE CODE N465
CINCPACFLT
250 MAKALAPA DRIVE BLDG 251
PEARL HARBOR HI 96860

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ATTN FLEET EXERCISE OFFICER CODE N328
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HQ PACIFIC AIR FORCE
25 E ST SUITE D306
HICKAM AIR FORCE BASE HI 96853-5412

COMMANDING GENERAL
ATTN DOT
HQ PACIFIC AIR FORCE
25 E ST SUITE I232
HICKAM AIR FORCE BASE HI 96853-5426

COMMANDING GENERAL IX CORPS REINF
ATTN APIX EN
9TH REGIONAL SUPPORT COMMAND
2058 MALUHIA ROAD
FORT DERUSSY HI 96815-1997

CHIEF OF STAFF
ATTN COLONEL ROBERT G F LEE
9TH REGIONAL SUPPORT COMMAND
2058 MALUHIA ROAD
FORT DERUSSY HI 96815-1997

DEFENSE TECHNICAL INFORMATION CENTER
DTIC CUSTOMER SERVICE HELP DESK DTIC BLS
8725 JOHN J KINGMAN ROAD SUITE 0944
FORT BELVOIR VA 22060-6218

GUAM MILITARY--NAVY AND MARINES

COMMANDER
ATTN CODE N4
COMNAVMARIANAS
PSC 455 BOX 42
FPO AP 96540-1500

COMMANDER
ATTN STAFF JUDGE ADVOCATE
COMNAVMARIANAS
PSC 455 BOX 152
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PSC 455 BOX 30
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NCTAMS WESTPAC GUAM
PSC 488 BOX 101
FPO AP 96537-1802

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NCTAMS WESTPAC GUAM
PSC 488 BOX 129
FPO AP 96537-1825

COMMANDING OFFICER
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NCTAMS WESTPAC GUAM
PSC 488 BOX 177
FPO AP 96537-1819

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US NMCB 40
CAMP COVINGTON GUAM
FPO AP 96601-4981

RESIDENT NMCB
CAMP COVINGTON
SANTA RITA GU 96915

OFFICER IN CHARGE
NAVAL CONSTRUCTION BRIGADE DET GUAM
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III MARINE EXPEDITIONARY FORCE FMF
UNIT 35601
FPO AP 96606-5601

COMMANDING OFFICER
ATTN S 3
31ST MARINE EXPEDITIONARY UNIT FMF
UNIT 35821
FPO AP 96606-5621

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III MEF SOTG
UNIT 35605 CAMP HANSEN
FPO AP 96606-5605

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36TH CS CC
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APO AP 96543-4009

COMMANDER
ATTN TRAINING OFFICER
HELICOPTER COMBAT SUPPORT SQUADRON FIVE
UNIT 14052 BOX 51
APO AP 96543-4052

COMMANDER
36TH CES CEV
UNIT 14007
APO AP 96543-4007

COMMANDER
ATTN MS HEIDI HIRSH
36TH CES CEV
UNIT 14007
APO AP 96543-4007

COMMANDER
36TH SPTG CC
UNIT 14041
APO AP 96543-4041

COMMANDER
36TH LG CC
UNIT 14043
APO AP 96543-4043

COMMANDER
36TH OSS CC
UNIT 14035
APO AP 96543-4035

COMMANDER
36TH CES CC
UNIT 14007
APO AP 96543-4007

COMMANDER
36TH ABW CC
UNIT 14003
APO AP 96543-4003

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BLDG 50 AMMON AVENUE
RADIO BARRIGADA
FPO AP 96540

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USAR MARIANAS
56 AMMON AVENUE
BARRIGADA HEIGHTS GU 96913

COMMANDER
ATTN GU ARO T
GUAM TERRITORIAL AREA COMMAND
622 EAST HARMON INDUSTRIAL PARK
TAMUNING GU 96911-4421

COMMANDING OFFICER
HQ 1ST BN 294TH INFANTRY LIGHT
FORT JUAN MUNA
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MR EDWARD CHARGUALAF
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AGANA GU 96932

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PORT AUTHORITY OF GUAM
OPERATIONS BUILDING
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PITI GU 96925

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TIYAN GU 96913

DEPT OF EDUCATION
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DIRECTOR
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AGANA GU 96932

DEPT OF LAND MANAGEMENT
ATTN MR J A MARTINEZ
DIRECTOR
PO BOX 2950
AGANA GU 96932

DEPT OF PARKS AND RECREATION
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GUAM HISTORIC PRESERVATION OFFICER
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AGANA GU 96910

DEPT OF PARKS AND RECREATION
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DEPT OF PUBLIC HEALTH AND SOCIAL SERVICES
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DIRECTOR
PO BOX 2816
AGANA GU 96932

DEPT OF PUBLIC WORKS
ATTN MR GIL A SHINOHARA
DIRECTOR
542 NORTH MARINE DRIVE
TAMUNING GU 96911

DISASTER RECOVERY OFFICE
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DIRECTOR
PO BOX 2950
AGANA GU 96932

DIVISION OF AQUATIC AND WILDLIFE RESOURCES
ATTN MR ROBERT ANDERSON
192 DAIRY ROAD
MANGILAO GU 96923

DIVISION OF AQUATIC AND WILDLIFE RESOURCES
ATTN MR ROBERT BECK
192 DAIRY ROAD
MANGILAO GU 96923

DIVISION OF AQUATIC AND WILDLIFE RESOURCES
ATTN MR MARVIN AGUILAO
192 DAIRY ROAD
MANGILAO GU 96923

DIVISION OF AQUATIC AND WILDLIFE RESOURCES
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DIVISION OF AQUATIC AND WILDLIFE RESOURCES
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FISHERIES SECTION
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MANGILAO GU 96923

GUAM NATIONAL WILDLIFE REFUGE
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NATIONAL BIOLOGICAL SURVEY
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DEDEDO GU 96912

DEPT OF AGRICULTURE
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ADMINISTRATOR
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FIRE CHIEF
ATTN MR GIL REYES
BACHELORS OFFICERS QUARTERS
BLDG 1 1301
TIYAN GU 96913

GUAM INTERNATIONAL AIRPORT AUTHORITY
ATTN MR JAY W SPRAGUE
EXECUTIVE MANAGER
PO BOX 8770
TAMUNING GU 96931

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ATTN MR JACK S SHIMIZU
CHIEF OF POLICE
BLDG 233 CENTRAL AVE
TIYAN GU 96913

GUAM POWER AUTHORITY
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GENERAL MANAGER
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GUAM TELEPHONE AUTHORITY
ATTN GENERAL MANAGER
PO BOX 9008
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PORT AUTHORITY OF GUAM
ATTN MR EULOGIO C BERMUDES
GENERAL MANAGER
1026 CABRAS HIGHWAY SUITE 201
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GUAM WATERWORKS AUTHORITY
ATTN MR FRANK CHIBRERA
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AGANA GU 96932

GUAM WATERWORKS AUTHORITY
ATTN MR RICHARD A QUINTANILLA
CHIEF OFFICER
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AGANA GU 96932

GUAM WATERWORKS AUTHORITY
ATTN MR LARRY TOVES
PO BOX 3010
AGANA GU 96932

TERRITORIAL PLANNING COUNCIL
103 REFLECTION CENTER
222 SANTO PAPA
AGANA GU 96910

TERRITORIAL PLANNING COUNCIL
ATTN MR GALEN LUJAN
EXECUTIVE ASSISTANT
101 N STREET
TIYAN GU 96913

TIYAN REUSE AUTHORITY
ATTN MR THOMAS C OKADA
SUPERINTENDENT
PO BOX 2950
AGANA GU 96932

BRAC 95 STEERING COMMITTEE
ATTN MR MICHAEL J CRUZ
BOX 2950
AGANA GU 96910

MAINLAND AND GUAM GOVERNMENT OFFICES/SENATORS

US HOUSE OF REPRESENTATIVES
ATTN ADMINSTRATIVE ASSISTANT
REP ROBERT A UNDERWOOD
424 CANNON HOB
WASHINGTON D C 20515

CNMI REPRESENTATIVE TO THE US
ATTN MR FRANCISCO I TAITANO
OFFICE OF JUAN N BABAUTA
2121 R STREET NW
WASHINGTON DC 20008

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Appendix A-8
Agency Comment Letters and Responses

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
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MAR 24 1997

Mr. Fred Minato,
Planner-in-Charge, Code 231 FM
Environmental Planning Division
Pacific Division, Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Minato:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (EIS) for the proposed Military Training in the Marianas Islands. Our review is based on the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) NEPA Implementation Regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act (CAA).

The proposed action would augment current military training activities at the Marianas Islands to develop combat skills and to maintain the constant readiness of U.S. troops stationed in portions of the Pacific rim. The Marianas, a chain of fifteen volcanic islands in the western Pacific Ocean, include the Islands of Guam, Tinian, Rota and Farallon de Medinilla.

Activities proposed under the proposed action include basic military occupational skills training, weapons certification, parachute and aviation certification, logistics training, tactical exercise, and joint-service exercise involving over 1,000 troops. These activities would augment or add to extensive military training that is currently conducted in the Marianas. Most training sites would be limited to active military bases and facilities around Guam.

Alternatives identified in the Draft EIS include: Alternative 1, the "No Action" Alternative, consisting of all ongoing training activities and locations; Alternative 2, the "augmented set of training activities" (or, "Augmented Set") Alternative, which would retain all current training activities and would add several new training activities and locations; and, Alternative 3, the "mitigated set of training activities" (or, "Mitigated Set") Alternative, which would retain all current training activities and would add selected new activities and locations which are not expected to have significant impacts on the environment or which have impacts that can be successfully mitigated. In the Draft EIS, the Navy identifies the "Mitigated Set" Alternative as the environmentally preferred alternative.

Significant biological and cultural resources impacts are identified in the Draft EIS. The most severe impacts are associated with the "Augmented Set" Alternative. While the analysis does contain an informative discussion of the proposed action, several specific issues should be discussed in greater detail and in some instances additional information should be provided in the Final EIS. For example:

- The Draft EIS does not contain a full range of alternatives as required by NEPA;
- The proposed action alternatives are not explicitly justified in terms of the Draft EIS statement of purpose and need; and,
- The Draft EIS does not include a full analysis of cumulative impacts as required by NEPA.

Although the Draft EIS acknowledges that the Mitigated Set Alternative "best meets the needs for training in the Marianas while avoiding significant impacts to the environment," the Draft EIS appears not to identify a preferred action alternative. Consequently, EPA's NEPA review guidelines direct us to rate each alternative individually. Based upon our review, we classify the Mitigated Set and No Action Alternatives as EO-2, Environmental Concerns -- Insufficient Information (see attached *Summary of the EPA Rating System*). This rating reflects our conclusion that the Final EIS should contain additional information regarding these alternatives, as noted. We classify the Augmented Set Alternative as EO-2, Environmental Objections -- Insufficient Information. This rating reflects our conclusion that the Augmented Set Alternative, as presented in the Draft EIS, would result in several significant, often unmitigable impacts, particularly to sensitive biological resources. Our detailed comments are enclosed.

We appreciate the opportunity to comment on the proposed project and request that one copy of the Final EIS be sent to my attention (Mail Code CMD-2) at the letterhead address at the same time it is filed with our Washington, D.C. office. We would be pleased to meet with you to discuss any aspect of our comments. If you have any questions or wish to discuss any aspect of our comments, please contact Mr. David Farrel, Chief of the Federal Activities Office, at (415) 744-1584 or Jeff Phillibar of his staff at (415) 744-1574.

Sincerely,

Deanna Wieman

Deanna Wieman, Deputy Director
Cross Media Division

Enclosures: (2)

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

EPA DEIS COMMENTS, US NAVY, MILITARY TRAINING IN THE MARIANAS, MARCH 24, 1997

NEPA and Procedural Issues

1. Pages ES-1, 101, 2-43, 3-23: Nowhere in the Draft EIS statement of purpose and need is a direct justification for increasing the training that is currently conducted in the Marianas. The Draft EIS reports that "adequate training lands in the Marianas are required" to maintain military readiness, but current training activities and lands are not identified as being deficient. Furthermore, military forces stationed in the Pacific rim are not described as needing additional training to maintain "a state of combat readiness." Finally, the Draft alludes to the executive Base Realignment and Closure decision to close and dispose of military facilities at NAS Agana on Guam, but the effect of this action on Marianas military training needs is not discussed. The Final EIS should expand its statement of purpose and need to include these issues.

2. Pages ES-2, 2-21: Alternative 1, the No Action Alternative, would continue all ongoing training activities currently conducted on the islands of Guam, Tinian, Rota and Farallon de Medinilla "in recent years." The Final EIS should identify under what authority these training activities are conducted, and for what duration they are expected or approved to continue. In addition, the Final EIS should identify whether a NEPA analysis of this ongoing activity has been conducted.

3. Pages ES-3, 2-33: The Draft EIS presents two action alternatives—one of which is a variation of the second, and both of which fully incorporate the training program that currently exists on the Marianas. NEPA requires that the Navy "rigorously explore and objectively evaluate all reasonable alternatives." (40 CFR Part 1502.14(a)) Given the Draft EIS' lack of a clear statement of purpose and need, and given the similarity of the two action alternatives, the Navy has not demonstrated that it has developed and analyzed a full range of alternatives.

   While Alternative 3, the Mitigated Set Alternative, would reduce the level of impacts for new or expanded activities proposed in Alternative 2, the Augmented Set Alternative, it does not appear that either alternative offers to mitigate significant or substantially adverse impacts that may be presently occurring under current operations, and which would continue as part of both proposed action alternatives. We propose that the Navy develop and fully analyze an additional alternative in the Final EIS that

would mitigate the significant impacts of both proposed and existing military training activities. This would serve to: meet NEPA's requirement for a broad range of alternatives; meet or attempt to meet the Navy's training needs; and, offer an environmentally preferable alternative that addresses the environmental impacts from the existing as well as proposed training programs.

For example, the Augmented Set Alternative proposes amphibious assault vehicle landings at Unai Bubui on Tinian, while the Mitigated Set Alternative offers a mitigated approach to this activity by stipulating that those assault vehicles be restricted to single-file landing approaches to minimize coral reef damage. A fourth Alternative could include incorporation of that proposal, and, in addition, could stipulate that amphibious assault vehicle landings taking place currently (and under the No Action Alternative) in sensitive areas also use this single-file landing approach.

4. Pages ES-9 - ES-22: Table ES-1, Comprehensive Table of *Significant and non-Significant Potential Impacts and Mitigations*, would be more useful if it were to identify significant impacts as well as whether proposed mitigation would be sufficient to render potentially significant impacts to less than significant status. The Navy should consider modifying this table in the Final EIS.

5. We support several of the provisions of the Mitigated Set Alternative, which would serve to decrease the potential impacts that could be expected from the activities identified in the Augmented Set Alternative. We encourage the Navy to minimize the environmental degradation that could occur even under the Mitigated Set Alternative by requiring post-activity monitoring by qualified biologists, archaeologists and/or historians or other appropriate field experts to assess Navy training compliance with environmental restrictions and to assess the actual environmental damage that would result from proposed activities. The Navy should be required to follow practicable recommendations from these experts to reduce or mitigate unexpected impacts identified in the course of field monitoring. For example, marine biologists should be used to monitor subsequent coral reef damage from amphibious landing activities--even if protective measures identified under the Mitigated Set Alternative are followed.

6. Page 4-70: The Draft EIS environmental consequences analysis does not appear to provide a full examination of cumulative impacts as required by NEPA. NEPA defines a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR Part 1508.7) The Draft EIS cumulative impacts analysis discussion appears to misidentify cumulative impacts as those that would result from repetitive activities under the proposed action (this would be a direct impact per 40 CFR Part 1508.8). Second, the Draft EIS cites Table 4-8 as identifying significant and non-significant cumulative impacts. This is not evident upon examining Table 4-8, as no cumulative impacts are identified. Finally, the Draft EIS fails to address cumulative impacts on a resource-by-resource basis (with the exception of wastewater issues), other than to read that "many of the potential impacts on endangered species, cultural resources and public safety are cumulative in nature," and by providing a hypothetical example of a cumulative impact from the proposed action. The final EIS should provide a full cumulative impacts discussion, including analysis for each resource area, as required by NEPA.

7. Page 4-71: Although the Draft EIS contains a brief assessment that no "environmental justice" impacts would occur, the Final EIS should expand its analysis to consider specific action activities that may disproportionately affect low-income or minority communities. For example, the Draft EIS identifies that periodic restrictions on public access to Tinian hiking trails due to target range activities may affect religious practices, which, in turn, might affect certain communities more than others. In addition, underwater detonations that may disturb fish populations in the Apra Harbor might discourage subsistance fishing (and the lower-income populations who might depend on it) from that area. These issues should be considered in the Final EIS.

Biological Resources Issues

1. Page 4-2: In its evaluation criteria to determine impact significance, the Draft EIS stipulates that a biological resources effect would be significant if it were to "appreciably reduce" the likelihood of the survival and recovery of threatened or endangered species or migratory birds. We believe any incidental taking of endangered

species to be a significant impact. The Navy uses a more conservative significance threshold for wetlands, reefs, potential habitat and endangered plant species by stipulating that any reduction in the "natural function or appearance of these areas or plants" would be significant. In the Final EIS, the Navy should change its evaluation criteria for protected animal species to reflect the same degree of sensitivity it provides for plants, wetlands and habitat. The Navy should consult with the US Fish and Wildlife Service if it has any questions regarding the appropriate significance thresholds for endangered animal species.

2. Page 4-5: As part of the Navy's underwater demolition program, both action alternatives propose the training with and detonation of live 20-pound charges in the lower depths of the outer Apra Harbor. Currently, 10-pound charges are used and are approved by Guam EPA and the US Fish and Wildlife Service. This new practice would increase the potential underwater impact area by 50 percent, thus posing a greater risk to the endangered hawksbill sea turtle, the threatened green sea turtle, various fish and any coral that might inhabit the area. Although the Navy proposes several measures to mitigate potential impacts of this action, the Draft EIS presents no rationale for why this action is considered necessary—that is, as to why the Navy needs to detonate 20-pound instead of 10-pound charges in Apra Harbor. We recommend that the Navy, at minimum, explore the merits of using 10-pound charges (perhaps attached to additional 10-pound weights to simulate 20-pound charges) to fulfill its training needs. Otherwise, a similar approval should be sought from Guam EPA and the US Fish and Wildlife Service for 20-pound charge underwater detonations as currently exists for 10-pound charges. Moreover, the Final EIS should briefly explain why underwater explosions are necessary for training purposes.

   As identified in the Draft EIS and the Navy's *Current Conditions Report for Apra Harbor Naval Complex*, the richness of biological resources in Apra Harbor varies greatly within a relatively short distance. The Final EIS should stipulate that underwater demolition activities be restricted to specific areas determined to be free of sensitive biological resources.

3. Page 4-12: As with underwater detonation, discussed above, the Navy should justify the use of explosives in its existing and proposed bombardment target practice.

Without further information, we assume that the objective of the training is to measure the accuracy of bomb delivery to a target area--it is not evident why explosives are needed for this exercise. Given the adverse environmental impacts that would arise from the use of explosives in bombing practice, the Navy should provide the rationale for using live ammunition for this activity in the Final EIS.

4. Page 4-69: Under the Mitigated Set Alternative, the Draft EIS reports that the proposed action may: damage up to 24 cubic meters of coral at Unai Bubui; temporarily disturb endangered Mariana crows during non-breeding season; disturb protected fruit bats during night foraging at Andersen AFB; and, disturb endangered sea turtles in Apra Harbor. These impacts could be potentially significant should they occur. This appears to contradict the Draft EIS assertion that the Mitigated Set Alternative is designed to "avoid significant impacts on the environment" that would be experienced under the Augmented Set Alternative. As stated previously, we recommend that the Navy design and analyze a third action Alternative that would allow for expanded training opportunities but that would avoid the potentially significant impacts to biological resources identified above. This alternative should be identified and fully analyzed in the Final EIS.

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Ser 231/ 2492
2 JUL 1998

Ms. Deanna Wieman, Deputy Director
U.S. Environmental Protection Agency
Cross Media Division, Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Ms. Wieman:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter of March 24, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in June 1998. A copy will be forwarded for your review.

Those issues raised by a number of reviewers are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the purpose and need for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required).

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: More detail was requested on the proposed training activities, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a full range of alternatives, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use*, *less use*, *no change in use*, and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The Preferred Alternative consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The Maximum Land Use Alternative includes proposed new training land uses which are not desirable because of significant impacts that cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense (DoD) has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

U.S. EPA COMMENTS

Our responses to your numbered comments are as follows:

NEPA and Procedural Issues

a. Comment: Provide expanded statement of purpose and need to include direct justification for increasing training in the Marianas. Identify any deficiencies in training activities and lands, and explain effect of Base Realignment and Closure (BRAC) closure of NAS Agana.

Response and Revisions to DEIS: (See paragraph a under Common Issues). Other training venues in the Pacific have been reduced in recent years. Training in the Philippines ceased with the 1993 closure of U.S. military bases. Training areas in Japan are very limited and are becoming more so. No other lands under U.S. control are available in this region of responsibility. The BRAC closure of NAS Agana has not effected our training needs since no training activity is or has been proposed at this former Navy base.

b. Comment: Identify under what authority training is conducted, duration of future training, and whether NEPA analysis has been conducted for ongoing training.

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Response: Training is conducted by the DoD, under authority provided in the constitution and by Congressional enactment's (including appropriations) for such purposes. For each DoD training area proposed for use, ownership, lease, or use agreements allow for training use. This DEIS provides NEPA analysis of the cumulative effects of ongoing training and training land uses described in the DEIS for the foreseeable, although indefinite future. Past NEPA evaluation has been accomplished for various portions of DoD training lands and for various activities, but this is the first comprehensive evaluation of military training in the Marianas.

Revisions to DEIS: Chapter One has been revised to clarify the need for continuing military training in the Mariana Islands. The opening sentence states, "The purpose of this DEIS is to evaluate environmental impacts of *continuing use* of DoD)-controlled lands for military training conducted in the Mariana Islands in the *foreseeable future*."

c. Comment: Demonstrate that a full range of alternatives has been developed and analyzed. Add an alternative that would mitigate the significant impacts of both proposed and existing military training.

Response/Revisions: (See paragraph c under Common Issues). The range of alternatives has been broadened to include the Reduced Land Use and No Land Use alternatives, which mitigate most or all (respectively) potentially significant impacts of training land use.

d. Comment: Table ES-1 should identify significant impacts and whether proposed mitigation would change the impacts to less than significant.

Response and Revisions to DEIS: The table has been modified as requested.

e. Comment: Post-activity monitoring by qualified scientists or other field experts would minimize environmental degradation if the Navy were required to follow practicable recommendations from such experts to reduce or mitigate unexpected impacts identified during monitoring.

Response and Revisions to DEIS: Post-activity monitoring has been added as a mitigation in the case of some potentially significant impacts. Changes to training activities, as recommended by monitors during consultation with the training operators would be considered in the context of training requirements and the availability of alternative training venues, as well as in consideration of the environmental effects.

f. Comment: Provide a more comprehensive cumulative impacts discussion, including analysis for each resource area.

Response and Revisions to DEIS: A cumulative impacts discussion is provided in Chapter Two for each land area under consideration. Cumulative impacts are also addressed within each significant issue discussion in Chapter Four and are summarized at the end of Chapter Four.

g. Comment: Expand the analysis of environmental justice impacts to include consideration of specific activities, such as access to hiking trails and subsistence fishing areas.

Response: Hiking trails are used by a wide variety of civilians and are not considered an environmental justice issue. The proposed sniper range in the Ordnance Annex has been modified so that the hiking trail need not be closed at all. No subsistence fishing areas on Guam will be affected. Subsistence fishing areas on Tinian could be closed a few days each year, but multiple other subsistence fishing areas, are available outside the area to be closed so no significant or disproportionate impacts will occur.

Revisions to DEIS: The section on environmental justice has been expanded to address subsistence fishing on Tinian. As the Ordnance Annex hiking trail is not an environmental justice issue, it is not included in that section.

Biological Resources Issues

a. Comment: Significance criteria for animals should be more conservative; EPA considers any incidental take to be significant. Consult with the U.S. Fish and Wildlife Service (USFWS) regarding appropriate significance thresholds for endangered species.

Response: Agreed. The criterion in question was intended to specify that an incidental take would be considered significant.

Revisions to DEIS: The evaluation criterion for protected animal species has been revised to clarify its intent as follows: "Are protected species present at the training site, and is training land use likely to result in a take, or is training land use likely to result in habitat reduction that would affect species survival potential or otherwise reduce chances of survival and recovery?"

b. Comment: Regarding underwater demolition training in Apra Harbor, recommend restricting use of 10-pound (versus 20-pound) charges or simulated 20-pound charges. Explain briefly why underwater explosions are necessary for training.

Response: In a real-world adversarial situation, Explosive Ordnance Disposal personnel must be able to manage both the inherent dangers of disarming live mines and the dangers of working close to enemy ships and facilities. Training with

live charges in a safe (controlled) situation eliminates the latter of these two hazards and provides essential practice with the other. Training must be performed with live charges so that personnel can become accustomed to acting with the heightened safety awareness, detailed procedures, and self-confidence that must be maintained for safety. Simulated devices fail to prepare personnel mentally and emotionally for the conditions and after-effects of setting off such charges. A 20-pound charge is used for different combat situations than a 10-pound charge. It is important for personnel to receive training involving both types of charges. Personnel require training in identifying the correct charge to use, how it should be rigged and fused, safe handling, and redeployment to a safe distance. Both 10-pound and 20-pound charges have been used in Outer Apra Harbor in the past, and the environmental impacts of such activity were evaluated in the *Final EIS for Proposed Facilities Development and Relocation of Navy Activities to the Territory of Guam from the Republic of the Philippines* (U.S. Navy, July 1993).

Revisions to DEIS: The DEIS has identified a second mine countermeasures site outside of Apra Harbor, offshore of Dadi Beach, and recommends that 20-pound charges be deployed at the Dadi Beach site in preference to the Apra Harbor site, whenever possible, to decrease the need to temporarily close Apra Harbor to commercial and recreational traffic during training.

c. Comment: Justify use of live ammunition on FDM. It is not evident why live bombs are necessary to measuring the accuracy of delivery.

Response: Live ordnance is used on FDM for a variety of reasons. The primary sources of live ordnance delivery are surface ship-delivered fire, naval aviation-delivered ordnance from aircraft carriers, and bombs delivered by strategic aircraft. In all cases, ordnance training includes the entire process of identifying the required type of ordnance for the target, providing the item(s) to the point of delivery, properly fusing the item, and then delivering on target. Use of inert ordnance does not train the entire system of people and units involved in use of this ammunition. There is a heightened risk and need for alertness involved in live ammunition handling; personnel must be trained in these more stressful situations under controlled peacetime training conditions, to be able to respond properly during wartime operations.

In addition, the fleet units that use FDM for training are doing so as part of operational deployments. They are combat ready and have no room aboard for storage of ordnance that could not be used in an actual wartime mission. Therefore, the only ordnance available for training during a deployment is live ordnance.

Revisions to DEIS: Chapter One has been modified to provide this explanation.

d. Comment: The Mitigated Set Alternative may result in significant impacts, i.e., may damage up to 24 square meters of coral, temporarily disturb endangered Mariana crows during non-breeding season, disturb protected fruit bats at night, and disturb endangered sea turtles in Apra Harbor. Recommend an additional alternative that would avoid these potentially significant impacts. This alternative should be identified and fully analyzed in the FEIS.

Response: The Mitigated Set Alternative has been revised to become the Preferred Alternative. Reduced Land Use is a new alternative evaluated for all training locations and compared to other alternatives in the revised DEIS. In most cases, the Reduced Land Use alternative does not result in substantially reduced impacts in comparison to the Preferred Alternative. In some locations, such as the Waterfront Annex, reduced land use is the Preferred Alternative. In other cases, significant impacts have been minimized to the extent possible, while continuing to meet the purpose and need for training. Specifically:

Amphibious assault landings are only possible at beaches within Tinian's Exclusive Military Use Area; the Preferred Alternative minimizes both the potential impact on coral and limits to a bare minimum the extent of amphibious training. Proposed mitigation includes moving any live, loose coral from the designated assault amphibian vehicle approach lane and working with local agencies on other protective measures.

The Preferred Alternative for aviation training at Andersen Air Force Base is mitigated by full compliance with USFWS conditions for minimizing impacts on Mariana crows and fruit bats.

The Preferred Alternative includes underwater demolition's training in Apra Harbor, which occurs in compliance with agreements with local regulatory agencies intended to protect the safety of endangered sea turtles.

The Preferred Alternative includes continued use of the aerial bombardment and naval gunnery range at FDM. That activity currently occurs in compliance with a USFWS Biological Opinion for the period May 1, 1998 through May 1, 2001, stating that, "aerial bombardment, naval gunfire, and small arms gunfire over the next three years is not likely to jeopardize the continued existence of the Micronesian megapode or Mariana fruit bat." Navy intends to implement conservation recommendations cited in that opinion (USFWS, April 6, 1998).

Revisions to DEIS: The Reduced Land Use and No Land Use alternatives avoid the known potentially significant impacts, although in most cases they fail to meet the purpose and need for training. Both alternatives are identified and fully analyzed in Chapter Two of the revised DEIS.

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We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338, by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard, First Floor
Honolulu, HI 96813-5406



United States Department of the Interior
Fish and Wildlife Service

Guam National Wildlife Refuge
Box 8134, MOU-3
Dededo, Guam 96912
671-355-5096, FAX 671-355-5098

March 24, 1997

Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Re: Draft Environmental Impact Assessment (DEIS) for Military Training in the Mariana Islands

Dear Mr. Minato:

The Guam National Wildlife Refuge (Refuge) has reviewed the above-referenced document for proposed military training on Guam and the Commonwealth of the Northern Mariana Islands of Rota, Tinian, and Farallon de Medinilla. The following comments address only Refuge lands on the island of Guam and are provided for your consideration.

The DEIS adequately describes the existing environmental conditions of the Refuge and proposed training activities. Additionally, the DEIS adequately considers potential impacts and mitigative measures for locally and federally listed species as well as cultural/archaeological resources. The Refuge concurs with the DEIS that the "Preferred Alternative: Mitigated Set of Training Activities" would be more environmentally sensitive due to the use of constrained area overlays. We understand that these overlays limit the locations of certain training activities to reduce/eliminate potential adverse impacts to flora, fauna, and cultural/archaeological resources.

The Refuge is concerned that the surface danger zone (SDZ) of the sniper range may include the southern portion of Fena Valley Reservoir and another sensitive natural area located near the western boundary of the Ordnance Annex. Fena Reservoir is an important habitat for federally endangered Mariana common moorhens (*Gallinula chloropus guami*). Monthly surveys conducted by Refuge biologist have documented that the majority of moorhens and active nesting occur on this portion of the reservoir. The other sensitive area provides foraging and roosting habitat for federally endangered Mariana fruit bats (*Pteropus mariannus*). Both of these areas are constrained areas (CA) designated as NWD (no wildlife disturbance) which includes no live ammunition.

We realize that the SDZ depicted in Figure 2-7 is a composite of three potential safety fan boundaries shown in Figure 4-16 and recommend that picture "c" on Figure 4-16 be accepted as the limit of fire and safety fan for sniper training.

The DEIS does not generally give the timing, intensity, and frequency of occurrence of each training activity. This should be clarified prior to the completion of the Final EIS so that potential impacts to listed species can be evaluated. Additionally, we recommend that the section "Endangered Birds and Mammals" in Appendix K be rewritten to reflect current and correct information concerning Mariana crows (*Corvus kubaryi*), Mariana common moorhens, and island swiftlets (*Aerodramus vanikorensis*). For example, crows have not been recorded from southern Guam since the 1960s-1970s, the swiftlet caves are located in the southeast (not northeast) portion of the Ordnance Annex, and moorhens are not restricted to Fena Reservoir; they use two small wetlands to the east and one to the northwest of Fena Reservoir as well. Finally, we recommend that Figure C-1 (Appendix C) be changed to depict the 371-acre Guam National Wildlife Refuge located along the beach at Ritidian Point.

The Refuge appreciates the opportunity to provide these comments. If you have any questions regarding these comments please contact Refuge Biologist Michael Ritter at 671-355-5096/7 or 5098 (fax).

Sincerely,

John S. Sanchez
Acting Refuge Manager

RECEIVED TIME MAR.28. 2:33PM PRINT TIME MAR.28. 2:38PM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/ 1984
20 MAY 1998

Mr. John S. Sanchez, Acting Refuge Manager
U.S. Fish and Wildlife Service
Guam National Wildlife Refuge
Box 8134, MOU-3
Dededo, GU 96912

Dear Mr. Sanchez:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated March 24, 1997, regarding the Draft Environmental Impact Statement (DEIS) for the above-referenced action. In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in May-June 1998 timeframe. A copy will be forwarded for your review. Your specific comments are addressed below.

a. Comment: The Refuge is concerned that the surface danger zone (SDZ) of the proposed Ordnance Annex sniper range may include a portion of the Fena Reservoir and another sensitive natural area near the western boundary of the annex which provide habitat for the endangered Mariana common moorhen and habitat/forage area for the endangered Mariana fruit bat. You recommended that picture "C" on Figure 4-16 be accepted as the limit of fire and SDZ for the sniper range.

Response and Revisions to DEIS: Although the SDZ has not been limited exactly as depicted in Figure 4-16 (now Figures 4-6 and 4-7), it has been adjusted to avoid the hiking trail in the southwest portion of the annex and thereby avoids the fruit bat forage/habitat area. Sniper fire is unlikely to impact birds in Fena Reservoir, as its frequency is low in volume and geared for precision. The actual targets will be placed no more than 1 kilometer from the firing points, and will only rarely be missed by the expert marksmen designated to use the range. In most cases, existing topography backstops the target areas, limiting travel of the projectile. Such backstops are not formally considered when the SDZ is delineated, because of the potential for ricochet. Section 4.3.1.1 of the revised DEIS specifically addresses risks to moorhens at Fena Reservoir.

b. Comment: You requested clarification of the timing, intensity, and frequency of each training activity.

Response and Revisions to DEIS: New Table 1-1 identifies typical unit size and frequency of all training activities covered by the DEIS. Chapter Two has been extensively rewritten and clarifies impacts of training activities on particular land areas.

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c. Comment: You requested that a section of Appendix K be rewritten to correct information on Mariana crows, Mariana common moorhens, and island swiftlets.

Response and Revisions to DEIS: Appendix K has been revised as requested.

d. Comment: You recommended that Figure C-1 be corrected to show the Guam National Wildlife Refuge along the beach at Ritidian Point.

Response and Revisions to DEIS: Figure C-1 (now Figure 3-2) has been corrected as requested.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
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Honolulu, HI 96813-5406

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, California 94107-1376

May 6, 1997

ER 97/0079

Mr. Fred Minato
Environmental Planning Division
Pacific Division, Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Minato:

The Department of the Interior (DOI) has reviewed the January 1997 Draft Environmental Impact Statement (DEIS) for Military Training in the Mariana Islands. The Department of Defense (DOD) is the lead agency for the proposed training, which encompasses numerous activities on Guam and the islands of Rota, Tinian, and Farallon de Medinilla (FDM) in the Commonwealth of the Northern Mariana Islands (CNMI). The U.S Fish and Wildlife Service (FWS) responded to the Notice of Intent (NOI) to prepare the DEIS on February 28, 1996. The following comments are largely constructively critical of the current DEIS due to numerous deficiencies. They are provided for your consideration for preparation of a revised DEIS.

GENERAL COMMENTS

The DOI finds the DEIS difficult to review because important information on the large number of activities (147) associated with the training exercise alternatives appear to be absent, deficient, or presented in the wrong chapter. Many activities are not adequately described, often making many training components of each alternative difficult to understand. Because their training components might pose individual or cumulative impacts to fish and wildlife, including Federal trust species and their habitats, these activities need to be clarified.

The analysis of alternatives presented in the DEIS is deficient. For example, the No Action Alternative includes all continuing activities considered to be ongoing (113); however, previous National Environmental Policy Act (NEPA) analysis evaluated many of these training activities as one-time, not ongoing, events. The cumulative impact analysis of these actions, including these activities in the "No Action Alternative", is lacking. Therefore, the DEIS does not provide valid environmental analyses. We request the DEIS be revised to fully describe and adequately analyze the impacts of project activities, including their training components.

The range of practicable alternatives needs to include alternatives that would 1) eliminate or 2) reduce the scope and frequency of training activities at sites with sensitive fish and wildlife resources. For example, eliminating bombing or reducing the scope and frequency of bombing activities at FDM would avoid or minimize impacts to migratory seabirds and endangered and threatened species. The revised DEIS should clarify whether the military considers the bombing of FDM a nondiscretionary action.

Also, an alternative to exclude Rota as a site for military training activities should be addressed and evaluated in the revised DEIS. The DOI believes the environmental risk of introducing the brown tree snake (BTS) to Rota is high. The revised DEIS should evaluate accomplishing activities similar to those proposed for Rota on Guam (where the BTS is already established) or on Tinian (where the introduction and colonization of the BTS is more likely due to ongoing military training and proposed large-scale private construction). Use of Rota also risks many more public trust resources vis-à-vis a BTS infestation than these other two islands.

The presentation of information in the DEIS on existing resources is generally deficient, especially for marine resources in the affected environments of each island. A significant body of relevant literature exists on the resources of Guam and Tinian; however, very little of this information is included, even in summary form. In particular, information on the existing species and habitats at FDM is so sparse that ascertaining what species and habitats are at risk from the proposed training activities is limited.

The DEIS does not evaluate potential impacts of the No Action Alternative (over 110 ongoing activities) because they have been evaluated in previous environmental reviews, even though most appear to have been reviewed only as one-time events for specific past exercises (*e.g.*, Tandem Thrust). For the preferred action (*i.e.*, Mitigated Set of Training Activities), the analysis of potential impacts is deficient, especially for the Tinian and FDM sites.

As a result, mitigation for potentially unavoidable, adverse impacts is either absent or, when proposed, often cannot be evaluated for adequacy or for the possibility of eliminating the need for an individual review of the activity. For species listed under the Endangered Species Act (ESA), deficient evaluations of potential impacts and inadequate determinations of appropriate mitigation result in the need for consultation under section 7 of the ESA on a case-by-case basis rather than at the programmatic level.

The Brown Tree Snake Control/Interdiction Plan described in Appendix F is generic in nature. It should be refined to ensure its effectiveness. The FWS recommended in its NOI response that the DEIS include discussions of how the plan would be implemented for each training exercise within each proposed training area, yet no such discussions are included in the DEIS. The information presented in the DEIS does not eliminate the need for the DOD to consult with the FWS each time an inter-island training activity is to occur for the purpose of tailoring the generic BTS plan with appropriate details.

The DEIS appears to be thorough and comprehensive in its coverage of cultural resources, impacts on cultural resources, and mitigation proposed for those impacts. We are concerned about the small range of alternatives and, more importantly, about what constitutes the proposed

action. The proposed action, described as military training in the Mariana Islands, seems to be composed of all of the alternatives. Its distinguishing features need to be clarified.

SPECIFIC COMMENTS

Executive Summary 2.0 Proposed Action and Alternatives Page ES-2. The Executive Summary should include a map showing locations of the various activities.

Page 1-2. Figure 1-1, Site Location. This figure shows the island of Saipan at an incorrect scale. The size of that island is too small, and it should be shown to scale with either nearby Tinian or Rota.

Chapter 1. Purpose and Need for Training in the Marianas

1.2. Proposed Action Summary and Background

Page 1-3. The second paragraph states: "Table 1-1 identifies the units that must train in the COMNAVMARIANAS area of responsibility, particular training required, mandated frequency (*e.g.*, quarterly) where applicable, facilities required, and potentially suitable locations in the Mariana Islands." However, this statement is inconsistent with the footnote at the end of Table 1-1, located on page 1-16.

The revised DEIS should clarify whether the information presented in the table is complete. In addition, the numbers of personnel and frequencies associated with the required training are either not identified or are too vague to be of value in understanding what individual or cumulative impacts are anticipated from implementation of the various training components. The table should present more detailed information to allow a greater understanding of the required training components and accurately support the statement in the second paragraph.

Screening Process and Issues Discarded from Detailed Consideration.

Page 1-25. The summary of "Issue: Minimize airport approaches over populated areas of Rota," states that "helicopter flight tracks .. coincide with existing civilian airport approach and departure routes" and "Therefore, no further discussion of this issue is necessary." However, the issue of increased noise and its impact on Mariana crows (*Corvus kubaryi*) in the area has not been adequately addressed. We recommend that this potential impact be evaluated in the revised DEIS.

In the summary of "Issue: Risk assessment for brown tree snake introduction to Rota as a result of proposed SEAL activities," it is stated that "No preliminary risk assessment will be necessary" because SEAL movements out of Guam "...will strictly comply with the BTS Control/Interdiction Plan..." We disagree since the BTS plan that is referenced (Appendix F) is too generic to be adequate for every exercise. Rather, it should be used as a blueprint for identifying more specific BTS plans tailored to the specific activities and islands planned for each exercise. The revised DEIS should indicate that the BTS plan presented in Appendix F will be used in this manner.

Furthermore, the revised DEIS should state that no future military training activities will occur on Rota due to the environmental sensitivity of the island.

1.3.2. Identification of Significant Issues.

Page 1-31. In the summary of "Issue 1: Impacts on Biological Resources," it is stated that "Prevention of BTS import from Guam to other islands...is probably the most significant issue addressed in this DEIS." We agree the potential introduction of the BTS from the proposed training exercises needs to be addressed as a significant issue, and this issue also needs to be addressed in detail in Chapter 4 (Environmental Consequences).

1.3.3. Non-significant Impacts Due to Existing Management Requirements.

Page 1-32. The first paragraph states: "...potential impacts...will be routinely mitigated (*i.e.*, avoided) by adherence to existing orders and regulations" and "...all training units have organic orders and SOPs...[that] provide information and guidance...including...BTS interdiction procedures..." We do not agree the BTS problem is non-significant. The threat of BTS introduction should be considered significant until a time when specific details in the BTS Control/Interdiction Plan (Appendix F) are addressed and formulated for each exercise and to a degree that warrants a determination of non-significance.

1.3.3.1. Alien Species and Disease Control.

Page 1-33. The first sentence states: "The potential to introduce alien species ...will be managed by existing quarantine procedures" and "...strict compliance with the .BTS Control/Interdiction Plan..." We believe existing quarantine procedures and the referenced BTS plan will not adequately relieve the threat of introducing alien species, especially BTS, since limited funds currently make full inspection and control (especially for BTS) difficult for small training missions and impossible for massive military movements. The referenced quarantine procedures and the BTS plan should undergo review and refinement to ensure adequate funding and training for effective implementation prior to each training exercise, and the results should be reflected in the revised DEIS.

Page 1-33. The second sentence states: "BTS interdiction will be accomplished by strict compliance with the *Brown Tree Snake (BTS) Control/Interdiction Plan* discussed in Chapter Four." The revised DEIS can reduce confusion in the presentation of information in the DEIS by incorporating the BTS-related points included in this section into a discussion of the BTS problem and the referenced control/interdiction plan. This discussion should be included in Chapter 4 (Environmental Consequences).Page 1-33. The first bullet states: "All exercise participants will be briefed on the BTS threat and on prohibitions on importing uncertified fresh produce." We recommend: 1) field commanders be briefed by biologists from the FWS, CNMI-DFW, USDA/ADC, and BRD; 2) these agencies, along with DOD, develop a short one-page briefing memorandum that includes important BTS control, capture, and reporting procedures; and 3) the commanders and USDA/ADC distribute the memorandum and conduct the briefings with exercise participants prior to each exercise.

Page 1-33. The third bullet states: "All personnel and material will undergo customs inspection prior to shipping off-island from Guam. Trained dogs will inspect all materiel, except office supplies and personnel luggage." We are concerned that not enough ADC dogs will be available to inspect all material at once for large exercises. The revised DEIS should state that high-risk cargo that is difficult for humans to visually inspect shall be first checked by dogs. Specifics such as this should be clarified in a detailed BTS plan for each exercise.

Page 1-33. The fourth bullet states: "All vehicles and mobile equipment will be inspected and steam-cleaned prior to staging and embarkation in Guam and Okinawa." Although this was stated in the 1995 Tandem Thrust BTS plan, it is our understanding that no steam-cleaning was done nor were any steam-cleaners available, at least not on Guam. The revised DEIS should state that steam-cleaners be made available on Guam, Okinawa, Australia, and other known BTS locations used by military aircraft and vessels involved the in training exercises. It should also state that the cleaners be fully utilized.

Page 1-33. The fifth bullet states: "All material designated for transport off Guam will be staged in areas identified as low-risk for BTS, i.e., areas with low or no vegetation and dog surveillance." The revised DEIS should clarify how these "low-risk" staging areas are different from fenced and trapped "quarantine" staging areas for high-risk cargo, as has been mentioned in past BTS plans. All exercise-related material should be staged in fenced and trapped "quarantine" staging areas that have low or no vegetation and are patrolled by dogs.

Page 1-33. The sixth bullet states: "A BTS surveillance and trapping program will be established prior to any exercise involving both Guam and another tropical location." The DOI believes it is prudent to also establish a BTS plan for any exercise involving the warmer regions of the continental U.S., since a live BTS made it from Guam to Corpus Christi, Texas, in a military personnel's household effects (inside a dishwasher in a plastic-wrapped pallet) after nine months of storage and shipping. DOI Secretary Bruce Babbit has advised the BTS could be a threat to the southern U.S., and therefore, we recommend the last line in Section 1.3.3.1 should read: "..involving both Guam and other tropical, subtropical or temperate locations, including the U.S. mainland."

Chapter 2. Proposed Action and Alternatives

Page 2-1. The third paragraph states: "The alternatives represent the two extreme cases of the proposed action-(1) no new training activities and (2) all of the proposed new training activities-and (3) a "middle ground" alternative, which includes only the proposed new activities which are not expected to significantly impact the environment." We do not believe that the range of practicable alternatives, such as eliminating or reducing the scope of some activities and eliminating military training on the island of Rota, is included in the DEIS. The revised DEIS should include adequate treatment of reasonable alternatives.

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The first alternative listed states: "No Action: This alternative consists of all ongoing training activities (110+) conducted on the islands of Guam, Tinian, Rota, and FDM in recent years." A true No Action Alternative should be included in the revised DEIS (*i.e.*, an alternative that includes only those military training activities that are ongoing and for which any required NEPA analysis was conducted with the understanding that these activities would be long-term activities carried out continuously into the future).

2.1. No Action Alternative

Page 2-2. The first paragraph states: "This section describes ongoing training in sufficient detail to provide readers with an understanding of training activity components which might have cumulative environmental impacts." According to the DEIS, these ongoing activities would continue under the No Action Alternative. Although the section provides a comprehensive listing of these activities, it does not contain the level of detail needed to understand the implications of their components, either individually or cumulatively. A reference is given to the 1993 and 1994 Environmental Assessments (EAs) for Tandem Thrust exercises on the island of Tinian as documents containing previous evaluations of these ongoing activities. However, the level of detail on the components of the proposed activities in these documents is also insufficient for an adequate evaluation of cumulative impacts. The revised DEIS should either contain much greater detail on the activities or provide an accurate reference list of environmental documents that do adequately describe them.

Page 2-2. Third paragraph states: "Many of the [ongoing] activities...have been previously evaluated for potential environmental impacts." A reference is given to the 1993 and 1994 Tandem Thrust EAs as documents containing previous evaluations of these ongoing activities. Both EAs were clearly developed to cover exercises during a specific and relatively short time period and were never intended to address permanent, ongoing training activities. The revised DEIS should either: 1) evaluate these activities as ones to be conducted indefinitely into the future and address how impacts from these activities would be avoided, minimized, or compensated for; or 2) include an accurate reference list of environmental documents that have provided such an evaluation and present a summary of this information in Chapter 4 (Environmental Consequences).

Table 2-1. Existing and Proposed Training Activities and Locations

Page 2-3. Table 2-1 lists ongoing and proposed training activities with descriptors such as "Bivouac" and "Swimmer Insertion" and their locations. The numbers of military personnel or units involved in each activity are not identified in this table. Although Table 1-1 identifies military units and their required training and, in some cases, mentions specific numbers of units involved, the same descriptors found in Table 2-1 are not used. Further, the required training identified in Table 2-1 is broken down by location, whereas it is broken down by each branch of the military in Table 1-1. As a result, it is impossible to correlate the activities listed in Table 2-1 with the numbers of personnel or units mentioned in Table 1-1. It is difficult to properly understand the activities involved in the proposed training from the information given in Table 2-1. The revised

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DEIS should include a table of proposed "Training Activities" that is similar to Table 2-1 and list the specific training activities, their locations, and also the numbers of military personnel involved in each activity.

2.1.1. Introduction of Forces

Page 2-15. The description of "Amphibious Assaults" states: "These assaults normally [involve] delivery of troops and equipment across the beach by ..landing craft..." and "The largest landing craft in the inventory, the LCAC (Landing Craft, Air Cushion]...is designed to transport 63,000 kg" and "...LCAC training currently occurs at ...Unai Dankulo and Unai Chulu in the EMUA [Tinian]." The weight of an LCAC is not given. The total weight of an LCAC plus troops and cargo should be given in the revised DEIS to provide readers with an understanding of the activity components that might result in impacts to sea turtle nests.

2.2.2. Combat and Combat support Training

Page 2-32. The description of "Reconfigure the Closed Firing Range" states: "On Tinian, [the military intends to] reconfigure the closed firing range on the eastern coast of the EMUA to include a fire and maneuver range for small arms . and machine guns, and a mortar range..." The need for these new facilities or the inadequacy of the existing range is not identified. The revised DEIS should identify the justification for the new facilities since adverse impacts to Tinian monarchs and their habitat would likely result from the reconfiguration.

Figure 2-20, Tinian Constrained Areas

Page 2-39. Although mitigation measures have been identified in the document (no digging within 3 feet of any historic structure), it is not clear what activities would be prohibited within the North Field National Historic Landmark, including the site of the A-bomb loading pit. This figure shows the landmark area to be outside of any of the identified constrained areas. In fact, graphics show that pyrotechnics and fires would be permitted within the landmark and that a fire and maneuver range and a mortar range are to be developed either within or adjacent to the landmark.

Chapter 3, Environmental Setting

3.3.1. Guam, 3.3.1.2. Marine Environment

Page 3-6. The revised DEIS needs to adequately describe the marine environment at Guam, especially the conspicuous, native marine and estuarine organisms and those habitats adjacent to all proposed training areas. These habitats are the portion of the marine environment that would be affected by the proposed action. A significant body of relevant information exists on these resources, however, a literature search is not mentioned in either the text of the DEIS, Appendix C, or Appendix I. The revised DEIS should include a literature search and a summary of the major native marine biota. It should list species such as fishes, corals, molluscs, crustaceans,

echinoderms, algae, seagrasses, mangroves and habitats at all proposed training sites in the affected marine environment.

3.3.1. Guam, 3.3.1.3. Rare, Threatened, and Endangered Species.

Page 3-8. The third paragraph states: "The endemic Mariana crow is estimated to have a current population of 40 [or less] individuals restricted in distribution to AAFB [Anderson Air Force Base], mostly occurring in the northern cliffline forests." According to the Guam Division of Aquatic and Wildlife Resources (DAWR), the correct number of crows remaining on Guam is believed to be 14 wild birds, plus an additional 8 birds that are in the process of being released at AAFB. The revised DEIS should provide this updated information.

3.3.1. Guam, 3.3.1.4. Brown Tree Snake.

Page 3-9. This section states: "The BTS has already been sighted on Oahu, Saipan, and Rota but is not thought to be established on those islands." Based on recent evidence that may be obtained from the CNMI-DFW or the Biological Research Division (BRD) of the U.S. Geological Survey, the BTS may be establishing on Saipan. The revised DEIS should include this information on the BTS, and evaluate it in section 4.1 (Impacts on Biological Resources) in Chapter 4 (Environmental Consequences).

3.3.2. Tinian, 3.3.2.1. Habitat.

Page 3-10. The third paragraph states: "The remaining limestone forest on Tinian is an important refuge for endangered species." While this is true, the importance of tangantangan (*Leucaena leucocephala*) as habitat for endangered species and other native wildlife should be acknowledged in the revised DEIS.

Page 3-10. Footnote 29 does not reference the FWS's February 1996 report entitled "Characteristics of Mariana Common Moorhens and Wetland Habitats within the U.S. Department of the Navy's Military Lease Area and Exclusive Military Use Area on the Island of Tinian, Commonwealth of the Northern Mariana Islands, July 1994 - August 1995." The information in the footnote is taken directly from the FWS's report. The revised DEIS should provide references in the footnote.

Page 3-9. This section does not mention that migratory birds use the three primary wetlands on Tinian. This information should be reflected in the revised DEIS.

3.3.2. Tinian, 3.3.2.2. Marine Environment.

Page 3-11. The document states "...reefs on the eastern (leeward) coastline are better developed and have greater species diversity than those on the western coast." This sentence is inaccurate since it is the western (leeward) coastline that has better developed and more diverse reefs. This sentence should be corrected in the revised DEIS.

Page 3-11. The revised DEIS needs to adequately describe the marine environment at Tinian, especially the conspicuous, native marine and estuarine organisms and habitats documented adjacent to proposed training areas, which is the portion of the marine environment that would be affected by the proposed action. Relevant information on these resources at some of the proposed training sites has been documented in previous studies and some of this information is provided in Appendix I. The revised DEIS should provide: 1) a literature search for the training areas not addressed in the appendix; 2) the results of additional marine surveys conducted at sites not previously surveyed (*e.g.*, Unai Dankulo); and 3) an improved summary of the major native marine biota, including fishes, corals, molluscs, crustaceans, echinoderms, algae, and seagrasses and habitats at all training sites in the affected marine environment.

3.3.2. Tinian. 3.3.2.3. Rare, Threatened, and Endangered Species.

Page 3-11. The first paragraph states: "Tinian has five federally protected...bird species and two protected sea turtles." Tinian currently supports three extant federally protected birds, the Micronesian megapode (*Megapodius laperouse*), the Tinian monarch (*Monarcha takatsukasae*), and the Mariana common moorhen (*Gallinula chloropus guami*); one extinct bird species, the Mariana mallard (*Anas platyrhynchos*), and one extirpated bird species, the island swiftlet (*Aerodramus vanikorensis*). This information should be corrected in the revised DEIS.

Page 3-11. The revised DEIS should also mention that all of the above species are on the CNMI Endangered Species List in addition to the Mariana fruit bat (*Pteropus mariannus*).

3.3.3. Rota. 3.3.3.2. Habitat.

Page 3-12. The revised DEIS should mention the existence or location of seabird colonies and bat colonies on the island.

3.3.3. Rota. 3.3.3.2. Marine Environment.

Page 3-13. The statement: "Coral reefs are found offshore on Rota's north and west sides (see Figure C-3 in Appendix C)" is incorrect since coral reefs are found on all sides of Rota. This section and Figure C-3 should be corrected in the revised DEIS.

Page 3-13. This section inadequately describes the marine environment at Rota, especially the conspicuous, native marine and estuarine organisms and their habitats. These resources occur adjacent to proposed training areas, which is the portion of the marine environment that would be affected by the proposed action. Relevant information on these resources has been documented in previous studies. A literature search should be conducted. The revised DEIS should then include an improved summary of the major native marine biota, including fishes, corals, molluscs, crustaceans, echinoderms, algae, and seagrasses and habitats in the affected marine environment near the proposed training site adjacent to Songsong Village.

3.3.3. Farallon de Medinilla. 3.3.4.1. Habitat.

Page 3-13. The first paragraph states: "Farallon de Medinilla (FDM)... has historically been used by the DOD as a bombing site." This sentence is misleading since it implies that the island has been used as a bombing site for a much longer period of time than it really has. The revised DEIS should identify the specific date that FDM was first used as a bombing site (*i.e.*, October 1971).

Pages 3-13 and 3-14. The last sentence on 3-13 states: "While the vegetation is damaged by bombardment, no plant species appears to be seriously affected." While no particular species may have been extirpated, it is very likely that bombing has significantly altered the structure of the native vegetation. A 1902 report by G. Fritz and the Navy's 1975 EIS for bombing FDM both mention areas covered with brush or shrubs that were approximately 12 feet tall. Recent visits to the island verified that no shrubby areas of this height are present. Therefore, the sentence in the revised DEIS should reflect these apparent changes in vegetation structure that may have occurred as a result of naval bombardment. This information be included in the summary of Potential Impacts in section 4.1.2.5 in Chapter 4 (Environmental Consequences).

Page 3-14. The first paragraph states: "Birds nest, forage, and shelter in the dense vegetation " While some areas of shrubby vegetation might be considered "dense", large sections of the island are either bare ground or grassy. Many birds, including seabirds and shorebirds, use these bare or grassy areas for nesting, foraging and shelter. The revised DEIS should reflect this fact and provide a map of different areas with estimates of the percentage of vegetation cover.

Page 3-14. This section does not mention the presence of the great frigatebird (*Frigata minor*) colony seen during the November 1996 survey. The significance of this colony should be determined since it represents one of only two small breeding populations located in the Mariana Islands, on the edge of the species' range and a significant distance from other known breeding colonies. This information should be included in this section of the revised DEIS.

3.3.4. Farallon de Medinilla. 3.3.4.2. Marine Environment.

Page 3-14. This section does not adequately describe the marine environment at FDM on the basis of information contained in a preliminary report (Appendix H-2) that presupposes existing conditions and does not include the results of a direct, recent marine survey. Very little is known of the marine biological diversity and habitats of FDM. An adequate marine survey should be conducted at FDM, and the results presented in the revised DEIS.

Page 3-14. The first paragraph states: "There is no fringing reef or shallow coastal zone at FDM." This statement conflicts with another statement in the same paragraph that "There is little shoal area around most of the island, with the exception of the northern and southern ends.", a statement in the second paragraph that "...on the leeward side of the island, where the substrate drops gradually seaward...coral growth...is good, with approximately 50 percent coverage...", and a statement in Appendix H-2 that "...at the northern end and central parts of the leeward side of the island, the substrate drops gradually seaward. In these areas coral...coverage [is] about 50%..."

On the basis of the limited information available, the revised DEIS should delete the words "fringing reef or" from the first paragraph.

The first paragraph also states: "The shoreline consists of...little beach formation." and the second paragraph states: "...green sea turtles have been observed in the nearshore waters." In addition, two small beaches on FDM are identified in Figure 2-6. The revised DEIS should note the presence of green sea turtles (*Chelonia mydas*) and include an evaluation of the potential for turtle nesting in section 3.3.4.3.

3.3.4.3. Rare, Threatened, and Endangered Species

Page 3-14. The first sentence states: "A brief daytime avifaunal survey of FDM (Appendix H) recorded a total of 17 avian species..." A thorough search of the literature (especially the grey literature in the form of CNMI-DFW reports) would help determine the broader distribution of those species found on FDM. The search information would also help evaluate the impacts of the proposed training. A thorough literature search should be conducted, and the revised DEIS should include information relevant to FDM seabirds.

Chapter 4. Environmental Consequences

4.1. Impacts on Biological Resources

Page 4-1. The second paragraph states: "The most significant impact which could result from proposed training is export of the brown tree snake (BTS) from Guam, discussed at length in section 4.1.2.3." The section referenced in this statement discusses significant impacts only on the island of Tinian. The revised DEIS should include an overall discussion of potential BTS impacts in section 4.1. Discussions of potential BTS impacts in the sections on individual islands should be related to the specific activities planned for those islands.

Page 4-2. The first paragraph states: "The proposed mitigation measures...are subject to consultation and concurrence by several government agencies." Development of mitigation should be coordinated with both federal and local natural resource agencies and presented in the revised DEIS. These agencies should include the FWS, the National Marine Fisheries Service (NMFS), the Guam Department of Aquatic and Wildlife Resources (DAWR), and the CNMI-DFW. The DFW personnel on Rota, Tinian, and the main Saipan office should also be included.

4.1.2. Significant Impacts, 4.1.2.1. Anderson Air Force Base.

Page 4-4. The first paragraph states: "The only type of training activity that has the potential to cause significant impacts is aircraft training." and that "Potential disturbance of these endangered species [Mariana crow and Mariana fruit bat] will be mitigated by limiting aircraft training activities during the Mariana crow breeding season." and "If mitigation is required for...impacts to the Mariana fruit bat, it will be determined from the consultation process." Consultation between the Air Force and the FWS under section 7 of the ESA is ongoing to address potential impacts of this

activity on Mariana crows and Mariana fruit bats. The outcome of this consultation should be included in the revised DEIS.

Page 4-4. The summary of "Existing Conditions" states "Only 12 crows remain on Guam, and all of them are at AAFB." According to the DAWR, the correct number of crows remaining on Guam is believed to be 14 wild birds plus 8 birds that are in the process of being released on AAFB. This updated information should be included in the revised DEIS.

Page 4-4. The summary of "Existing Conditions" states "...most of the [Mariana] crows have moved to the MSA [Munitions Storage Area]." This statement is erroneous since the remaining crow population on AAFB has not moved but simply experienced a reduced distribution due to attrition. This information should be corrected in the revised DEIS.

Page 4-4. The summary of "Existing Conditions" states "Endangered species at AAFB include the Mariana crow and Mariana fruit bat." According to information presented on Page 3-7 the federally listed green sea turtles are known to nest on the sand beaches at AAFB. The existence of green sea turtles at AAFB should be acknowledged in this section of the revised DEIS.

Page 4-4. The summary of "Potential Impacts" does not mention potential impacts to newly released crows at AAFB. Impacts to these crows should be assessed in the revised DEIS since they may exhibit behavior different from the existing wild crows as they move into unoccupied areas and attempt to establish territories.

Page 4-4. The summary of "Potential Impacts" does not mention potential impacts to sea turtles from activities at AAFB. Impacts to sea turtles and their nesting habitat from swimmer insertion and EOD training at AAFB should be included in the revised DEIS.

Page 4-5. The summary of "Proposed Mitigation" states: "Any mitigation for potential impacts on Mariana fruit bats will be decided through section 7 consultation." Consultation between the FWS and the Air Force is ongoing to address potential impacts of lifting airspace restrictions at AAFB on Mariana fruit bats (and Mariana crows). Proposed mitigation should be consistent with the outcome of this consultation and with previous FWS recommendations made for Fleet Carrier Landing Practice (FCLP), and should be addressed in the revised DEIS.

Page 4-5. The summary of "Proposed Mitigation" does not mention protection of the Mariana fruit bat roost at Pati Point and the ½ nautical-mile perimeter flight operation restriction (except for direct take off and landing) to avoid impacts on the bat colony at AAFB. This protection was a result of the informal section 7 consultation that was completed on March 21, 1997. This information should be reflected in this section of the revised DEIS.

Page 4-5. The summary of "Proposed Mitigation" does not mention measures to mitigate potential impacts to sea turtles and their nesting habitat from swimmer insertion and EOD training at AAFB. The revised DEIS should include measures to mitigate these impacts.

4.1.2. Significant Impacts. 4.1.2.2. NAVACTS Waterfront Annex.

Page 4-5. It is stated that "The use of 10-pound charges [for EOD training in Apra harbor] has been approved by the Guam EPA and USFWS" and that "...potential impacts on sea turtles will be mitigated by compliance with the protocol established by the Guam EPA and USFWS.." The NMFS, not the FWS, has approved and established the protocol referred to in this section. These statements should be corrected in the DEIS.

4.1.2. Significant Impacts. 4.1.2.3. Tinian.

Page 4-6. The section on "Proposed Mitigation" states: "Mitigation of the BTS problem will be provided by requiring strict compliance with the *BTS Control/Interdiction Plan* for all training activities originating from or transiting through Guam...(see Appendix F)." The DOI does not believe that preventing BTS introductions to other islands has been adequately addressed by the generic BTS plan in Appendix F. We recommend that the military consult with the FWS for the purpose of tailoring the generic plan with details appropriate for the planned training area and activity each time an inter-island training activity is to occur. This mitigation measure should be included in the revised DEIS.

4.1.2. Significant Impacts. 4.1.2.4. Rota.

Page 4-9. The first paragraph states: 1) "The only activity with potentially significant biological impacts on Rota protected species is night vision goggle (NVG) training." 2) "Endangered Mariana fruit bats roost in the Sabana Heights Wildlife Conservation Area...," and 3) "...the nearest crow nest is approximately 1.5 km away [from the site of NVG training]..." Although the Sabana Heights Wildlife Conservation Area is where most of the colonial bat roosting takes place, these bats are expected to forage at night anywhere on the island where food is available, including within the vicinity of the airport.

Figure 4-2 does not specify the training patterns that would be flown. Based on recent sightings that documented crows within airport boundaries and crow nests within ½ km of the airport, crow nests may be expected to occur under the proposed NVG helicopter flight area on an annual basis. Also, the averaged daily decibel level (50) is used in the DEIS as a basis to evaluate potential noise impacts, but the peak maximum instantaneous noise levels expected, which are well over 100 decibels, are not identified in either the text or Figure 4-2. In addition, the low-level ambient light needed for the training may not exist in the near future at the Rota airport since the Sinapalo area is expected to grow with planned airport expansion and new residential development. The NVG training should continue on Guam and Tinian (Page 2-19) where environmental impacts are not expected and should not be initiated on Rota where noise impacts could affect bats and crows and the activity would increase the potential for the accidental introduction of BTS.

4.1.2. Significant Impacts. 4.1.2.5. Farallon de Medinilla.

Page 4-12. The first paragraph states: "...five species of migratory birds were sighted on the island." This statement conflicts with the information contained in section 3.3.4.3, which references the results of the November 1996 survey (Appendix H-3). The revised DEIS should evaluate impacts to all 14 migratory birds found on FDM in the context of their distributions throughout the CNMI.

Page 4-12. The first paragraph states: "Mitigation measures involve...spraying rodenticide..." This sentence is misleading since dry rodenticide pellets would be dropped on the island and liquid rodenticide would not be "sprayed" since the aerial application of liquid rodenticide in the Marianas is not yet permitted. The term "controlling the rat population" should replace "spraying rodenticide" in the revised DEIS.

Page 4-12. The summary of "Existing Conditions" does not mention the presence of beaches on the west side of the island where green sea turtles have been observed in the nearshore waters of FDM. This information and acknowledgment that sea turtles may potentially nest at FDM should be included in the revised DEIS.

Page 4-12. The summary of "Existing Conditions" states: "A 1975 report [U.S. Navy EIS] estimated the population of...boobies to be 50,000 on FDM." The accuracy of this estimate is discounted in the DEIS because the report does not describe the survey methodology that was used and because two other reports (1985 and 1991) from subsequent surveys estimated fewer than 4,000 boobies for the entire Mariana Islands. However, the estimates contained in both of these other reports were based on indirect observation from afar since, as indicated in the reports, the military consistently denied the scientists landing access to FDM. Since it is likely that the estimates in all three reports were based on observations from afar and because these estimates were all made several to many years after the military began bombing FDM in October 1971, bombardment of the island may have possibly resulted in reduced seabird numbers. Therefore, for the reasons stated in the DEIS, the booby population estimate in the Navy's 1975 EIS should not be discounted in the revised DEIS.

Page 4-12. The summary of "Existing Conditions" states: Mariana fruit bats are "... not a protected species on FDM." While it is true that fruit bats are not federally listed, they are protected from hunting throughout the CNMI. This fact should be clarified in the revised DEIS by changing this sentence to read "..not a federally protected species on FDM but are protected from hunting on FDM under CNMI law."

Page 4-12. Footnote 28 at the bottom of the page incorrectly references the FWS for a 1985 report. The revised DEIS should correct the reference to this report as the CNMI-DFW.

Page 4-15. The summary of "Existing Conditions" states: "...the presence of species on FDM and...[FDM's] use as a bombardment range suggest that some sort of equilibrium between the bird population and ongoing use has been established." Although birds persist in using FDM,

bombardment must cause their direct mortality as well as nest destruction and abandonment. Because the degree of their reproductive success is affected by the bombardment cannot be ascertained, the suggestion that "some sort of equilibrium" has been established is scientifically unsound. We recommend the second sentence be rewritten in the revised DEIS to read "Despite the fact that bombardment must cause direct bird mortality as well as nest destruction and abandonment, recent surveys have documented that birds persist in using FDM."

Page 4-15. The summary of "Existing Conditions" does not mention the existence of the great frigatebird colony seen during the November 1996 survey or its significance. This information should be summarized in this section of the revised DEIS.

Page 4-15. The summary of "Potential Impacts" states: "...bombardment could affect the endangered Micronesian megapode and migratory birds on FDM in two ways: direct contact, or alteration of habitat and/or food source." The 1975 Navy EIS indicates: 1) boobies were observed to nest as a colony that was fairly evenly distributed over the vegetated top of the island and 2) a 12-foot-high forest, which would provide ideal nesting habitat for boobies and megapodes, as well as roosting bats, covered a portion of the island. This vegetation cover is substantially reduced today, and it is highly improbable that the plants on FDM, which have evolved to be adapted to the natural conditions of the Mariana Islands, would have been so reduced to current levels by natural causes. Bombing-related impacts to birds, bats, and habitats on FDM should be acknowledged and addressed in the revised DEIS.

Page 4-15. The summary of "Potential Impacts" states: "BTS could be introduced through importation of bombing targets" but does not evaluate the potential impacts of BTS on the fauna of FDM. An evaluation of these impacts should be summarized in the revised DEIS.

Page 4-15. This summary of "Potential Impacts" does not address impacts to the breeding colony of great frigatebirds seen during the November 1996 survey. These impacts should be addressed in the revised DEIS in relation to the ecological significance of this colony.

Page 4-15. The summary of "Potential Impacts" does not address impacts to seabirds from mortar and gun fire targeted to an area set up as a "simulated oil storage area consisting of 12 dumpsters" in the south-central portion of FDM, which is identified in Fig 2-14. During the November 1996 survey, this particular area was found to be rich in seabirds, especially a masked booby (*Sula dactylatra*) colony that represents the largest known nesting site for this species in the Mariana or Caroline islands. This potential impact should be addressed in this section of the revised DEIS in relation to the ecological significance of this colony.

Page 4-15. The summary of "Potential Impacts" does not address the potential for training activities to impact sea turtles and their nesting sites from mortar fire at targets located on FDM's two beaches or in the island's nearshore waters from ordnance that misses shoreside targets. These potential impacts should be addressed in the revised DEIS.

Page 4-15. The summary of "Proposed Mitigation" does not address mitigation for potential impacts to sea turtles from mortar and gunfire directed to beach targets and from ammunition that misses the island and lands in the surrounding water. Mortar and gun fire should be restricted to outside the sea turtle nesting season (*i.e.*, from egg laying through dispersal of hatchlings) when eggs, young, and breeding adults are unlikely to be present. This should be included in the revised DEIS. The Navy should also consult with the NMFS regarding finalization of a conservation agreement to protect sea turtles in waters of all the Mariana Islands, especially waters fronting potential nesting sites, similar to the agreement in effect for Apra Harbor on Guam (Appendix E).

Page 4-15. The summary of "Proposed Mitigation" states that "Further studies on seabirds and megapodes will be conducted...aerial photographs will be taken on a quarterly basis for two years..." The revised DEIS should disclose exactly what kind of studies are being proposed and whether the Navy would conduct these studies or contract them through another agency. Without ground-truthing by direct observation, the taking of pictures quarterly is inadequate to determine the effects of bombing on seabirds and would be completely useless in determining the effects of bombing on megapodes.

This section of the revised DEIS should either identify in detail what studies will be conducted to determine the effects of bombing on seabirds and megapodes or detail how the Navy would decide what studies need to be completed. The revised DEIS should also give a definite time frame for their completion and identify what mitigation is proposed (*e.g.*, enhancing habitat on other islands in the Marianas) to offset the loss of seabirds due to bombing-related impacts.

Page 4-15. The summary of "Proposed Mitigation" does not mention limiting bombing to low periods in the seabird breeding season. Limiting bombing to non-peak seasons is one of the easiest and most significant steps the military can take to mitigate impacts on seabirds. The revised DEIS should provide for a thorough literature review and interviews with experts in seabird breeding. The literature review and interview results may be used to determine what times of the year bombardment would have the least impact on seabirds. The revised DEIS should also indicate that the DOD should partially mitigate impacts of bombardment of FDM by limiting activity to non-peak breeding seasons.

Page 4-15. The summary of "Proposed Mitigation" does not specifically address mitigation for potential impacts to the masked booby breeding colony that exists near the "simulated oil storage area consisting of 12 dumpsters" in the south-central portion of FDM, which is identified in Fig 2-14. This target should be either removed or relocated to avoid or minimize this impact in the revised DEIS.

Page 4-15. The summary of "Proposed Mitigation" does not specifically mention mitigation for potential impacts to the breeding colony of great frigatebirds at FDM. The great frigatebird colony on FDM should be given a high priority for protection in the revised DEIS and should be monitored to identify breeding cycles, number of birds, etc.

Page 4-15. The summary of "Proposed Mitigation" does not include information or recommendations contained in the FWS's January 29, 1997, "Biological Opinion for Aerial Bombardment and Gunnery Practice associated with Tandem Thrust 1997 at Farallon de Medinilla in the Commonwealth of the Northern Mariana Islands." In addition, consultation has been initiated between the FWS and the Navy under section 7 of the ESA concerning impacts to endangered species from additional bombardment of FDM. Results of these consultations should be incorporated into the revised DEIS.

4.1.3 Non-Significant Impacts: Proposed New Activities. 4.1.3.2 NAVACTS Waterfront Annex.

Page 4-16. The descriptions of "Shallow Water Mine Countermeasure Training" and "Underwater Demolitions at Dadi Beach", state that "...sites chosen for live ammunition lack biota..." and that "Use of underwater explosives of up to ten pounds at a new site at Dadi Beach will not cause significant impacts because no protected species or coral are present," respectively. Although sea turtles were not observed during the site visits documented in Appendix I, federally listed sea turtles are expected to transit through the water column over the areas. The revised DEIS should provide for protocols developed by the NMFS (Appendix E) to protect sea turtles from underwater demolitions implemented for all explosives training.

Page 4-16. The section on "Underwater Demolitions at Dadi Beach" states: "Potential impacts of these charges on sea turtles will be mitigated by continued compliance with Guam EPA and USFWS protocol, developed for similar activities in Outer Apra Harbor." The NMFS, not the FWS, has approved and established the protocols referred to in this section. The revised DEIS should make this correction.

4.1.3 Non-Significant Impacts: Proposed New Activities. 4.1.3.2 NAVACTS Ordnance Annex.

Page 4-17 Under the Proposed Action Alternative, a new sniper range would be developed at the Ordnance Annex on Guam. According to the DEIS, the conceptual Surface Danger Zone (SDZ) illustrated in Figure 2-7 for the sniper range is a composite of three possible safety fan boundaries under consideration. Individual safety fan boundaries are depicted in Figure 2-14. The SDZ includes the southern portion of Fena Valley Reservoir and another sensitive area located near the western boundary of the Ordnance Annex. Both of these areas are depicted in Figure 2-17 as Constrained Areas (no wildlife disturbance). Fena Reservoir is an important habitat for federally listed endangered Mariana common moorhens, and the majority of moorhens and active nesting occur within the southern portion of the reservoir. The sensitive wildlife area depicted near the western boundary of the Ordnance Annex is foraging and roosting habitat for federally listed endangered Mariana fruit bats.

Since none of the individual safety fan boundaries excludes all of the constrained wildlife areas, we cannot concur that there will be no significant impacts to biological resources from the construction and use of a new sniper range at the Ordnance Annex. The revised DEIS should include an evaluation of potential impacts to endangered species that may result from

development of a new sniper range and identify mitigation measures to avoid or minimize these impacts.

4.1.3 Non-Significant Impacts: Proposed New Activities. 4.1.3.4. Non-DOD Land (Vicinity of Ordnance Annex)

Page 4-18. It is stated that "No endangered species were identified in this immediate area [[Talofofo River Valley]..." This statement should acknowledge that the Talofofo River Valley is the prime foraging area for the federally listed endangered island swiftlet. We recommend that the revised DEIS indicate the presence of this species in the area and that the proposed activity is not likely to adversely affect this species.

4.1.3 Non-Significant Impacts: Proposed New Activities. 4.1.3.5. Tinian.

Page 4-18. The DEIS states: "Proposed activities on Tinian that are of concern but will not cause significant impacts are the construction and use of a new firing range and a shooting house. Potential impacts would be due to clearing, fire, and projectiles." Because the proposed activities would have individual low-level impacts to Tinian monarchs from the proposed activities and since the firing range and shooting house construction would impact approximately 25 acres, (habitat for an estimated 60-90 Tinian monarchs), these activities represent an adverse effect, and would have cumulative impacts to this species. Appropriate mitigation should be developed in consultation with the FWS under section 7 of the ESA and in coordination with the CNMI. The results should be identified in the revised DEIS.

Page 4-18. The DEIS states: "The projectile fire hazard from use of the proposed firing range will be mitigated by strict adherence to the fire prevention and response plan used in Tandem Thrust 95." This plan (Appendix L) includes the use of two CNMI fire trucks on Tinian that may not always be available or in adequate operating condition or be capable of heavy off-road use to respond to training-related fires caused by projectiles. The military should fully provide for their fire prevention and response needs as part of every planned exercise. The revised DEIS needs to include this provision.

4.8. Summary of Impacts.

Page 4-69. The DEIS states: "Table 4-8 includes all potential impacts of the proposed action for which mitigative measures and parties responsible for implementing mitigation have been identified." However, several deficiencies occur in this table regarding the identification of possible impacts and proposed mitigation measures. The table should be revised to include complete information.

Page 4-73. Table 4-8 identifies "appropriate fire fighting equipment" available for response as proposed mitigation to protect natural resources from fire damage. The military should fully

provide for their fire prevention and response needs as part of every planned exercise and not partially depend on CNMI fire trucks to respond to fire emergencies. This provision should be included in the revised DEIS.

Page 4-73. Table 4-8 identifies "Cut no vegetation larger than wrist size" as proposed mitigation for "Depletion of vegetation by clearing for tactical exercises and bivouacs." Where on a plant this measurement is to be made and specific types of native vegetation recommended for protection are not identified. The revised DEIS should specify no cutting of the remaining four percent of native forest on Tinian and the *Merrilliodendron* forest at NAVACTS Ordnance Annex on Guam would be allowed. The military should consult with the FWS under section 7 of the ESA for proposed vegetation cutting on Tinian.

Page 4-74. Table 4-8 identifies using "off limits" or "no wildlife disturbance" designations as proposed mitigation to protect endangered species and their habitats to protect Mariana common moorhens at Lake Hagoi. The revised DEIS should specify that the wetland and an upland buffer extending to the perimeter road that bounds the wetland be off-limits to air traffic as well as ground traffic (*i.e.*, no hovering over the restricted areas). To support this off-limits designation, fences with access gates should be placed along the perimeter road rather than at the wetland boundary or Restricted Area signs should be posted every 10 feet around the perimeter road.

Page 4-74. Table 4-8 identifies "Restricting training dates, times, and types of training to avoid loud noises or physical disturbance of nests by vehicles, aircraft, or personnel during breeding seasons in designated areas" as proposed mitigation for "Disturbance of endangered species and endangered species habitat by noise or by physical interference from off-road vehicles and vegetation clearing." Impacts from AAVs and LCACs are not mentioned, and the proposed mitigation in Table 4-8 mentions only off road vehicles.

The revised DEIS should clarify whether the proposed measures would apply to AAVs at Unai Babui and LCACs at Unai Dankulo and Unai Chulu on Tinian. The revised DEIS should provide: 1) AAV and LCAC landings be restricted to outside the normal breeding season for sea turtles; 2) the three Tinian landing sites be continuously monitored by a qualified biologist in cooperation with the CNMI at least three months prior to landings to determine sea turtle use and to accurately identify nest locations; and 3) landings at Unai Dankulo occur only at the largest beach, designating all pocket beaches to the north as "off limits" to protect the more important nesting sites. The FWS is available to provide technical assistance on methodology for turtle use and nesting.

Page 4-74. Table 4-8 identifies designating a "...restricted lane of approach, maximum of 15 m wide" and conducting "...landings at high tide; remain within designated lane" as proposed mitigation for "Damage to coral reefs from AAV landings at Unai Babui." Mitigation measures to protect sea turtle nests from AAV landings, identified on Page 4-9 include: 1) pre-landing nest surveys, flagging of suspected nest sites to restrict vehicles from areas suspected of containing nests, prevention of pre-landing beach modifications and 2) post-landing restoration of original

beach topography do not appear in the table. These measures should be given in this table in the revised DEIS.

The DOI can not concur with a determination that the proposed activity is not likely to adversely affect sea turtles without the inclusion of these measures.

Page 4-75. Table 4-8 identifies "Select routes to minimize vegetation impacts; use beach matting to reduce erosion caused by disembarking vehicles traversing soft sand beaches; restore beach topography upon completion of exercise" as proposed mitigation for impacts to "Beach vegetation and sand dispersion caused by landing vehicles, landing craft, and embarked vehicles." Impacts from landing craft, especially LCACs, are not addressed in Chapter 4 and the proposed mitigation in Table 4-8 mentions only disembarking vehicles. The revised DEIS should clarify whether the proposed measures will apply to LCACs at Unai Dankulo and Unai Chulu. Potential impacts to sea turtle nests from LCAC landings should be addressed in the revised DEIS. Mitigation measures identified on Page 4-9 for AAV impacts to sea turtle nests should also be used for LCAC impacts. The DOI can not concur with a determination that the proposed activity is not likely to adversely affect sea turtles without the inclusion of these measures.

4.8.2. Cumulative Impacts.

Page 4-71. The DEIS states: 1) "Other cumulative impacts consist of a changed effect due to repetition of a particular training activity. An example is repetition of certain aircraft exercises in areas populated by endangered bird species. A single such event might cause a bird to temporarily leave its nest but would have no permanent effect; whereas repeated events might cause the bird to abandon its nest site altogether, possibly resulting in failure to brood and raise young" and 2) "Cumulative impacts, identified as significant as well as non-significant, are included in Table 4-8, together with proposed mitigation."

The first statement is accurate but not adequately addressed in this section or in Table 4-8. We are concerned that the DEIS is supposed to serve as a blueprint for numerous military activities, many of which are innocuous at low levels of activity but can be potentially problematic at higher levels. For several training activities, the revised DEIS needs to include the necessary details to evaluate possible cumulative impacts. Furthermore, cumulative impacts also need to be evaluated at the metapopulation level for some species (*e.g.*, Mariana crows impacted by proposed aircraft overflights at AAFB and the Rota airport).

Appendix C

The Guam National Wildlife Refuge encompasses Ritidian Point but this is not identified in Figure C-1. In Figure C-2, Mahalang Wetlands are incorrectly located, the extent of native limestone forest is only partially identified, and Makpo Wetland is not identified. Coral reefs present along approximately 90 percent of Guam's coastline and nearly 100 percent of the coastlines of Tinian and Rota, are not so identified in the figures C-1 through C-3. The Sasanhaya Fish Reserve on Rota is incorrectly named as the Sasanhaya Marine Preserve, and its boundaries are not accurately

identified in Figure C-3. The symbol for migratory birds is not included in the legends of figures C-1 through C-3, and the presence of migratory bird species is not identified at Lake Hagoi, Mahalang Wetlands, and Bateha Wetland in figure C-2. The figure is not given for depicting the resources at FDM similar to figures C-1 through C-3 for Guam, Tinian, and Rota, respectively. These corrections and additions should be made to Appendix C the revised DEIS.

Appendix F

While many helpful BTS control procedures have been developed and adopted by the DOD in the last several years for ongoing activities and specific training events, the implementation of such general "BTS plans" has on occasion broken down. These plans did not include specific procedural details, did not assign responsibilities to specific personnel, did not include on-site coordination with the Federal and local government agencies immediately preceding and during the exercises, and did not adequately fund plan implementation.

For example, the 1994 Tandem Thrust snake reporting protocol on Tinian was not properly developed and implemented. The reporting of the "snake" did not reach the DFW herpetologist until over a day later. While the 7-page BTS plan is a good general plan, it does not have the specifics necessary for each individualized training exercise. The revised DEIS should provide that the DOD would have early coordination with federal and local government wildlife agencies to develop the BTS control/interdiction specifics for each planned exercise and to ensure they are effectively implemented.

Appendix H

Appendix H-2 does not adequately describe the marine environment at FDM. Very little is known of the marine biological diversity and habitats of FDM. The revised DEIS should include an adequate marine survey of the major native marine biota, including fishes, corals, molluscs, crustaceans, echinoderms, algae, and seagrasses and habitats in the affected marine environment at FDM and provide the survey report in this appendix. Without adequate information on these resources, the DOI is unable to assess potential training-related impacts likely to occur at FDM.

Appendix I

Appendix I does not cover all proposed training sites in the marine environment on Guam (*e.g.*, Haputo, Teragne, Ritidian) and Tinian (*e.g.*, Unai Dankulo, Unai Lamlam) and for those that are covered, presents incomplete information. Relevant information should be gathered from literature searches, and additional field surveys should be conducted, as appropriate. The results of these investigations on the major native marine biota, including fishes, corals, molluscs, crustaceans, echinoderms, algae, and seagrasses and habitats in the affected marine environment should be reported in this appendix and summarized in the revised DEIS.

Appendix K

Appendix K should reflect the following information in the revised DEIS: Mariana crows have not been recorded from southern Guam since the 1960s-1970s, the island swiftlet caves are located in the southeast (not northeast) portion of the Ordnance Annex, and Mariana common moorhens are not restricted to Fena Reservoir in that moorhens use two small wetlands to the east and one to the northwest of Fena Reservoir.

SUMMARY COMMENTS

Based on the above, the DOI recommends that a revised DEIS be prepared in accordance with section 1502.9 of the Council on Environmental Quality's regulations for implementing the NEPA. The DOI recommends that the revised DEIS include more detailed information on the proposed training activities, greater in-depth analyses of activity-related impacts to fish and wildlife resources, and a complete and clear presentation of the mitigation measures associated with the various activities analyzed. The revised DEIS should include the following information:

a. Clear descriptions of all training activities, making it possible for readers to understand the training components that may result in individual or cumulative impacts to fish and wildlife and their habitats;

b. Rigorous evaluations of reasonable alternatives, including alternatives that eliminate or reduce the scope of some activities (*e.g.*, using the existing firing range on Tinian, no military training on Rota, and eliminating or reducing bombardment of FDM);

c. Adequate summary descriptions of the major terrestrial and marine fish and wildlife species and habitats in the environment affected by the activities encompassed within the proposed training exercises; and

d. Realistic discussions of the anticipated impacts of all alternatives under consideration, any unavoidable, adverse training-related impacts to fish and wildlife and their habitats, and the mitigation measures proposed to offset those impacts.

The DOD should initiate programmatic interagency consultation under section 7 of the ESA with the FWS for training-related actions which could adversely affect federally listed species. These species include the Mariana crow, Mariana fruit bat, Mariana common moorhen, Tinian monarch, Micronesian megapode, and green sea turtle. The status of the consultation should be included in the revised DEIS.

The Department of the Interior supports the DOD's efforts to implement long-range planning for military training activities in the Mariana Islands and encourages the DOD to support long-term planning and implementation of conservation measures to mitigate the unavoidable impacts of these training actions on federal trust resources.

Thank you for the opportunity to comment on this project.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc:
Director, OEPC, with original incoming
Regional Director, FWS, Portland
Regional Director, NPS, Pacific West Region

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DEPARTMENT OF THE NAVY
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29 JUL 1998

Ms. Patricia Sanderson-Port
Regional Environmental Officer
U.S. Department of the Interior
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, CA 94107-1376

Dear Ms. Sanderson-Port:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter of May 6, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS. A copy will be forwarded for your review.

Those issues raised by you, as well as a number of reviewers, are in the Common Issues section of enclosure (1). We trust that these responses adequately address your concerns.

Should you have any questions, please contact Mr. Fred Minato at (808) 471-9338, by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division

Encl:
(1) Review Comments

Blind copy to:
Ms. Amy Sheridan
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REVIEW COMMENTS
ON
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
MILITARY TRAINING IN THE MARIANAS

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the **purpose and need** for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required).

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: More detail was requested on the **proposed training activities**, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a **full range of alternatives**, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to

ENCLOSURE(1)

accomplish the purpose and need for training in the Marianas area include *more use, less use, no change in use,* and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The **Preferred Alternative** consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The **Maximum Land Use Alternative** includes proposed new training land uses which are not desirable because of significant impacts that cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense (DoD) has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

U.S. Department of Interior (DOI) Comments

Our responses to your general and specific comments are as follows. In most cases, page numbers and section numbers in the DEIS have changed substantially from the original DEIS, so those identifiers are no longer relevant. Some comments have been grouped and re-ordered, to facilitate clear and complete responses.

General Comments

a. Comment: Important information on the large number of activities are not adequately described or are presented in the wrong chapter.

Response and Revisions to DEIS: (See paragraph b under Common Issues). Better description of each training activity has been inserted into Chapter two of the revised DEIS.

b. Comment: Analysis of alternatives in the DEIS is deficient. Revised DEIS should clarify whether the military considers bombing FDM a nondiscretionary action. An alternative to exclude Rota as a site for military training should be addressed and evaluated.

Response and Revisions to DEIS: (See paragraphs a and c under Common Issues). The Preferred Alternative does not include night vision goggle training on Rota, but does include ongoing small group overnight bivouacs on a small island in Songsong Harbor. The continued use of FDM for aerial and surface weapons training is mission-essential.

c. Comment: Information on existing resources is deficient, especially for marine resources. In particular, information on existing species and habitats at FDM is too sparse to ascertain what species and habitats are at risk.

Response and Revisions to DEIS: Since publication of the original DEIS, a marine survey of FDM has been performed. The report, included as an appendix to the revised DEIS, provides information regarding species and habitats observed in waters surrounding FDM. The description of FDM's marine environment in Chapters Three and Four of the DEIS has been supplemented with information from that report.

d. Comment: The DEIS does not evaluate potential impacts of the No Action Alternative. For the preferred action, the analysis of potential impacts is deficient, especially for Tinian and FDM. Mitigation for potentially unavoidable adverse impacts is either absent or cannot be evaluated for adequacy or for the possibility of eliminating the need for an individual review of the activity.

Response and Revisions to DEIS: More explicit impact evaluations have been added throughout the DEIS, including a detailed comparison of impacts of the alternatives in Chapter Two and the discussions of potentially significant impacts in Chapter Four.

e. Comment: The DoD should initiate programmatic interagency consultation under Section 7 of the Endangered Species Act; the status of the consultation should be included in the revised DEIS.

Response and revisions to DEIS: Section 7 consultation will be formally initiated by the Navy upon publication of the revised DEIS. Informal discussions with U.S. Fish and Wildlife Service (USFWS) and local regulatory agencies have been in progress since 1994. The revised DEIS will indicate that the Section 7 consultation will be initiated upon its publication.

f. Comment: The Brown Tree Snake (BTS) Control/Interdiction Plan is generic in nature and should be refined. Recommend discussion of how the plan would be implemented for each training exercise within each proposed training area. Information in the DEIS does not eliminate the need for the DoD to consult with the USFWS each time an inter-island training activity is to occur, for the purpose of tailoring the generic BTS plan with appropriate details.

Response and Revisions to DEIS: We are well aware of the seriousness of preventing the spread of the BTS from Guam during our training activities. We have and will continue to work with the appropriate agencies to set up staging areas and appropriate protocols to maintain a snake-free environment. The revised DEIS now includes a detailed list of BTS control procedures developed by U.S. Department of Agriculture (USDA) Wildlife Services in cooperation with Commander, U.S. Naval Forces Marianas (COMNAVMARIANAS) and Andersen Air Force Base (AFB) environmental staff. The procedures are included as Appendix E-2.

The BTS plan was developed by federal and local regulatory agencies and military representatives working together to establish a framework for addressing this serious problem. The plan establishes all necessary requirements to prevent spreading the BTS as a result of military training activities, while providing flexibility in execution.

Specific Comments:

Executive Summary (ES)

a. Comment: ES should include a map showing locations of the various activities.

Response: This is certainly possible but would result in 15 figures in the ES. We have instead included location maps showing mitigation areas, which are more essential to have in the ES.

Revisions to DEIS: A complete set of figures is now bound together at the back of the DEIS text, so that figures may be easily referenced while reading any section of the DEIS.

b. Comment: Figure 1-1 shows Saipan at an incorrect scale (too small).

Response: Saipan and Tinian are both between 12 and 13 miles long and are shown as

approximately equal length in the figure. The figure is based on a Soil Conservation Service generated map. The font labeling Saipan is smaller, since Saipan is not one of the study areas in the DEIS.

Revisions to DEIS: None.

Chapter One

a. Comment: Text and footnote to Table 1-1 are inconsistent regarding whether all training is included in the table.

Response and Revisions to DEIS: Agreed. Table 1-1 has been replaced with a table that includes all units and all proposed training, with frequency and number of personnel also indicated.

b. Comment: Recommend impact of helicopter noise on Mariana crows on Rota be evaluated in the revised DEIS.

Response and Revisions to DEIS: There is no research data that adequately determines whether projected training noise would or would not disturb nesting or foraging crows nearby. However, there is no further need to address this issue since the proposed helicopter night vision goggle (NVG) training on Rota will no longer be pursued. The revised DEIS will indicate NVG training on Rota as **not** a Preferred Alternative.

c. Comment: Revised DEIS should indicate that the BTS plan will be used as a blueprint for identifying more specific BTS plans tailored to specific activities and islands. Revised DEIS should state that no future military training activities will occur on Rota due to the environmental sensitivity of the island.

Response and Revisions to DEIS: The revised DEIS clarifies that the BTS plan is a blueprint used and adapted on a daily basis by USDA Wildlife Service in coordination with local natural resource agencies and the military. (See paragraph e under General Comments). The revised DEIS proposes continued forward staging base training by the SEALS in Songsong Harbor, which has a low risk of introducing BTS to Rota. The revised DEIS does not propose other types of training on Rota.

d. Comment: BTS introduction should be addressed in detail in Chapter Four.

Response and Revisions to DEIS: Agreed. BTS introduction is discussed in detail in sections 4.1, 4.2.1.2 (Tinian), 4.6.1.3 (FDM), and 4.7.2.1 (Rota) in the revised DEIS.

e. Comment: The BTS problem is not non-significant (and should not be addressed in a section on non-significant impacts due to existing management requirements).

Response and Revisions to DEIS: Agreed. BTS introduction is clearly presented as a significant impact in the revised DEIS, particularly in Section 4.1. Inappropriate reference to BTS control has been deleted from the section (now section 1.5.3).

f. Comment: The existing quarantine procedures and referenced BTS plan will not adequately relieve the threat of introducing alien species, especially BTS, since limited funds currently make full inspection and control (especially for BTS) difficult for small training missions and impossible for massive military movements. The referenced quarantine procedures and the BTS plan should undergo review and refinement to ensure adequate funding and training for effective implementation prior to each training exercise.

Response and Revisions to DEIS: The DoD has provided substantial funding to ensure that BTS control measures are implemented for both large and small exercises. All military equipment and supplies are fully inspected and certified by USDA Wildlife Services prior to leaving Guam. BTS control measures have the full support of the military on Guam and will be formally incorporated in future revisions of standing training orders. BTS control measures cannot be avoided by exercising units departing Guam, regardless of funding problems. The funding will be considered organic to the cost of the training. A training exercise will not be allowed until the necessary BTS control measures are in place.

g. Comment: Chapter Four should have a full discussion of the BTS problem and the BTS control/interdiction plan, including recommendations of U.S. DOI. Recommend USFWS, Commonwealth of the Northern Mariana Islands (CNMI) Department of Fish & Wildlife (DFW), USDA/Animal Damage Control and Biological Research Development, together with DoD, develop a short one-page briefing including important BTS control, capture, and reporting procedures; field commanders be briefed by biologists from same agencies; and field commanders distribute the memorandum and conduct the briefings with each participant prior to each exercise.

Response and Revisions to DEIS: Section 4.1 of the revised DEIS discusses the significance of potential BTS introduction and existing control technology. (See paragraph e under General Comments). The discussion is enlarged upon in the section on Tinian, as that is the only island proposed for major amounts of shipping from Guam and other BTS-infested locations. The section on Rota briefly addresses BTS introduction and refers back to the expanded discussion of Section 4.1. Proposed mitigation includes briefing of exercise participants in potential impacts to natural and cultural resources prior to any exercise in a sensitive area. DoD, through COMNAVMARIANAS, will continue to update its mandatory briefing on BTS and will be included in the updated area training orders.

h. Comment: Regarding BTS plan, not enough dogs will be available to inspect all material at once for large exercises.

Response and Revisions to DEIS: There is now 14 dogs, which USDA Wildlife Services stated should adequately cover the BTS inspection of all military supplies and equipment for all

exercises in the Marianas. Equipment and supplies will not be transported off Guam until they have been fully inspected. Dogs are not the only effective means of controlling BTS populations. A combination of quarantine areas, traps, and dog inspections is used at all airports and harbors used for military transport between Guam and Tinian. All materiel arriving on Tinian from Guam has already been quarantined and dog inspected and is isolated in containment areas for reinspection prior to field deployment.

i. Comment: Revised DEIS should state that steam cleaners will be available and fully utilized on Guam, Okinawa, Australia, and other known BTS locations used by military aircraft and vessels involved in the training exercises.

Response and Revisions to DEIS: The revised DEIS states that steam cleaners will be available and fully utilized on Guam. Equipment and supplies arriving on Guam from other locations is staged and inspected for BTS prior to transshipment to other places like Tinian.

j. Comment: Clarify how "low risk (BTS) staging areas" differ from "high-risk" staging areas. All material should be staged in fenced and trapped quarantine staging areas.

Response and Revisions to DEIS: "Low risk materials" (not "low risk staging areas") do not originate from Guam and are only stored on Guam during the daytime, when the snakes are not active, or are stored within sterile areas during nighttime hours. Regardless of risk factor, all materiel will be fenced in for all exercises. This will be clarified in the revised DEIS.

k. Comment: A BTS surveillance and trapping program should also be established for any exercise involving warmer regions of the continental U.S.

Response and Revisions to DEIS: Agreed. The BTS plan focuses on areas most at risk (i.e., CNMI and Hawaii and other snake-free Pacific Islands), but this doesn't exclude applying the same BTS control procedures to continental US locations. The DEIS clarifies that all military aircraft and materials are inspected for BTS prior to leaving Guam for any location.

Chapter Two

a. Comment: We do not believe a full range of alternatives is included in the DEIS.

Response and Revisions to DEIS: (See paragraph c under Common Issues). An expanded range of training alternatives will be addressed in Chapter two of the revised DEIS.

b. Comment: A true No Action Alternative would include only those military training activities that are ongoing and for which any required NEPA analysis addresses the fact that they would continue into the future.

Response and Revisions to DEIS: (See paragraph c under Common Issues). The No Action alternative will reflect your comment in Chapter two of the revised DEIS.

c. Comment: Revised DEIS should contain much greater detail on the training activities.

Response and Revisions to DEIS: (See paragraph b under Common Issues). Better details on the various training activities, including photographs and illustrations, are now included in the revised DEIS.

d. Comment: Revised DEIS should evaluate ongoing activities for indefinite future and/or should provide accurate list of previous environmental documentation.

Response and Revisions to DEIS: The revised DEIS will evaluate impacts of ongoing activities for the indefinite future and references both environmental assessments (EA) for Tandem Thrust activities in 1993 and 1995. These EA represent the largest exercise conducted in the Marianas. Tandem Thrust are joint military exercises that are conducted biennially. The intent of this EIS is to assess all training activities, including the cumulative impacts of ongoing and new activities, under one comprehensive document.

e. Comment: It is impossible to correlate activities with numbers of personnel or units in Tables 1-1 and 2-1.

Response and Revisions to DEIS: Table 1-1 in the revised DEIS will be expanded to provide better details on the various training activities, including correlation of number of personnel or units.

f. Comment: Provide total weight of a Landing Craft Air Cushioned (LCAC) plus troops and cargo, for evaluating impacts to sea turtle nests.

Response and Revisions to DEIS: The weight (fully loaded or unloaded) is not a factor, as LCACs will avoid areas with potential to have turtle nests. The beach landing sites will be surveyed by a qualified biologist to assure we avoid any turtle nesting sites.

g. Comment: Provide better justification for new live fire ranges on Tinian, as adverse impacts would result.

Response and Revisions to DEIS: Chapter 1 of the revised DEIS provides justification for proposed fire and maneuver range on Tinian. Due to safety and other environmental concerns, the proposed mortar range will no longer be pursued. The revised DEIS will reflect the mortar range as not a Preferred Alternative.

h. Comment: Provide a better description of what activities would be limited within the North Field Historic Landmark on Tinian. The figure appears to show the Landmark to be outside of any of the identified constrained areas. Clarify graphically.

Response and Revisions to DEIS: Fires and pyrotechnics are proposed to be limited to paved areas only. Figure 27-a of the revised DEIS will identify this accurately as the only constraint in

this area. No other constraints are proposed within the Landmark.

Chapter Three

a. Comment (Guam-marine environment): DEIS should include a literature search and summary of major native marine biota at Guam, especially the conspicuous native marine and estuarine organisms and those habitats adjacent to all proposed training areas.

Response and Revisions to DEIS: Council on Environmental Quality (CEQ) regulations direct that an EIS should not be encyclopedic. The DEIS has been written to focus on biota which may be impacted by the proposed action. For Guam, the revised DEIS will highlight potentially affected marine biota in all the proposed training areas.

b. Comment (Guam-endangered species): Provide updated number of Mariana crows remaining on Guam in accordance with Guam Division of Aquatics and Wildlife Resources (DAWR) figures.

Response and revisions to DEIS: The revised DEIS will reflect the updated number of crows.

c. Comment (Guam-brown tree snake): The BTS has already been sighted on Oahu, Saipan and Rota. Include and evaluate possible establishment of BTS on Saipan in Chapter Four.

Response and Revisions to DEIS: The proposed action does not include training or other activities on Saipan. Accordingly, the revised DEIS will not evaluate the possible establishment of BTS on Saipan.

d. Comment (Tinian-habitat): Acknowledge the importance of tangantangan forest, in addition to limestone forest, as habitat for endangered species and other native wildlife on Tinian.

Response and Revisions to DEIS: The DEIS has been revised to acknowledge that tangantangan serves as important habitat for endangered species and other native wildlife.

e. Comment (Tinian-habitat): Reference USFWS Feb 1996 report, "Characteristics of Mariana Common Moorhens and Wetland Habitats within the U.S. Department of the Navy's Military Lease Area and Exclusive Military Use Area on the Island of Tinian. CNMI, July 1994 through August 1995" in footnote 29.

Response and Revisions to DEIS: The DEIS has been revised to include the reference.

f. Comment (Tinian-habitat): Clarify that migratory birds use the three primary wetlands on Tinian.

Response and Revisions to DEIS: The revised DEIS clarifies that migratory birds use the two

smaller wetlands in addition to Lake Hagoi.

g. Comment (Tinian-marine environment): In section 3.3.2.2, Tinian marine environment, correct statement to indicate that the western (leeward) coastline has better developed and more diverse reefs than the eastern, rather than vice versa.

Response and Revisions to DEIS: The DEIS has been revised per the comment, but clarifies that Unai Dankulo (eastern) and Unai Babui (western) are exceptions to the general statement.

h. Comment (Tinian-marine environment): Adequately describe the marine environment at Tinian. Provide a literature search for training areas not addressed in Appendix I, results of additional marine surveys, and improved summary of major native marine biota at all training sites.

Response and Revisions to DEIS: CEQ regulations stresses that an EIS should not be encyclopedic. The revised DEIS has been written to focus on biota which may be impacted by the proposed action. For Tinian, the revised DEIS highlights potentially affected marine biota in all the proposed training areas.

i. Comment (Tinian-endangered species): Correct statement in section 3.3.2.3 to clarify that Tinian supports three extant federally protected birds, one extinct bird species, and one extirpated bird species, and cite species. State that species are all on CNMI endangered species list, in addition to Mariana fruit bat.

Response and Revisions to DEIS: The DEIS has been revised.

j. Comment (Rota-habitat): Mention existence and location of seabird colonies and bat colonies on Rota.

Response and Revisions to DEIS: The DEIS has been revised to mention bat colonies. Seabirds are not protected species and do not occur in areas proposed for training use.

k. Comment (Rota-marine environment): Coral reefs are found on all sides of Rota, not just the north and west sides. Correct section 3.3.3.2 and Figure C-3. Adequately describe the marine environment at Rota.

Response and Revisions to DEIS: Marine environment at Rota will not be affected by the proposed action. The DEIS adequately addresses marine resources within the area of potential effect.

l. Four Comments (FDM-habitat):

1) Identify when FDM was first used for bombing.

2) Clarify that bombing has apparently changed the vegetation structure, notably taller shrubs.

3) Clarify that "dense" vegetation does not cover most of the island.

4) Mention presence of great frigatebird; determine significance of the colony, which is one of only 2 breeding populations in the Marianas and is a significant distance from other known breeding colonies.

Response and Revisions to DEIS: The revised DEIS clarifies that bombing on FDM began in 1971. Other requested revisions have been made. Seabirds nesting on FDM are widespread throughout the Pacific, and their overall population should not be affected by the proposed action.

m. Three comments (FDM-marine environment):

1) Adequately describe marine environment of FDM; perform a survey.

2) Eliminate contradictions regarding presence of fringing reef/shallow coastal zone.

3) Note presence of green sea turtles and evaluate potential for turtle nesting.

Response and Revisions to DEIS: A marine survey was completed in July 1997, and reports are appended to the revised DEIS. The reports contain detailed information on the substratum. Green sea turtles were occasionally spotted in the water, but FDM beaches are wave-washed coarse materials that are unsuitable for turtle nesting.

n. Comment (FDM-endangered species): A thorough literature search should be conducted, particularly using CNMI Department of Fish & Wildlife (DFW) reports, on broader distribution of avifaunal species found on FDM.

Response and Revisions to DEIS: The avifauna report is based on an awareness on the part of the researcher of the extant literature on the subject. As you may be aware, the literature based on primary research for the population distribution of seabirds in the Marianas is not substantial.

Chapter Four

a. Two Comments on biological resources:

1) Revised DEIS should contain overall discussion of potential BTS impacts on each island, not just Tinian. Expand more on adequately addressing preventing BTS introductions to other islands as it relates to specific activities planned for each of these islands. Include this as mitigation in revised DEIS.

2) DEIS should contain mitigation as coordinated and agreed upon with federal and local agencies such as USFWS, National Marine Fisheries Service (NMFS), Guam DAWR, CNMI FWS as well as DFW personnel on Rota, Tinian and Saipan office.

Response and Revisions to DEIS: The BTS issue is discussed in a separate section (4.1) at the beginning of Chapter Four of the revised DEIS. Specific BTS control procedures are itemized in Appendix E-2 and cited as mitigation in the text. However, as the primary traffic of concern is between Guam and Tinian, the majority of the discussion applies to Tinian. No cargo or vehicles are transported to Rota or FDM from Guam; therefore, no BTS export is expected. In the event that such items are shipped to those islands, USDA Wildlife Services has a standing mandate to inspect all such cargo before its shipment.

b. Comments on significant impacts at Andersen AFB (six comments on crows and fruit bats):

1) Include outcome of USAF and USFWS consultations regarding impacts of aviation at Andersen AFB on endangered Mariana crows and Mariana fruit bats. Proposed mitigation should be consistent with this outcome.

2) Correct the number of crows remaining on Guam with updated information with Guam DAWR.

3) Correct statement that crows have "moved" to the Munitions Storage Area to indicate that crows have not moved but have experienced reduced distribution due to attrition.

4) Specifically address impacts to newly released crows, as their behavior may be different from wild crows as they move into unoccupied territories.

5) Mitigation should be consistent with the outcome of the ongoing consultation between USFWS and Andersen AFB on both Mariana crows and fruit bats on low-level flight training.

6) Summary of proposed mitigation does not mention protection of fruit bats at Pati Point and 1/2 nautical mile perimeter flight restriction per the informal Section 7 consultation of March 21, 1997. This should be reflected in the revised DEIS.

Response and Revisions to DEIS: Agreed. Chapter Four has been modified in accordance with the most recent consultations with USFWS and in accordance with the above suggestions. Number of crows on Guam has been revised in accordance with conditions as of April 1, 1998. No information was available on differences in behavior between wild and captive crows as of April 1998.

c. Comments on significant impacts at Andersen AFB (two comments on green sea turtles):

1) Acknowledge existence of green sea turtles in list of endangered species at Andersen AFB.

2) Summaries of impacts and proposed mitigation should include measures to mitigate impacts on turtles and nesting habitat from swimmer insertion and Explosives Ordnance Disposal (EOD) training.

Response and Revisions to DEIS: Chapter Three has been revised to identify the presence of sea turtles at Andersen AFB beaches. The proposed mitigation for potential impacts of EOD training is to perform a surface sweep of the area and halt training activities if protected marine species are encountered. No impacts on turtles are anticipated from individuals swimming to the beach.

d. Comment on significant impacts – NAVACTS Waterfront Annex: Agreement regarding EOD training in Apra Harbor was with National Marine Fisheries Service (NMFS), not USFWS. Please correct.

Response and Revisions to DEIS: The text has been revised to reflect NMFS versus USFWS.

e. Comment on significant impacts – Tinian: Recommend military consult with USFWS to tailor generic BTS plan with specific inter-island training activity.

Response and Revisions to DEIS: Concur. (See paragraph a, this section).

f. Two comments on significant impacts – Rota:

1) Bats are expected to forage at night anywhere on the island including the airport, not just at Sabana Heights.

2) Specify training flight patterns for helicopter NVG training. There have been recent sightings of crows within airport boundaries and nests within 1/2 km of the airport. Provide peak maximum instantaneous noise levels (well over 100 decibels) in text and Figure 4-2. Rota area may be too lighted for good NVG training in the future, due to planned airport expansion and residential development. Continue NVG training on Guam and Tinian, but do not initiate it on Rota.

Response and Revisions to DEIS: NVG training on Rota is no longer being pursued. Therefore, additional studies on impacts to the endangered crows are no longer necessary. The revised DEIS will reflect this.

g. Specific comment (significant impact – FDM): Evaluate impacts to all 14 migratory species identified in November 1996 survey.

Response and Revisions to DEIS: The entire section on FDM has been expanded. All bird species sighted on the island are discussed in Section 4.6.1.

h. Specific comment (significant impact on FDM): Correct mitigation measures to indicate dropping pellets of rodenticide (not spraying) and use phrase "controlling the rat population" vs. "spraying rodenticide."

Response and Revisions to DEIS: The text has been revised to "broadcasting rodenticide pellets."

i. Specific comment (significant impact on FDM): Identify beaches and potential for turtle nesting in existing conditions.

Response and Revisions to DEIS: Beaches on FDM do not serve as suitable nesting habitat for green sea turtles; this was agreed upon by USFWS, NMFS and CNMI FWS personnel, who participated in the 1997 marine survey of FDM. Survey results are provided in revised Chapter Four.

j. Specific comment (significant impact on FDM): Booby population of 50,000 reported in 1975 EIS should not be discounted.

Response and Revisions to DEIS: The variance in booby survey numbers is discussed at length in revised Chapter Four. A former Navy biologist who visited FDM in 1974 has viewed USFWS videotapes of the 1996 booby populations and has stated that the 1975 EIS estimate of 50,000 boobies is probably incorrect (USFWS Memorandum of July 8, 1998, attached).

k. Comment on significant impacts on FDM: Clarify that fruit bats are protected from hunting throughout CNMI, although they are not federally protected on FDM.

Response and Revisions to DEIS: The status of fruit bats has been clarified.

l. Comment on significant impacts on FDM: Footnote incorrectly identifies USFWS as author of a report which is actually by CNMI-DFW.

Response and Revisions to DEIS: The footnote has been revised as requested.

m. Comment on significant impacts on FDM: The claim that "some sort of equilibrium" has been established is scientifically unsound; replace with the statement "Despite the fact that bombardment does cause direct bird mortality as well as nest destruction and abandonment, recent surveys have documented that birds persist in using FDM."

Response and Revisions to DEIS: Section 4.6.1.2 of the revised DEIS expands the discussion of potential impacts and expressly states that bombardment causes some direct bird mortality and alters vegetation used for nesting, particularly for bird species preferring taller vegetation. The wording "some sort of equilibrium" has been deleted.

n. Comment on significant impacts on FDM: The summary of existing conditions should include a summary of the great frigatebird colony and its significance.

Response and Revisions to DEIS: Section 4.6.1 now discusses all seabird species found on

FDM. The great frigatebird is widespread throughout the tropical Pacific and Indian Oceans. The revised DEIS acknowledges that the great frigatebird colony is one of only two small breeding populations in the Marianas, but this species is not restricted to the Marianas and is not unique to this part of the world.

o. Comment on significant impacts on FDM: In potential impacts section, bombing-related impacts to birds, bats, and habitats on FDM should be acknowledged and addressed. The 12 feet high forest, which would provide ideal nesting habitat for boobies, megapodes, and bats, covered a portion of the island in 1975 and is now reduced. It is highly unlikely the reduction was due to natural causes.

Response and Revisions to DEIS: The DEIS acknowledges that it is likely that fire and ground disturbance from ordnance use have been the primary factors in altering the vegetation distribution on FDM. Per USFWS memorandum of July 8, 1998 (see paragraph j above), the vegetation cover in 1996 survey closely resembled that present in 1974.

p. Comment on significant impacts on FDM: Evaluate the potential impacts of BTS on FDM fauna.

Response and Revisions to DEIS: Section 4.6.1.3 of the DEIS addresses possible impacts of BTS on FDM fauna.

q. Comment on significant impacts on FDM: Potential impacts should address impacts to great frigatebird colony in relation to its ecological significance.

Response and Revisions to DEIS: The great frigatebird is widespread throughout the tropical Pacific and Indian Oceans. The revised DEIS acknowledges that the great frigatebird colony is one of only two small breeding populations in the Marianas, but this species is not restricted to the Marianas and is not unique to this part of the world.

r. Comment on significant impacts on FDM: Potential impacts should address impacts to seabirds from targeting of south-central portion of FDM. This area was found to be rich in seabirds in November 1996, especially masked booby colony that is the largest known nesting site for this species in the Mariana or Caroline islands.

Response and Revisions to DEIS: The DEIS acknowledges potential impacts to large numbers of seabirds on the island. Proposed mitigation is that a Navy biologist will assist with target placement so that the majority of ordnance delivered will avoid the most sensitive areas for nesting and roosting birds.

s. Comments on significant impacts on FDM (two comments on turtles):

1) Potential impacts should address impacts to sea turtles and nesting sites from mortar fire.

2) Proposed mitigation should restrict mortar and gunfire to outside the sea turtle nesting season. Consult with NMFS regarding finalizing a conservation agreement to protect sea turtles in waters off all the Mariana islands, similar to the agreement in effect for Apra Harbor (Appendix E).

Response and Revisions to DEIS: On-island training activities such as mortar fire is no longer being pursued due to safety concerns to personnel. The revised DEIS will reflect this. Therefore further evaluation on impacts to birds and turtles are no longer necessary. Green sea turtles were only spotted in two of the 10 surveys recorded, and there is no suitable nesting habitat for sea turtles on FDM. Therefore, potential for harm to this species from gunfire is minimal. The Section 7 consultation will address protection of the turtles from the impacts of the proposed action.

t. Comments on significant impacts on FDM (three comments on seabirds):

1) Proposed mitigation should disclose exact nature of aerial studies of seabirds and megapodes, and who would perform the surveys. Without ground-truthing, photographs are inadequate to determine the effects of bombing on seabirds and completely useless in determining effects on megapodes.

2) Detail what studies will be conducted and include a time frame for completing studies and identify mitigation proposed to offset the loss of seabirds due to bombing.

3) Mitigation should include limiting bombing to low periods in the seabird-breeding season, referencing a thorough literature review and interviews with experts in seabird breeding.

Response and Revisions to DEIS: Aerial surveys will be conducted at least twice annually, as recommended in the April 6, 1998 USFWS Biological Opinion on programmatic aerial and naval bombardment of FDM for the next three years. Aerial surveys have been performed before and after each FDM bombing exercise by a Navy biologist travelling in a helicopter. The purpose is to determine what impact the use of the range is having on the larger nesting or roosting birds using the flat upper portion of the island. The surveys also incidentally record what species of birds are present on the island at the time of the survey. At each of approximately 40 pre-established stations live and dead birds are counted, bomb craters are counted, and stations are photographed while the helicopter hovers at an altitude of about 300 feet or less just seaward of each station. General observations of vegetative cover and any other details relevant to bird survival are recorded. Overflight of all the stations lasts about one hour. Redfooted and masked boobies sitting on the ground cannot always be distinguished from the helicopter. It is not possible to accurately survey the smaller birds, although populations can be identified.

The helicopter also circles the island at a distance of approximately 300 meters offshore, and the biologist looks for sea turtles and mammals or signs thereof. The marine survey also lasts approximately one hour.

Ground-based surveys are not possible, as personnel are no longer permitted on the island due to the presence of extremely dangerous, small cluster bombs scattered throughout the island. The various seabird species present on the island have different breeding seasons, which extend throughout the year. Therefore, it would not be possible to perform necessary training and avoid all breeding seasons. Targets will be placed to minimize impacts to the birds.

u. Comments on significant impacts on FDM (two comments on bombing seabirds and great frigatebirds):

1) Mitigation should be proposed for impacts to rich seabird colony in south-central portion of FDM: either remove or relocate target from that area.

2) Mitigation should be proposed for impacts to breeding colony of great frigatebirds, which should be given a high priority for protection in the revised DEIS. Mitigation should include monitoring to identify breeding cycles, numbers of birds, etc.

Response and Revisions to DEIS: Targets will be placed with the assistance of a Navy biologist so that nesting areas can be avoided. The great frigatebird is widespread in the tropical Pacific and Indian Oceans and is not accorded special regulatory protection. We will continue to monitor the birds, including the frigatebird by performing aerial surveys twice a year. On-island mitigation measures are not possible, as non-EOD personnel may not land or work on the island due to the presence of widely-scattered submunitions. The only monitoring possible is via aerial surveys, which are not detailed enough to accomplish the monitoring proposed in the U.S. DOI comment.

v. Comments on significant impacts on FDM: Results of all USFWS biological opinions regarding FDM should be incorporated in DEIS. (Opinion published after DEIS was not included in DEIS.)

Response and Revisions to DEIS: Agreed. All USFWS opinions on FDM to date will be included in the appendix.

w. Comments on nonsignificant impacts on Waterfront Annex (two comments on turtles):

1) Revised DEIS should provide protocols developed by the NMFS to protect sea turtles at Dadi beach.

2) Revised DEIS should correctly mention that NMFS has approved and established protocols to protect sea turtles.

Response and Revisions to DEIS: (See paragraph d above). Revised DEIS will reflect the above comments.

x. Comments on nonsignificant impacts on Ordnance Annex: Sniper range surface danger zones (SDZ) includes Fena Reservoir (moorhen habitat) and a sensitive wildlife area (fruit bat foraging and roosting habitat), so DOI cannot concur that there will be no significant impacts. Evaluate these impacts and propose mitigation.

Response and Revisions to DEIS: Fena Reservoir is 3 kilometers or more from the firing points. Sniper fire is unlikely to impact birds in the Fena Reservoir, as it is low in volume and very precise. The actual targets will be placed no more than 1 kilometer from the firing points, and will only rarely be missed by the expert marksmen designated to use the range. In most cases, existing topography backstops the target areas, limiting travel of the projectile. Such backstops are not formally considered when the SDZ is delineated, because of the potential for ricochet. Section 4.4.1.1 of the revised DEIS specifically addresses risks to moorhens at the Fena Reservoir. No risks are expected to moorhens or fruit bats from the sniper range and no mitigation is proposed.

y. Comments on nonsignificant impacts on non-DoD land: Acknowledge that Talofofo River valley is prime foraging area for endangered island swiftlet.

Response and Revisions to DEIS: Riverine training on the Talofofo River is no longer being pursued. Therefore, further detailed information and analysis of environmental impacts at Talofofo River are not included in the DEIS. The presence of swiftlets in the Talofofo River valley is identified in Chapter Three.

z. Two comments on nonsignificant impacts of new activities on Tinian:

1) Construction of new live fire range and shooting house would impact approximately 25 acres of monarch habitat and represent an adverse effect. Appropriate mitigation should be in Section 7 consultation with USFWS and in coordination with CNMI.

2) The fire plan includes use of two CNMI fire trucks that may not be available or may not be able to access the live fire range. Modify to show that military will fully provide for their fire prevention and response needs as part of every planned exercise.

Response and Revisions to DEIS: The USFWS has issued notification that it plans to de-list the Tinian monarch. The revised DEIS proposes possibly planting 4 hectares of tangantangan elsewhere on Tinian, if loss of tangantangan at the proposed live fire range is deemed disruptive to monarch recovery at the time the range is built. This represents approximately 60% of the habitat that may be lost to the range and is equivalent to the mitigation negotiated with Voice of America for its impacts on tangantangan forest elsewhere on Tinian.

Restrictions on training activities are designed to reduce the potential for fires. Training involving refueling operations will include a requirement for on-site fire fighting capability as part of the exercise. The Fire Plan will specify that all training units will coordinate with the Tinian Fire Department and will provide fire fighting capability commensurate with the potential

for fire resulting from the training activities.

aa. Comments on summary of impacts (four comments on Table 4-8):

1) The table of all-potential impacts and mitigation measures is incomplete.

2) The table should indicate that the military fully provides own fire prevention and response needs as part of every exercise and does not depend on CNMI resources.

3) The table identifies "cut no vegetation larger than wrist-sized": where on a plant will this measurement be made? Specify no cutting of limestone forest or native vegetation.

4) Lake Hagoi should be off limits to hovering aircraft. Fences with access gates should be placed along perimeter road or Restricted Area signs should be posted every 10 feet along perimeter road.

Response and Revisions to DEIS: The table (now Table 2-11) has been revised and crosschecked with the text for completeness, including information regarding fire prevention, vegetation, AAVs, and LCACs. Fire prevention is a routine component of virtually every military training exercise, and this is made explicit in the DEIS. Hand cutting of vegetation occurs for selected tactical reasons and is typically akin to pruning; no greater specificity is required. The USFWS Section 7 review of activities for a large exercise on Tinian (Tandem Thrust 95) did not take exception to proposed clearing of vegetation by hand within the EMUA. No vegetation clearing or other activities are planned to occur in the area around Lake Hagoi as part of training. No cutting is planned in remaining native limestone forest, and such areas are constrained by No Wildlife Disturbance restrictions in the revised DEIS.

The new "no training area" designation in the DEIS includes no hovering by aircraft and covers the entire Lake Hagoi vicinity. The most effective way to ensure that training units avoid the area is to mark it officially off limits in training exercise orders. (This is commonly accomplished by identifying the area as a supposedly hazardous site, e.g., radioactive, and instructing exercise participants that they are "dead" if they enter the area). Fences are not proposed, as the area is clearly marked by roads on three sides and is used for purposes other than training. Signs would not be useful for units training at night. If necessary during a large exercise, the western side (not marked by a road) will be temporarily marked using surveyors' flagging tape.

bb. Comments on Table 4-8 (four comments on AAVs and LCACs):

1) AAVs and LCACs have noise impacts which should be noted in the table.

2) AAV and LCAC landings should be restricted to outside sea turtle breeding season and beaches should be continuously monitored at least 3 months prior to landings to accurately identify nests and sea turtle use. Landings at Unai Dankulo should be limited to the largest

beach, designating all pocket beaches to north as off limits to protect more important nesting sites. USFWS is available to provide technical assistance on methodology for turtles.

3) Mitigation of AAV and LCAC impacts (pre-landing surveys, etc) are not included in table of impacts and mitigation measures.

4) Chapter Four does not include impacts from landing craft on beach vegetation and sand and should clarify whether mitigation will apply to LCACs as well as to disembarking vehicles.

Response and Revisions to DEIS: The revised DEIS proposes monitoring for sea turtle nests by a Navy biologist within six hours prior to any actual AAV or LCAC landing exercise. A Navy biologist will be present during any nighttime AAV or LCAC landings. Agency representatives are welcome to participate in monitoring surveys. Areas deemed to be free of possible turtle nests will be flagged. Vehicles landing at Unai Dankulo and other beaches will be required to remain within flagged nest-free areas. The impacts of different motorized vehicles on turtle nests are not distinguishable; all vehicles are heavy and may create tracks in the sand. Therefore it is not necessary to itemize all the vehicles in the impacts sections. Chapter Four of the DEIS and Table 2-11 include information regarding impacts of all proposed landing vehicles and offloaded vehicles on topography, strand vegetation, and sea turtles.

cc. Comment on cumulative impacts: Neither section 4.8 nor Table 4-8 adequately addresses cumulative impacts due to repetition of a particular training activity. U.S. DOI is concerned that the DEIS will be a blueprint for other military activities, many of which are innocuous at low levels of activity but can be potentially problematic at higher levels. For several training activities, DEIS should include necessary details to evaluate possible cumulative impacts. Cumulative impacts also need to be evaluated at the metapopulation level for some species (e.g., Mariana crows at Andersen AFB and Rota).

Response and Revisions to DEIS: Cumulative impacts of training at each land area are identified in Chapter Two. Potentially significant cumulative impacts are addressed in the detailed impact analyses and in a cumulative impact summary in Chapter Four. NVG training on Rota is no longer being pursued and therefore, no further impact analysis has been provided. The Mariana crow population on Guam is so tiny, that extreme mitigation measures have already been negotiated and instituted at Andersen AFB to protect remaining individuals. Such a level of mitigation is not necessary for seabirds, whose populations are not in the same circumstances.

Some agencies have commented that, because the nature of the proposed action is repetitive use of various land areas, the impacts of such repetitive use are direct impacts. Other agencies have commented to the contrary, that the impacts are cumulative. Regardless of the terminology used, the potentially significant impacts of training land use are discussed in detail in Chapter Four, including the effects of repetitive use. Potential impacts, which were not identified as significant, are identified in Table 2-11, together with proposed mitigation.

Appendix C

Comment: Correct Figure C-1 to show Ritidian Point as part of Guam National Wildlife Refuge (NWR). In Fig C-2, Mahalang Wetlands are incorrectly located, extent of native limestone forest is only partially identified, and Makpo Wetland is not identified. Coral reefs are incomplete for Guam, Tinian and Rota (Figures C-1 through C-3). Correct the name Sasanhaya Marine Preserve to Sasanhaya Fish Reserve on Rota and its boundaries (figure C-3). The symbol for migratory birds is not included in legends (figures C-1 to C-3) and presence of migratory bird species are not shown on Lake Hagoi or Tinian wetlands (figure C-2). Where is a similar figure for FDM?

Response and Revisions to DEIS: Figure C-1 (now Figure 3-2) has been corrected as requested. We believe limestone forest shown on Figure C-2 (now Figure 3-1) is correct. Mahalang wetland location has been corrected to a location 1000 meter south of the original position on Figure C-2. Makpo Wetland is shown on the figure, although it is not in an area used for training and will not be affected by training. Reefs will not be affected by training at most locations on Guam and Rota, so the full extent of those reefs is not pertinent and has not been shown on Figures 3-2 and 3-4. Sasanhaya Fish Reserve has been correctly labeled, and a symbol for migratory birds has been added to Lake Hagoi on Figure 3-1. A similar figure (3-3) has been added for FDM.

Appendix F

Comment: The plan does not have the specifics necessary for each individualized training exercise, notably assigned responsibilities to specific personnel, on-site coordination with agencies immediately preceding and during exercises, and adequate funding plan implementation. Revised DEIS should specify early coordination with federal and local agencies to develop BTS specifics for each planned exercise and ensure they are effectively implemented.

Response and Revisions to DEIS: (See paragraph e under General Comments)

Appendix H

Comment: Does not adequately describe the marine environment of FDM. Include an adequate marine survey of major native marine biota and habitats.

Response and Revisions to DEIS: Reports on the July 1997 marine survey are now included in the appendix of the revised DEIS.

Appendix I

Comment: Does not include all proposed training sites in the marine environments for both Guam and Tinian and for those that were covered, incomplete information were presented.

Response and Revisions to DEIS: Additional studies were conducted for Guam sites and are now included in the appendix of the revised DEIS.

Appendix K

Comment: Appendix K should reflect that Mariana crows have not been recorded from southern Guam since the 1960s through 1970s, that the island swiftlet caves are located in the southeast (not northeast) portion of the Ordnance Annex, and that Mariana common moorhens are not restricted to Fena Reservoir but use two small wetlands to the east and one to the northwest of Fena Reservoir.

Response and Revisions to DEIS: The report has been revised in accordance with the information provided.

April 15, 1997

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

Fred Minato, Planner-in-Charge (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Minato:

The National Marine Fisheries Service (NMFS), Pacific Area Office (PAO) has received and reviewed the Draft Environmental Impact Statement (DEIS) For Military Training In The Mariana Islands, prepared by the Pacific Division and dated January 1997. The DEIS was received after the due date for comments (April 1, 1997). In addition, we note that essential information for the marine environment has not been included in the DEIS. Therefore, NMFS believes the DEIS is inadequate and a supplemental or revised DEIS must be prepared and circulated. The following general comments are offered for your consideration under the National Environmental Policy Act (NEPA).

NMFS is primarily concerned about potential impacts on the marine environment and associated biota from ongoing and selected new military training activities in the Mariana Islands. Of particular concern are the waters surrounding the uninhabited target island of Farallon de Medinilla (FDM). During the field expedition to FDM on November 1 to 6, 1996 (in which NMFS participated), plans were to conduct underwater surveys of the nearshore marine environment. However, an approaching typhoon forced an evacuation of the area prior to this work being completed. NMFS believes this information is essential in order to determine the existing conditions of marine habitats, including coral reefs, and associated marine biota. These data will also be necessary to evaluate the long term impacts from bombing and gunfire operations on those marine threatened and endangered species under NMFS jurisdiction.

NMFS believes that in order to comply with NEPA, and to provide sufficient information to allow us to adequately address potential impacts and appropriate mitigation measures for both ongoing and proposed additional military training activities, the above requested information must be included in a supplemental DEIS. We appreciate the opportunity to comment on the document. For further information concerning Endangered Species Act Section 7 requirements, please contact Mr. Eugene Nitta at 808/973-2987 in our Protected Species Program. Should you have an questions regarding these comments, please contact me at PAO (808/973-2940) in Honolulu.

Sincerely,

John J. Naughton
Pacific Islands
Environmental Coordinator

cc: F/SWR, Long Beach, CA
FWS, Honolulu
EPA, Region 9 (E-4)
WPRFMC, Honolulu
PAO (Nitta)

RECEIVED TIME APR.16. 9:22AM PRINT TIME APR.16. 9:23AM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1603
Ser 231/1987
20 MAY 1998

Mr. John J. Naughton
National Marine Fisheries Service, Southwest Region
Pacific Islands Environmental Coordinator
501 West Ocean Boulevard, Suite 4200
Long Beach, CA 90802-4213

Dear Mr. Naughton:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated April 15, 1997, regarding the Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in May - June 1998 timeframe. A copy will be forwarded for your review. Our responses to your specific comments are as follows:

a. Comment: Essential information for the marine environment was not included in the DEIS. Nearshore underwater survey information on FDM must be acquired and provided in a revised DEIS before NMFS can adequately review the DEIS.

Response and Revisions to DEIS: A marine survey of FDM was conducted in July 1997. A copy of the report and all other survey reports are included in Appendix D of the revised DEIS. Findings are incorporated into the analysis of impacts and mitigations.

We trust that this response adequately address your concern. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406

Commonwealth of the Northern Mariana Islands
Department of Lands & Natural Resources
Coastal Resources Management
Caller Box 10007 2nd Floor Morgen Building.
San Jose, Saipan, MP 96950

CABLE ADDRESS:
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TELE. (670) 234-6623/7326
FAX: (670) 234-0897

April 31, 1997

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

We have reviewed the DRAFT ENVIRONMENTAL IMPACT STATEMENT - MILITARY TRAINING IN THE MARIANAS prepared by the United States Pacific Command in January 1997.

We have comments concerning two subjects mentioned in the draft environmental impact statement (EIS). These subjects are the crossing of Tinian Unai Babui fringing reef and beach with assault amphibian vehicles (AAV's) and the proposed modifications to the present Tinian firing range near the blowhole and north of Unai Chiget, both in the present Tinian Military Exclusive Use Zone.

On page 4-6 of the draft EIS it is stated that the fringing reef at Unai Babui is almost barren, with one percent or less of living coral remaining. A reference for this statement is included at the bottom of page 4-6 which mentions personal communication with Steve Dollar, Marine Research Consultants on December 12, 1996. On page 4-9 of the draft EIS it is stated that approximately 24 square meters of the fringing reef at Unai Babui will be impacted by AAV's. It is also stated on this page that the Unai Babui beach will be flagged to avoid impacts upon sea turtle nests. No mitigation other than minimizing damage to the reef is mentioned.

We would like to know if any actual scientific studies have been performed on the Unai Babui fringing reef to support the claim that only one percent of the coral there is living. We would also like to know if you have considered the alternative of bringing the AAV's ashore in the Tinian Harbor where there would be no possibility of damage to coral reefs and turtle nesting sites. We believe that this would be a viable alternative.

Figure 2-10 shows a Conceptual Fire and Maneuver Range which is fan shaped extending for a considerable distance into the ocean east of the present Tinian firing range. It is unclear to us if this fan shaped area extending into the ocean east of the firing range is a safety area or if this area will actually be an impact site for weapons fired from shore. If this fan shaped area is actually part of the firing range rather than a safety area, we suggest you seek an alternative due to the possible impact upon marine organisms from exploding ammunition.

In order for us to approve your final EIS and concur with your Federal Consistency Statement, it will be necessary that you address the concerns we have stated above.

Thank you for the opportunity of commenting on your draft EIS. We look forward to working closely with you in the preparation of the final EIS and Federal Consistency Statement.

Sincerely yours,

MANUEL C. SABLAN
Director

cc: DLNR Secretary
DEQ Director
DFW Director
HPO Officer

RECEIVED TIME MAR.31. 7:46AM PRINT TIME MAR.31. 7:47AM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/ 1989
20 MAY 1998

Mr. Manuel C. Sablan, Director
Commonwealth of the Northern Mariana Islands
Coastal Resources Management
Caller Box 10007, 2nd Floor, Morgen Building
San Jose, Saipan, MP 96950

Dear Mr. Sablan:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated April 31, 1997, regarding the Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in May - June 1998 timefame. A copy will be forwarded for your review. Our responses to your specific comments are as follows:

a. Comment: Do any scientific studies of Unai Babui (proposed amphibious assault vehicle [AAV] landing site on Tinian) confirm estimate of one percent living coral on reef? Please consider alternative of landing AAVs in Tinian Harbor, which would avoid damage to coral reefs or turtle nesting sites.

Response: All prospective landing areas were surveyed by a marine biologist, who estimated coral coverage in various reef zones at each location. Those with the best potential for landings with least environmental harm were surveyed in more detail. A quantitative survey was not performed, as the purpose was to compare the richness of coral cover at alternative beach landing areas. The reefs at other alternative landing sites all have a greater density of coral than Unai Babui.

The reef flat at Unai Babui was found to be mostly lacking in live coral, primarily as a result of the high wave energy at that location. The existing live coral covers a very small fraction of the reef flat (estimated at one percent) and is primarily found in narrow crevices in the flat. The Unai Babui alternative was found to have reasonable AAV access across the reef front, flat, and beach with relatively little coral to be damaged. Tinian Harbor landings have been considered but would be limited in training value. The only potential landing area in the harbor free of well developed coral reefs is Kammer Beach, which is developed with picnic pavilions, rendering it unusable as a landing area.

Revisions to DEIS: AAV landings at Kammer Beach (Tinian Harbor) are proposed as an alternative in Chapter Two. The Preferred Alternative includes AAV landings at Unai Babui, with a limited approach lane (22 m wide). Proposed mitigation includes: (a)

moving any live, loose, movable coral away from the lane at the time that the lane is selected and delineated; and (b) working together with the Commonwealth of the Mariana Islands, Department of U.S. Fish and Wildlife Service to identify potential coral seed stock for eventual planting at a different location on Tinian.

b. Comment: Would the proposed fire and maneuver range (Tinian) have an explosive projectile impact area in nearshore waters? If so, recommend seeking another alternative.

Response: The proposed range would only be used with weapons using non-explosive projectiles, i.e., bullets. Most bullets would be stopped and retained by the range targets and backstops immediately behind the targets. Stray bullets might land in nearshore waters but would not explode. The copper-jacketed lead bullets would have no more adverse water quality effects than fishing sinkers which are routinely lost in coastal waters. Research indicates that surface layers of insoluble salts (primarily carbonates or sulfates) tend to form on the surface of metallic lead, preventing the lead from dissolving in water.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406

Commonwealth of the Northern Mariana Islands
Division of Fish & Wildlife
Department of Lands and Natural Resources
Lower Base, P.O. Box 10007
Saipan, Mariana Islands 96950

Cable Address:
Gov. RMI Saipan
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25 March 1997

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI, 96860-7300

Ref: Draft EIS Military Training in the Marianas

Dear Mr. Minato,

The CNMI Division of Fish and Wildlife (DFW) and Division of Environmental Quality (DEQ) have reviewed the Draft Environmental Impact Statement (DEIS) Military Training in the Marianas and appreciate the opportunity to provide comments. The DFW is responsible for maintaining and enhancing the wildlife and fishery resources in the islands and for reviewing land clearing permits for potential impacts to threatened and endangered species. DEQ is responsible for protecting public health and the environment within the CNMI. The Divisions have the following general and specific comments.

General Comments:
The Divisions found the DEIS to contain information irrelevant to the three alternatives discussed (no-action, augmented, and the mitigated). In addition, the Navy's initial review failed to ensure that figures, tables, and text accurately reflect the activities addressed by each alternative. Because of the omissions and conflicting information, a reviewer is required to flip from section to section in order to guess at which activities are being recommended. Individual inaccuracies and suggested corrections are included in the specific comments below.

Secondly, the DEIS does not accurately present the potential environmental impacts of each alternative in a manner that would allow the public to compare the relative merits of each option. Chapter 4, which discusses environmental consequences, contains brief statements of potential impacts such as "AAVs have the potential to damage or destroy any coral present in waters less than about 1.8 meters" (page 4-6). These statements contain neither quantitative nor qualitative assessments of the *extent* of impact under *each* alternative, nor do they discuss indirect effects as required under 40 CFR 1502.16(b) and Chief of Naval Operations OPNAVInstruction 5090.1B (OPNAVINST 5090.1B). The Navy is requested to provide data on the potential impact of each alternative, as required by NEPA.

The scientific basis for determining potential environmental impacts or for developing the proposed mitigation measures are not identified and referenced as required by 40 CFR 1502.24. References to literature on coral reef ecology, primary and secondary effects of reef damage from vessel groundings on the surrounding marine ecosystem, or potential effects of lead and antimony contamination by small caliber ammunition slugs on the marine environment, among others, are notably absent from the references used to develop the DEIS. The Divisions are requesting that references to the scientific methodologies used in determining both potential impacts and proposed mitigation be included in the document as required by NEPA.

The CNMI Division of Fish and Wildlife has consistently questioned the scientific rigor the Navy has applied to documents tasked with determining the environmental impacts from military activities in the Marianas. It is unclear why the Navy does not include CNMI agencies during the EIS planning process, as suggested in both OPNAVINST 5090.1B (Cooperation with State and Local Agencies) and 40 CFR 1502.5(b) Instead, input from the Divisions is requested primarily after a document has already been prepared. Public meetings held during the scoping process do not substitute for working directly with the Divisions to ensure that an adequate and scientifically rigorous assessment of environmental impacts is prepared and that follow-on studies are developed to assess environmental impacts over the course of the Navy activities. As the DEIS contains no references to environmental assessments performed to determine the impacts of past military exercises, it can only be assumed that the Navy has done little research in this area. It would therefore be beneficial for the Navy to assist the CNMI Divisions to develop studies to obtain these types of data for use in future environmental documents. At the very least, by working with the CNMI Divisions early in the DEIS development process, the Navy could avoid the mistakes of omission and poor organization that currently plague Navy documents on environmental issues in the Marianas.

One reason for the lack of scientific rigor may well lie in the qualifications of the DEIS preparers. Only one of the people tasked with writing the document has formal education in natural sciences, and then only at the bachelor level. Basic training in ecology does not qualify someone to determine how the various alternatives will affect coral reefs and reef habitat, nearshore fish communities and the fisheries that rely on them, sea turtles, megapodes, the Marianas crow, fruit bats, and vegetation. The limited qualifications of the reviewers does not meet the requirement of 40 CFR 1502.6 which states that "(t)he disciplines of the preparers shall be appropriate to the scope and issues identified in the scoping process." The lack of scientific rigor and the inadequate

Finally the DEIS is designed to cover "all military training in the Mariana Islands which is likely to be required for some years into the future" (page ES-1). The Divisions cannot support such an open-ended blanket exclusion to environmental review of military activities in the future. The current document contains insufficient information to determine what the potential impacts of the proposed activities will be now, much less years into the future when cumulative impacts will have occurred. The Navy is requested to provide a time frame during which the EIS will be in effect.

Specific Comments:

Executive Summary Table ES-1 The section titled "Coral reef and sand beach," on this table states that Unit Commanders will be responsible for restoring beaches to their approximate original topography. The Division would like to see further discussion of how this will be accomplished, what equipment the Unit Commanders will have at their disposal, and how the adequacy of the restoration will be determined.

The Divisions are requesting clarification of the measures that will be used to ensure that soil loosened from land activities (driving, troop movement, etc.) and shelling (dislodged soil and plants) does not

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lead to erosion and run-off eventually impacting shoreline and surrounding reef areas. Continual reference was made at the public hearing to existing, established plans and military orders that address vegetation mitigation, general exercise activities, erosion control, safety orders, etc. However, these plans and orders are not discussed in the DEIS. Existing plans and orders that are applicable to, and will be the primary driver for, mitigation measures included in the DEIS should be identified and a brief discussion of the activities that each plan or order addresses should be provided.

The Divisions are also requesting a time line for the repair of damage and restoration of beach and vegetation areas. Repair and restoration should occur immediately after exercises are complete. A statement to this effect should be included in the DEIS.

Chapter 2: Introduction of Forces: Amphibious Assaults: On page 2-15, under the discussion of ongoing training activities included in the No Action alternative, there is a description of a tracked amphibious assault vehicle (AAV). According to the maps on pages 2-9 through 2-14, and table 2-1, AAVs are not currently being used in the Marianas. Including them in the discussion on page 2-15 intimates that they are currently being used in the Marianas, which is confusing to a reader who attempts to discern what new activities are being proposed, and what the impacts of these activities might be. This issue should be clarified either by correcting the maps and table, or by moving the description of the AAV to the section on the Augmented Alternative. The document should be reviewed to determine if other mistakes of this type have been made.

The amphibious assault section also identifies three types of landing craft that have been used in the Marianas: LCM-8, LCU and LCAC. Only the LCAC as discussed in Table 2-1 is currently being used in the Marianas. Are the LCM-8 and LCU being proposed with the AAVs as a new activity? If their use in the Marianas is purely historical, dating to the Second World War, references to them in this document are irrelevant and should be removed.

Chapter 2: Combat and Combat Support Training: Ordnance Training: Page 2-20 states that the firing range on the east coast of the EMUA on Tinian was previously used for training with 60 mm mortars, light machine guns, and 5.56 and 7.63 mm rifles. As with the discussion of the AAVs, this information is not reflected in the comparison of alternatives in Table 2-1. Reconfiguration of the closed firing range on Tinian to include a fire and maneuver range for small arms (up to 5.56 mm) and machine guns, and a mortar range for 60 mm mortar is discussed under the Augmented Alternative giving the impression that these are new activities being proposed in the DEIS.

Table 2-1 does indicate that the 60 mm mortar range is still included in the proposed action (Mitigated Alternative). During the discussion of the Augmented and Mitigated alternatives in Chapter 2, the removal of the mortar range from the Mitigated Alternative is not discussed. However, the mortar range is discussed in Chapter 4; Section 4.6.2 (Proposed Activities and Potential Impacts of Firing Ranges) making it clear that the mortar range is still being proposed. The exclusion of the mortar range from Table 2-1 should be corrected to avoid any confusion.

Chapter 2: Figures 2-16 and 2-21: According to the scale on the figure, the approximate AAV landing area as diagramed in Figure 2-16 is over 60 meters wide, not the fifteen meters stated in the DEIS and at the public hearing held in Saipan on March 5th. The proposal for landing AAVs at Unai Babui requires the vehicles to proceed parallel to the reef until reaching the approach channel (Appendix I). It is unclear from Figure 2-21 whether the AAVs will be in contact with the reef (on top or beside) while paralleling the shore. The Divisions are concerned that, if the vehicles are floating at this point,

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they could be pushed out of the proposed channel by waves coming over the reef edge and become grounded on the reef. This is especially likely given that Unai Babui is a fairly energetic area with a significant flow of water across the reef. The Navy is requested to clarify this issue and identify measures to be implemented to prevent AAVs from moving out of the designated channel and grounding on the reef.

Chapter 2: Figure 2-21: This figure is titled "Detailed Constraints at Unai Chulu." Appendix I states that a landing craft approaching the beach at Unai Babui would "have to make a sharp turn and go approximately 500' alongshore until it reached the small sandy area...to get out of the water." There is no such statement regarding landing at Unai Chulu. Clearly, this figure demonstrates the constraints for landing at Unai Babui quoted above. The only discussion of the AAV approach is located in Appendix I, and the potential environmental consequences of this approach are not discussed in Chapter 4. Therefore, the Divisions are concerned that the information used to determine which beach was more appropriate for landing purposes was based on an erroneous assumption that the landing at Unai Babui did not require AAVs to proceed parallel to the shore, while the landing at Unai Chulu did. The Navy is requested to review Figure 2-21 and Appendix I and provide assurances that the constraints for landing at Unai Babui were taken into account in the decision to use that beach for AAV landings.

Chapter 4: This Chapter "should present the environmental impacts of the proposal *and the alternatives* in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public" (40 CFR 1502.14) (emphasis added). There is no discussion of the environmental impacts associated with individual alternatives in this chapter, nor is information presented in a manner which would allow for comparison between alternatives. No where in the DEIS is information provided to support the statement in Chapter 2 that the Mitigated Alternative avoids "causing significant impact to the environment" (page 2-33). The Divisions are requesting that discussion of the environmental consequences comply with the requirements of NEPA.

Chapter 4: Section 4.1.2.3 The DEIS proposes to land amphibious vehicles on the beach at Unai Babui. Page 8 of Appendix I states "(w)hile environmental considerations at Babui would not be as overriding as at Chulu, it appears that there would be considerable damage to the reef communities during the landing of tracked vehicles. However, the physical structure of the transition area between shallow and deep water, and the ruggedness of the shoreline indicate that this area is *definitely sub-optimal for landing exercises*" (emphasis added). During the public meeting on the DEIS (March 5, 1997), staff from Belt Collins stated that AAV training is currently undertaken in Hawaii. The Division is requesting clarification for the reason that the DEIS recommends landing of AAVs at Tinian despite an analysis indicating that Unai Babui would be suboptimal for AAV exercises, the fact that an established AAV landing area already exists in Hawaii, and the fact that such exercises would considerably damage the coral communities in the area.

Under the proposed mitigation to limit impacts from AAVs on sea turtles, there is no time frame given for surveying beaches for the presence of nests. The Division of Fish and Wildlife requires beaches to be surveyed during daylight hours no more than six hours prior to planned exercises. If exercises will take place during the nesting season, night landing is prohibited to avoid disturbing female turtles and discouraging them from coming ashore to nest. The proposed mitigation to flag nesting areas to prohibit vehicles from crossing them should be extended to foot traffic over those areas as well.

Beyond limiting the area of impact to a 15 meter channel, the DEIS offers no mitigation for the proposed damage to the reef at Unai Babui. The Divisions request that a plan for mitigation be

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developed that addresses compensatory mitigation for the reef areas that will be damaged

The DEIS does not address environmental impacts from the proposed small weapons firing range or the new mortar range. The safety zone for the proposed range extends a significant way over the water off Unai Chiget, a feeding area for green sea turtles. The DEIS does not directly state that firing will be onto land, and that no slugs will land in the water. Small caliber ammunition slugs are known to contain lead and antimony, both of which are regulated by the Environmental Protection Agency and have significant environmental toxicity. The effects of these compounds on the both the terrestrial and aquatic environments is dismissed by omission in the DEIS even though potential impacts would meet two of the criteria defined by the DEIS as significant: impacts to threatened or endangered species, and impact to wetlands, reefs and potential habitat.

All waters in Tinian and Rota are defined by the CNMI Water Quality Standards as Class AA, except San Jose Harbor and East and West Harbors, which are considered Class A. CNMI water quality standards stipulate that "all waters shall be free from toxic pollutants in concentrations that are lethal to, or that produce detrimental physiological responses in, human, plant or animal life. Detrimental responses include, but are not limited to , decreased growth rate and decreased reproductive success of resident or indicator species and/or significant alterations in population or community ecology or receiving water biota." The DEIS does not address whether the slugs from the small arms range or the mortars will have an adverse impact on marine water quality around Tinian in violation of CNMI water quality standards.

Page 4-62 of the DEIS states that "UXO will accumulate in the designated impact areas." In Chapter 3 (Overview of Affected Environment), is the statement "groundwater aquifers on Tinian and Rota are vulnerable to contamination by substances introduced into the soil surface because the porous soil and underlying limestone do not significantly impede the passage of contaminants to the water body" (page 3-3). This clearly indicates the potential for contaminants to be introduced into the groundwater, and therefore into the drinking water, on Tinian from small arms slugs and mortars. Yet the DEIS contains no discussion of the potential impacts of such contamination on public health or the environment.

The Navy's decision to omit the firing range from the discussion of environmental impacts needs be justified in the DEIS. Included in this justification should be a discussion of why the Navy has not made use of its own Ordnance Environmental Support Office (OESO), whose job includes characterization of the hazardous waste constituents of military unique equipment and supplies, or the Department of Defense Military Munitions Working Group to determine whether environmental impacts would occur and what the scope of those impacts might be.

The safety zone demarcated on the Tinian map as the "conceptual fire and maneuver range," is based on past point values with added "safety factors," which are arbitrary at best. Has the military considered using more rigorous probabilistic modeling to determine the firing range (e.g. stochastic analysis, uncertainty evaluations, and which parameters are most important to the model)? Several software packages are available, such as Crystal Ball®, an Excel® spreadsheet-based software package which uses both point values and full distribution of variables for exposure and risks. The probabilistic model would use probability distribution functions instead of just single point estimates for determining the conceptual fire and maneuver range currently demarcated. The advantage being that a more realistic perspective on both human exposure to fire and environmental impacts could be visualized as well as the uncertainties surrounding each key parameter in the model. Therefore, the modeled zone would be better supported by data rather than just adjusting a possible fire range using arbitrary safety factors.

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Chapter 4; Section 4.1.2.5: The DEIS indicates that populations of the endangered Micronesian Megapode could be adversely impacted by bombing maneuvers on Farallon de Medinilla. Proposed mitigation for this impact is to include "further studies," and "potential enhancement of megapode population(s) on another island in the Marianas." The latter proposal will be determined in consultation with the USFWS and the National Marine Fisheries Service. During the public meeting, it was mentioned that the Navy is currently conducting negotiations with the USFWS on a Section 7 incidental take permit under the Endangered Species Act. The Division is requesting that this information be included in the DEIS with a statement that mitigation will be conducted pursuant to the requirements of the Section 7 permit.

Chapter 4: Section 4.8.3: This section states that, "(t)here are no unavoidable adverse impacts or unresolved issues associated with the Mitigative Alternative." It is clear from the comments made in this letter that this statement is insupportable. The Mitigated Alternative will have a long-term and lasting impact on the coral reef at Unai Babui and potentially on the water and soil quality at Unai Chiget and the proposed firing range. Since the landing of AAVs and the use of live ammunition are new activities being proposed in the DEIS, it cannot be argued that they are unavoidable. They could be avoided by choosing the No Action alternative. A factual discussion of the long-term and unavoidable impacts of the alternatives is required.

Based on the issues raised in this letter, the Divisions of Fish and Wildlife and Environmental Quality do not believe that this DEIS meets the requirements of NEPA, as discussed in 40 CFR 1502, or the Navy's OPNAVINST 5090.b. The present document does not contain any scientifically credible data on which to base a comparison of the alternatives being reviewed. It also does not reference studies or analyses that have been undertaken to determine potential impacts and evaluate mitigation. As a result, the Divisions believe that the scientific discussion in the DEIS is so inadequate as to preclude meaningful analysis of the alternatives being reviewed and are requesting that a revised draft environmental impact statement be prepared, as required by 40 CFR 1502.9(a).

Questions or comments on this letter can be addressed to Katharine Miller, DFW Natural Resources Planner, or Kathy Yuknavage, DEQ Laboratory Supervisor.

Sincerely,

Roque Santos
Director, Division of Fish and Wildlife

[illegible] Castro, Jr.
Director, Division of Environmental Quality

Director, Division of Environmental Quality

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DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/ 2797

28 JUL 1998

Mr. Richard Seman, Director
Commonwealth of the Northern Mariana Islands
Division of Fish and Wildlife
Lower base, P.O. Box 10007
Saipan, MP 96950

Dear Mr. Seman:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

We are responding to CNMI Division of Fish and Wildlife (DFW) letter (from the former Director, Mr. Rogue Santos) of March 25, 1997, regarding the subject Draft Environmental Impact Statement (DEIS). This letter also included comments from the Division of Environmental Quality (DEQ). In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS. A copy will be forwarded for your review.

Those issues raised by a number of reviewers are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the **purpose and need** for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required.)

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based,

forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: More detail was requested on the **proposed training activities**, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a **full range of alternatives**, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use, less use, no change in use,* and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The **Preferred Alternative** consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The **Maximum Land Use Alternative** includes proposed new training land uses which are not desirable because of significant impacts that cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense (DoD) has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

DFW and DEQ COMMENTS

Our responses to your comments not covered above are as follows:

General Comments:

a. Comment: Tables, figures, and text are not internally consistent regarding elements of the proposed action and alternatives.

Response and Revisions to DEIS: Revisions have been made as per paragraphs b and c under Common Issues.

b. Comment: The discussion of impacts does not contain adequate quantitative or qualitative assessments of the *extent* of impact under *each* alternative, nor do they address indirect effects. The scientific basis for determining potential impacts is not identified and literature reviews and scientific methodologies for evaluations of impacts on marine resources are not referenced. The DFW questions the scientific rigor of the Navy's approach to determining impacts of military activities in the Marianas and can only assume the Navy has done little research in this area. The qualifications of the preparers appear to be lacking.

Response: Surveys of alternative prospective landing areas were conducted by a fully qualified marine biologist on two occasions. Comparison of findings was used to select the preferred landing beach and mitigation constraining its use. Aerial photographs were used in conjunction with the in-water survey to select the preferred approach lane. The depth of water in which the benthic environment would be affected by assault amphibian vehicle (AAV) landings is approximately 6 feet (less than 2 meters). Below this depth, coral would not be impacted. Because of the low density of coral in the area of potential effect, resource mapping was not conducted.

Revisions to DEIS: The revised DEIS contains the results of both surveys in the appendix. The scientist performing the survey has been included in the list of preparers of the DEIS.

c. Comment: The Division cannot support a DEIS covering training into the open-ended future. Provide a timeframe during which the EIS will be in effect.

Response and Revisions to DEIS: The DEIS provides NEPA documentation for the impacts of all continuing and newly proposed actions into the foreseeable, although indefinite future or *until or unless the impacts change significantly.* For several potentially significant impacts, proposed mitigation in the revised DEIS includes ongoing monitoring of impacts which will assist in identifying any situations that change from those anticipated in the DEIS. There is no formal time limit for a continuing action. This DEIS does not provide NEPA compliance for any new training that may subsequently be proposed if that training is substantially different in effect from the training covered in this DEIS.

Specific Comments:

a. Comment: How will beaches be "restored to their original topography," what equipment will be available and used, how soon will repair and restoration occur, and how will adequacy of restoration be determined? Repair should occur immediately after the exercises are complete. Clarify measures to ensure that soil loosened by training will not run off to silt shoreline and reef areas. Identify and describe any referenced existing plans and orders invoked as mitigation.

Response: Beach sand disturbance will consist of tire tracks, AAV tracks, and ruts from Landing Craft Air Cushion (LCAC) support struts. In LCAC landing areas, passage of a departing LCAC over the beach has the effect of leveling off the portion of the beach traversed. Any ruts in other areas will be smoothed with hand tools at the conclusion of the landing exercise. It is not anticipated that any soil will be introduced to the water by landing vehicles, as beach sediment consists primarily of sand-sized particles rather than silt. The planned future modifications to the training order governing training on Guam and Tinian will incorporate these measures.

Revisions to DEIS: Table 2-11 has been modified to clarify the method of beach regrading after a landing.

b. Comment: Clarify which activities are currently performed in the Marianas and which are not (e.g., AAV landings, live fire range, mortar range). The amphibious assault description includes landing craft medium (LCM) and landing craft utility (LCU), but neither of these is in Table 2-1 or is clearly proposed as training; please eliminate, if irrelevant.

Response and Revisions to DEIS: References to vehicles and other activities not proposed as part of the proposed action have been deleted. All amphibious assault vehicles proposed for training use are now included in the tables, figures, and text. [See also paragraph b under General Comments]. Cross-references between tables, figures, and text have been checked for consistency.

c. Comment: Clarify width and orientation of proposed AAV approach corridor to Unai Babui. Identify measures to prevent AAVs from moving out of channel and grounding on the reef.

Response and Revisions to DEIS: Figures and text have been revised to clarify that AAVs will approach perpendicular to the beach within a corridor approximately 22 meters wide. The AAV corridor will be delineated by a Navy-contracted marine biologist prior to the first AAV landing. The UTM coordinates of its end points will be recorded, along with appropriate bearing. AAVs are provided with adequate navigational equipment, including global positioning system, to find the initial point and maintain the corridor bearing across the reef flat. This information will be published in directives applicable to all units training on Tinian.

d. Comment: Clarify landing craft approach constraints at Unai Chulu, in conformance with details shown on Figure 2-21.

Response and Revisions to DEIS: The figure details constraints on offloaded vehicles on the beach (requiring them to remain on established roadways) and does not illustrate offshore approach. No constraints are proposed on the approach corridor for LCACs, which do not come in contact with underwater elements such as coral as long as they are fully up on cushion. However, the revised DEIS proposes constraints on LCAC approach method and speed, in order to prevent any surge wave in the water from damaging coral (to be addressed in section 4.1.1.3 of the revised DEIS). The figure was designed to illustrate protection of cultural resources and will not be in the revised DEIS.

e. Comment: Chapter Four does not address impacts associated with alternatives and does not allow for comparison between alternatives. There is no support in the DEIS for the claim that "the Mitigated Alternative...avoid(s) causing significant impact to the environment" (page 2-33).

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Response and Revisions to DEIS: (See paragraph c under Common Issues). Impacts of alternatives are compared in Chapter 2 of the revised DEIS.

f. Comment: Clarify why AAVs are required on Tinian, despite fact that landings may be made in Hawaii and despite Appendix I statement that "physical structure and ...ruggedness of the shoreline indicate that this area is definitely suboptimal for landing exercises." DFW requests compensatory mitigation for damage to reef at Unai Babui.

Response and Revisions to DEIS: The AAV is one of the principal ship-to-shore transportation means available for amphibious operations, and its safe and effective use requires training in launching and recovery, navigation to shore, crossing the shoreline, and operations ashore. Training includes both crew technical operations and tactical operations with other types of combat units. AAV's are a basic maneuver element of the Marine Expeditionary Unit (MEU) and as such require integration in MEU training. Tinian is closer than Hawaii and is the only training area in the region suitable for maneuver training of MEU units based in Japan. It is also the only maneuver training area for a MEU transiting from the continental U.S. or from Hawaii for six- to seven-month operational commitments in Africa, the Persion Gulf, or Southwest Asia (e.g., Somalia and Desert Storm). Chapter One has been revised to make this point more explicit.

The Appendix I report is from a marine scientist. Unai Babui and Unai Chulu were, in fact, highly successful amphibious landing areas in WWII; photographs on the cover of revised Chapter Two will document that Unai Chulu landing. While it is true that the beach at Unai Babui is rugged and that Unai Chulu would be a preferable landing area for operational reasons, Unai Babui was selected because landings can be made there with the least impact to the environment.

The DEIS proposes minimal AAV landing capability on Tinian, consisting of AAVs approaching Unai Babui along a designated single-file corridor. The corridor will be delineated by a marine biologist prior to the first AAV landing exercise. At that time, the biologist will relocate loose (movable) coral from the designated corridor to a nearby location on the Babui reef. The response to paragraph c under Specific Comments, pertains to this comment. Compensatory mitigation will initially consist of monitoring activities. Should coral damage exceed the degree estimated in this impact assessment, reef enhancement activities at another location will be considered in consultation with CNMI DFW.

g. Comment: Provide time frame for surveying beaches for presence of turtle nests. DFW requires survey during daylight hours no more than six hours prior to planned exercises. Request that night landing be prohibited during nesting season. Proposed flagging of nest areas to prohibit vehicles should also extend to prohibiting foot traffic.

Response and Revisions to DEIS: Beaches will be surveyed by a Navy biologist no more than 6 hours prior to a landing. CNMI biologists are invited to partake in the survey. Areas free of nests will be flagged and vehicles will be directed to remain within flagged areas. Nests will be monitored but not flagged, to reduce the risk of poaching which is a concern on Tinian. Also, beaches will be monitored by the biologist during any nocturnal landings and beach landings will be modified if turtles are observed in the area. The DEIS has been revised to reflect this information.

h. Comment: Address impacts of proposed live fire range and mortar range on sea turtles feeding within surface danger zone (SDZ). Slugs may contain lead and antimony: address effects of these toxic elements on endangered species, reefs and habitat, and offshore water quality. Address impacts of spent projectiles, including mortar shells, on underlying groundwater and drinking water and therefore on public health. Justify omission of live fire range from discussion of environmental impacts, including justification of why Navy has not made use of its Ordnance Environmental Support Office or DoD Military Munitions Working Group.

Response and Revisions to DEIS: The mortar range will no longer be pursued on Tinian due to safety and other environmental concerns and therefore not included under the Preferred Alternative. Accordingly, there is no need to perform more in-depth studies/surveys of the mortar range impacts in the DEIS. No turtle nesting beaches occur within the SDZ of the proposed small arms range (the SDZ excludes Unai Chiget). The proposed small arm live fire range will have backstops and usage will be minimal (usage may average once a month). Therefore the amount of stray bullets entering the water will be minimal and should not be considered a major concern to the marine environment.

Projectiles containing lead and antimony acquire surface layers of insoluble salts (in seawater these are primarily sulfates and carbonates), restricting release of free lead and antimony to ocean water. While some corrosion may be expected in soil, generally an inert coat of insoluble salt will form and limit further corrosion. Lead may also form complexes with organic matter and clay minerals that limit its mobility.[1] Groundwater in the northern portion of the island has not been established to be of potable quality and is not now used for drinking water. The freshwater lens tentatively mapped by military geologists ends at the proposed target area and SDZ. Chloride levels at wells near Lake Hagoi (relatively farther inland than the proposed range and SDZ) were reported to be 200-600 ppm, which is generally considered nonpotable quality. The unlikelihood of lead leaching and unlikelihood of groundwater at the site ever being used as a drinking water source should allay any concerns about this groundwater contamination issue.

[1] National Library of Medicine Hazardous Substances Data Bank, quoting US EPA (1984) *Health Effects Assessment for Lead*, EPA-540/1-86-055, Long DT, Angino EE (1977) Geochim et Cosmochim Acta 41: 1183-1191, and US EPA (1977) *Air Quality Criteria for Lead* pp 6-1 to 6-28, EPA-600/8-77-017.

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i. Comment: Justify statistical basis for demarcation of SDZ for the live fire ranges.

Response and Revisions to DEIS: The dimensions of surface danger zones for firing ranges are standardized in military publications including MIL-HDBK-1027, Army Regulation 385-63, and Marine Corps Order P3570.1. The size and configuration of the SDZ are based on the weapon and its projectile, the configuration of the range, and soil type. The SDZ for unbaffled ranges extends for the maximum projectile range. Lateral limits are established for ricochet potential and shooter error. Credit, or reduction in size of the SDZ, is not given for natural terrain masking. The basis for these dimensions is not statisticial, rather it is based on the type of weapon and the projectile's maximum travel potential.

j. Comment: Provide information from any Section 7 consultations regarding bombing on FDM. State that mitigation will be conducted pursuant to the requirements of any Section 7 permit.

Response and Revisions to DEIS: The USFWS has issued a programmatic Biological Opinion for range operations on FDM for the next three years. A copy of the opinion is appended in the revised DEIS. Various mitigation measures complying with existing USFWS Biological Opinions are identified throughout the text.

k. Comment: Statement that "there are no unavoidable adverse impacts or unresolved issues associated with the Mitigative Alternative" is unsupported by DEIS. Request a factual discussion of unavoidable adverse impacts and unresolved issues.

Response and Revisions to DEIS: The section has been modified in the revised DEIS where such impacts or issues are potentially significant.

We trust that these responses adequately address your concerns. Should you have any questions, point of contact is Mr. Fred Minato (Code 231FM) at (808) 471-9338, by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

FROILAN C. TENORIO
Governor

JESUS C. BORJA
Lt. Governor

Caller Box 10007
Saipan, MP 96950
Telephone: (670) 664-2200
Fax: (670) 664-2211

6 March 1997

Via Facsimile 808.474.5909
Mr. Fred Minato
Code 231FM
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

Thank you for the opportunity to comment on the DEIS for Military Training in the Marianas. The Commonwealth of the Northern Mariana Islands (CNMI) natural resource agencies (Division of Fish and Wildlife, Division of Environmental Quality, and Coastal Resources Management Office) will submit separate written comments covering their respective jurisdictions. I have three requests:

1. As stated in Governor Tenorio's letter of 13 December 1996 commenting on the Department of Defense notice of intent to prepare an EIS for military training, the CNMI wants the Department of Defense to establish Standard Operating Procedures to notify and coordinate with CNMI agencies during the planning and implementation of each training exercise to occur in the CNMI. The CNMI needs a minimum of 30 days prior notice before any activity occurs in the CNMI and sufficient detail of the planned exercise so that resource agencies can monitor for adverse impacts to natural and historical resources.

As discussed at the public hearing on Saipan on 5 March 1997, the Civilian/Military Advisory Council (CMAC) would be an appropriate organization to facilitate such notification and coordination activities. The CMAC is provided for in Part III of the "Technical Agreement Regarding Use of Land to be Leased by the United States in the Northern Mariana Islands" which is part of the "Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America," U.S. Public Law 94-241, Presidential Proclamation No. 4534. The CMAC was active starting in 1987 up until approximately early 1994. I have corresponded with CDR Darlene Iskra of COMNAVMAR to reactivate CMAC. An appropriate step to reactivate CMAC would be for the Admiral to write to Governor Tenorio requesting the Governor to designate members to CMAC, informing the Governor of the Department of Defense's members, and requesting a date for the next meeting.

2. The DEIS preferred alternative includes using munitions in parts of Tinian that are used by tourists, recreationists, boaters, and commercial airplanes. (a) The Standard Operating Procedures that you develop for notification need to include adequate provisions to ensure the safety of civilians, including people on planes and boats adjacent to Tinian, and on land on Tinian. (b) Procedures for clean-up after exercises need to ensure that UXO are removed without adversely impacting natural resources or Tinian's infrastructure, including removing UXO that end up in coastal waters, so that there is no threat to human safety.

3. The DEIS proposed mitigation for proposed adverse impacts to the fringing coral reef of Tinian at Unai Babui caused by driving vehicles over the reef is minimization and avoidance of Tinian's more sensitive coral reefs. (a) The estimated percent of live coral coverage at the reef in question is reported as less than one percent. You site Marine Research Consultants as the source of the percent cover data. The DEIS does not adequately describe the potential environmental impacts to the reef from the proposed activity. Prior to finalizing the DEIS please arrange to show CNMI marine biologists the proposed site to assess the health and sensitivity of the reef. Provide more information in the EIS about why the proposed site for degrading the fringing coral reef will result in less of an environmental impact than alternative coastal areas of Tinian. Provide information to justify that environmental impacts will not be significant from use of the AAVs at the proposed site. (b) There have been no exercises that included driving "AAVs" over coral reefs in the past 10 years in the CNMI. Please include information in the EIS on why it is necessary to practice driving the AAV's over Tinian reefs and why sites outside of the CNMI are not practicable. (c) You do not propose compensatory mitigation measures for destroying the proposed 24 square meters of coral reef. Please work with the CNMI Coastal Resources Management Office and Division of Fish and Willdife to define agreeable compensatory mitigation measures, such as paying for restoring the degraded Coral Garden reef on Rota.

Thank you for the opportunity to provide comments and identify concerns. Please feel free to contact me if you have questions or need assistance coordinating with CNMI natural resource agencies.

Sincerely,

Eric Gilman
Special Assistant to the Governor for Environment

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DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P-1G03
Ser 231/2015

22 MAY 1998

Mr. Eric Gilman
Commonwealth of the Northern Mariana Islands
Special Assistant to the Governor for Environment
Office of the Governor
Caller Box 10007
Saipan, MP 96950

Dear Mr. Gilman:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated March 6, 1997, regarding the subject Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in June 1998. A copy will be forwarded for your review. Our responses to your specific comments are as follows:

a. Comment: The CNMI would like DoD to establish standard notification procedures, including a minimum of 30 days advance notice prior to any DoD training in the CNMI. This would best be facilitated by the Civilian/Military Advisory Council formed in 1987.

Response: Agreed. After completion of the EIS, a Training Manual (TM) will be developed. The TM will be the guide that exercise planners should follow in order to conduct training in the Marianas and will establish training protocols to preserve the human environment, including public health and safety. Notification procedures will be incorporated in the TM.

Revisions to DEIS: The revised DEIS indicates that 30 days advance notice will be provided for all potential closures of the Tinian Exclusive Military Use Area (EMUA). In addition, CNMI agency representatives will be notified 30 days in advance of any landing beach surveys and will be welcome to accompany Navy survey teams.

b. Comment: The DEIS should standardize procedures to protect public safety during range use on Tinian.

Response: It is already a standard procedure to issue warning advisories and post observers during range use, to ensure that public safety is protected.

Revisions to DEIS: No revision required. Standard public safety protection measures are detailed in Chapter Four of the revised DEIS.

c. Comment: All UXO generated by range use on Tinian should be removed from land and water impact areas after each exercise, without adversely impacting natural resources or Tinian's infrastructure.

Response: UXO would only be generated by mortars using live ammunition. This is not a component of the Preferred Alternative, as UXO would be impossible to completely remove from the impact area.

Revisions to DEIS: No revision required.

d. Comment: Justify new need for AAV landings on Tinian. Provide more information regarding potential impacts of AAV landings on fringing coral reef at Unai Babui (Tinian), particularly justifying why it is the landing site with the least impacts. Arrange to show CNMI biologists the exact landing area proposed, so they may assess its existing condition. Justify that impacts will not be significant. Propose compensatory mitigation for destroying up to 24 square meters of coral reef.

Response: The EMUA is the only inland maneuver training area in the Mariana Islands; therefore, its beaches are the only ones which can provide amphibious assault landing training (which presumes and requires maneuver from the beach through a combat training area). Unai Babui was identified as the beach within the EMUA with the least live coral and the least likelihood for future coral development. Both Unai Chulu and Unai Dankulo have substantially more live coral cover, and neither of them is subject to as strong wave energy as is Unai Babui. For that reason, minimal impact on coral would be realized by selecting Unai Babui as the sole AAV landing beach and, as has been done, by limiting landings to single-file approaches.

We have met and discussed the landing location with CNMI biologists and they will be welcome participants before, during, and after the beach landing exercise. Compensatory mitigation is not proposed, at this time.

Revisions to DEIS: Chapter One of the DEIS has been revised to clarify the purpose and need for all types of training, including amphibious assault landings.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Stanley Y. Uehara

STANLEY Y. UEHARA
Director
Environmental Planning Division
Acting

GUAM ENVIRONMENTAL PROTECTION AGENCY

AHENSIAN PRUTEKSION LINA'LA GUAHAN

P.O. BOX 22439 GMF • BARRIGADA, GUAM 96921 • TEL: 472-8863 • FAX: 477-9402

Director, Environmental Planning Division
Department of the Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300
[fax (808) 474-5909]
Attn:Mr. Fred Minato (Code 231FM)

REF: Draft Environmental Impact Statement for Military Training in the Mariana Islands.

Dear Sir:

The Guam Environmental Protection Agency has reviewed the Draft Environmental Impact Statement for Military Training in the Mariana Islands which your office provided and we provide the following comments on this document.

1) We are concerned over possible impacts of the air cushioned landing craft landing for the first time at Dadi Beach. Although the craft is estimated to result in six pounds per square inch pressure, this may result in damage to projecting corals, especially with repeated passage over individual points. In addition, the Agency is concerned about the impact of "prop wash". Although we realize that ACLC do not utilize conventional propellors, there is a concern that the air jets will produce an energy force capable of toppling small corals or subjecting corals or other marine biota to a sandblasting affect as the craft navigate the shallow sections of the reef flat. Also, proposed shallow water mine countermeasure training using "strings of 20 one-pound charges" at Dadi is expected to have negative impacts, especially on the fish in the area. Although the DEIS says the site lacks biota, we expect there are fish there. For example, the application document for the Department of the Army permit for the ocean outfall at Tipalao Bay lists ninety (90) species of fish observed in the area during a short study in 1993. Tipalao is the small bay adjacent to Dadi Beach area. Such activities as proposed in this DEIS have not been practiced at these sites before, at least in the last fifty years.

2) The new deep site proposed for demolitions off Dadi Beach is claimed in the DEIS to "not have any noticeable biotic community structure". We are not convinced that resources in that area, especially fishes, will not be negatively impacted by the proposed demolitions.

3) Twenty pound charges have not been used for EOD exercises on Guam in the past and their greater impacts are expected to be more damaging to resources than experienced in previous training exercises. We suggest that procedures of training be modified to preclude the use of charges in excess of ten pounds.

"ALL LIVING THINGS OF THE EARTH ARE ONE"

4) The new site proposed for mine countermeasure training at Breakwater Beach is claimed to have "no biotic community structure". We expect fish and other marine resources vulnerable to explosions to be in the area, as well as a significant volume of boating activity.

5) The proposed expanded surface danger zone of the fire and maneuver range at Orote Point exposes a large area of boating, fishing and diving sites to danger from stray bullets.

6) The new sniper range in Navy Ordnance Annex could result in damage to wildlife, especially the unique wild carabao there, from ricochet bullets. A fire hazard could also result if incendiary bullets were used.

7) River insertion impacts were difficult to evaluate. We need to know what type of craft and engines will be used, how far the craft will go upstream and what techniques of landing will be used. As much as possible, the EIS should provide this information.

8) The impacts of the proposed Rapid Runway Repair at Northwest Field may affect historic resource values and may affect endangered species unnecessarily, for example from dust and noise.

9) Overall, the marine environmental assessments for this DEIS, as documented in Appendix I, appear extremely deficient.

Based on discusions of the DEIS at meetings of GEPA staff and Navy representatives on March 11, 1997 at our office, we understand that:

1) Coral cover is believed to be less than 1 to 3% at the Dadi Beach area proposed for air cushioned craft landings, operations would be limited to corridors having least impacts on the marine communities and specific sites planned for use will be shown to GEPA investigators for evaluation this spring.

2) The deep water explosives site off of Dadi Beach is in an area free of corals and macro-biota consisting of a "lifeless" sandy bottom and the specific sites planned for use will be shown to GEPA investigators for evaluation this spring. Navy representatives stated that if the area off Dadi Beach in Agat were approved as a deep water site for demolitions training, it would in fact become the primary area for demolitions training and the deep water site in Apra Harbor would be used as a secondary site when weather conditions preclude the use of the primary site at Dadi Beach.

3) The use of different larger C-4 charges than allowed in the past relates to the need for realistic training experiences. Improved notification to vulnerable watercraft, fishermen and divers will be

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4) The EOD representatives stated that because of the rough water conditions and the amounts of boat traffic, the Breakwater Beach site would not be used for shallow mine countermeasure training.

5) 50 caliber live ammunition will not be used at the Orote Point site.

6) River insertions were explained to consist of small inflatable rubber craft powered by small engines penetrating as far as possible up river, where one or two men would be offloaded and some blank firing may occur.

7) The US Fish and Wildlife Service will carefully review and advise on avoidance of impacts to wildlife at Northwest field.

8) Naval representatives stated that only two areas have been identified for marine demolitions training. These areas are the existing deep water site in Apra Harbor and the proposed site off Dadi Beach. All other requested sites within Apra Harbor will be retracted.

We are pleased to partake in the review of possible impacts of proposed military training in Guam and the Northern Marianas and hope that our concerns will be addressed in the Final EIS. We look forward to further cooperation with the Department of the Navy in this and other matters.

Sincerely,

Jesus P. Bathe
Administrator

CC: Director, BOP
Director, Dept. Agriculture
Director, Dept. Parks & Rec.
L.Lee, PIAP, USEPA Region 9

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DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P 1G03
Ser 231/ 2572

10 JUL 1998

Mr. Jesus T. Salas
Administrator
Guam Environmental Protection Agency
P O Box 22439 GMF
Barrigada, GU 96921

Dear Mr. Salas:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter [undated] regarding the Draft Environmental Impact Statement (DEIS) for the above-referenced action. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS. A copy will be forwarded for your review.

Our responses to your specific comments are as follows:

a. Comment: Please address concerns regarding the potential for landing craft air cushioned (LCACs) to damage coral.

Response and Revisions to DEIS: An LCAC fully up on its air cushion does not contact coral under the water. However, a test landing performed at Dadi Beach in 1997 showed that an LCAC which has slowed for a turn or landing may create wave surges that may be capable of moving large rocks and breaking off coral heads.

The DEIS now clarifies the above-described situation and proposes, as mitigation, that LCACs may only cross shallow reefs if they remain fully up on its air cushion. All turns must be conducted on land, and no landings will be allowed on beaches with more than a 6-degree grade. All landing beaches with shallow offshore reefs will be surveyed by exercise personnel or SEALs no more than one week in advance of a planned landing, to ensure that beach conditions allow a fully air-cushion landing and turnaround over land.

b. Comment: It is unlikely that there are "no biota" in the area offshore of Dadi Beach proposed for shallow water and deepwater mine countermeasures (MCM) training, and GEPA believes there will be impacts on fish and other resources which may be negatively affected by this proposed action.

Response and Revisions to DEIS: An additional survey was performed and the report clarifies exactly which biota were observed in shallow and deep waters. The report is appended to the revised DEIS. The DEIS has been revised to clarify that: (1) shallow water MCM will not employ live charges at Dadi Beach and (2) exactly what biota are present in the vicinity of the deepwater MCM training area.

c. Comment: Suggest restricting deepwater MCM to 10-pound charges, as 20-pound charges have not been used for EOD exercises on Guam in the past and their greater impacts are expected to be more damaging to resources.

Response: Training must be performed with various live charges so that personnel can become accustomed to acting with the heightened safety awareness, detailed procedures, and self-confidence that must be maintained for safety. A 20-pound charge is used for different combat situations than a 10-pound charge. It is important for personnel to receive training involving both types of charges. Personnel require training in identifying the correct charge to use, how it should be rigged and fused, safe handling, and redeployment to a safe distance. Both 10-pound and 20-pound charges have been used in Outer Apra Harbor in the past, and the environmental impacts of such activity were evaluated under National Environmental Policy Act (NEPA) and found to have no effect requiring further analysis.

Revisions to DEIS: The DEIS has identified a second mine countermeasures site outside of Apra Harbor, offshore of Dadi Beach, and recommends that 20-pound charges be deployed at the Dadi Beach site in preference to the Apra Harbor site, whenever possible, to decrease the need to temporarily close Apra Harbor to commercial and recreational traffic during training.

d. Comment: Site proposed for shallow water MCM at Breakwater Beach is expected to have fish and other marine resources vulnerable to explosions, as well as significant boating activity. Please correct.

Response and Revisions to DEIS: Breakwater Beach has scattered small encrusting coral colonies on some boulders, but there is no coral or other macrobiota on the sandy bottom at the base of the boulder walls. The charges used by the SEALs will be extremely small (.25 #), will have an extremely localized effect, and will be detonated under stealth conditions, i.e., at times when there is no boating activity.

e. Comment: The new SDZ for fire-and-maneuver on Orote Point exposes a large ocean recreation area to stray bullets.

Response and Revisions to DEIS: The fire-and-maneuver range, i.e., the range with the expanded SDZ, is proposed to be used approximately three weeks each quarter (or about one week per month). The size of the SDZ is a function of the weapons being employed and their direction of fire. Although backstops exist to contain the

majority of rounds fired, shots over the backstop and ricochets do occur. Notices to mariners and warning flags will be posted when the range is in use.

f. Comment: The proposed Ordnance Annex sniper range risks damage to wildlife, particularly wild carabao, from bullets and fire.

Response and Revisions to DEIS: Wild carabao have a very small potential of being hit by a sniper projectile. Personnel using the range would be expert snipers maintaining existing skills and marksmanship is expected to be excellent. Snipers make only a single shot at a target after a relatively long preparation time. The rifles are scoped, and the snipers are trained to notice and avoid targeting moving objects. Targets will be placed on forward slopes with hills as backstops, although these are not formally considered when the SDZ is delineated. Section 4.3.1.1 of the revised DEIS specifically addresses risks to carabao.

g. Comment: Need more information on river insertion training in order to evaluate impacts. How far will craft go upstream and what will be the landing techniques?

Response and Revisions to DEIS: Personnel are inserted or extracted on a riverbank by swimming or paddling on combat rubber raiding craft (CRRC). The CRRCs are periodically brought ashore and hidden for the duration of the operation, then recovered for extraction. Once on the bank, personnel move to the objective on land by foot. Chapter Two has been extensively rewritten to better describe components of training activities, relative to their impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

h. Comment: Proposed rapid runway repair at Andersen AFB may affect historic resources and endangered species.

Response and Revisions to DEIS: Rapid runway repair at AAFB will be restricted to a designated area once used as a parking apron and devoid of cultural sites. No impact is anticipated on cultural resources. [See section 4.4.2.1 of revised DEIS.] Although no endangered Mariana crows are known to have nested in the vicinity of Northwest Field in recent years, AAFB biologist works closely with Guam DAWR for an updated report. No significant impacts on endangered species are expected.

i. Comment: The marine environmental assessment in Appendix I appear deficient.

Response and Revisions to DEIS: (See paragraph b.) In addition, additional marine survey reports will be included in Appendix C of the revised DEIS.

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j. Your letter also mentioned the minutes of the meeting of March 11, 1997 with Navy representatives (items 1-8). In general, we agree with those statements. We wish to clarify item (8), which states that all requested marine demolition sites within Apra Harbor will be "retracted"with the exception of the existing MCM site in Outer Apra Harbor and the proposed MCM site offshore of Dadi Beach. This statement is true for deepwater demolitions only. Several shallow water MCM sites are still proposed as part of the Preferred Alternative in the revised DEIS.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely.

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
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BUREAU OF PLANNING
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Vincent P. Arriola
Director

APR 0 1 1997

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Hafa Adai Mr. Minato:

The Bureau of Planning's Guam Coastal Management Program coordinated with its network agencies and reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Military Training in Guam. In a meeting with the Guam Environmental Protection Agency (GEPA), Department of Agriculture, and Department of Parks and Recreation's Historic Preservation Officer, and Guam Civil Defense, several concerns were raised which we feel should be addressed before the preparation of the Final DEIS, as follows:

1. Marine Issues:

   a. The use of large charge packages (20 lbs) to be exploded underwater has not been justified. Guam's ecosystem is fragile and we have laws against the use of explosives (whether the resulting dead fish are collected or not). The damage expected to corals and marine life is not only unacceptable, but unnecessary. We suggest looking into significantly smaller charges, changing the location of the exercise, or using simulations rather than actual explosives.

   b. Aside from the Tokai Maru, a World War II Japanese ship lying in the harbor with two, unexploded depth charges on her deck, there are other sunken craft in Apra Harbor which still present dangers if damaged. Oil spills could be increased through the use of explosives and, in a worst case but possible scenario, the unstable depth charges could be set off.

   c. Apra Harbor does see endangered species with some frequency. Sea turtles in particular, can be expected to be found on a regular basis.

   d. We are concerned about the use of cushion craft, as there appears to be no data on the depth of water coverage needed above corals to avoid damage. Unless such data is furnished and compliance to safe operating depths is guaranteed, we would take the position that unnecessary risks to the environment are being suggested.

   e. Haputo is an area where Guam's endangered and threatened tree snails are found. The impact on these communities must be more thoroughly addressed.

   f. The constraints found in the Sasa Bay area must be more fully disclosed, including the mangrove areas.

2. Other:

   a. There have been concerns regarding faulty maps, particularly regarding environmental systems in the Pati Point area.

   b. The suggested use of Northwest Field for runway repair exercises contradicts the military's own assessment of the importance of the area. The Navy has nominated this area for inclusion on the National Register of Historic Places. Perhaps Orote Point facilities could be used instead.

   c. Closure of a trail in the Naval Magazine area has been identified as a concern. While we are aware of safety considerations, perhaps a compromise could be worked out for the continous accessability of the southern ridgeline trail to the public for the period of non-exercise time.

The agencies listed in the letter above are more than willing to work with the military to try to resolve these issues, and we suggest you contact them for that purpose. We do not think the problems are insurmountable if both sides understand the fragile nature of our environment and the range of options available. The Bureau will review the final EIS when these issues have been addressed, and will issue a determination for Federal Consistency at that time. We believe it is premature to do so in the draft stage.

If you have any questions regarding our position, please do not hesitate to contact us.

Si Yu'os Ma'ase,

VINCENT P. ARRIOLA
Director

cc: DoAg/DAWR
GEPA
DPR
Civil Defense

RECEIVED TIME APR. 7. 12:28PM PRINT TIME APR. 7. 12:29PM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/ 2238

12 JUN 1998

Mr. Vincent P. Arriola, Director
Bureau of Planning
Government of Guam
P.O. Box 2950
Agana, GU 96910

Dear Mr. Arriola:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter April 1, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in June 1998. A copy will be forwarded for your review. Our responses to your specific comments are as follows:

Marine Issues

a. Comment: Justify use of 20 pound underwater charges (versus 10 pounds). Recommend considering much smaller charges, change in training location, or using simulations.

Response: In a real-world conflict scenario, explosive ordnance disposal personnel must be able to manage both the inherent dangers of disarming live mines and the dangers of working close to enemy ships and facilities. Training with live charges in a safe (controlled) situation eliminates the latter of these two hazards and provides essential practice with the other. Training must be performed with live charges so that personnel can become accustomed to acting with the heightened safety awareness. Simulated devices fail to prepare personnel mentally and emotionally for the conditions and after-effects of setting off such charges. A 20 pound charge is used for different combat situations than a 10 pound charge or two pound. It is important for personnel to receive training involving different types of targets and various charges ranging two to 20 pounds. Personnel require training in identifying the correct charge to use, how it should be rigged and fuzed, safe handling, and redeployment to a safe distance. Both 10 pound and 20 pound charges have been used in Outer Apra Harbor in the past, and the environmental impacts of such activity were previously evaluated under National Environmental Policy Act and found to have no effect requiring further analysis.

Revisions to DEIS: The revised DEIS will identify a second alternative mine countermeasures site offshore of Dadi Beach, which would be more accommodating than the Apra Harbor site for the 20 pound charge. Use of the proposed Dadi Beach site

would not require any closure of the harbor to commercial or recreational activities.

b. Comment: Sunken vessels in Apra Harbor present possible dangers if damaged. For example, oil releases could be increased or the TOKAI MARU depth charges could be triggered by underwater demolitions.

Response: Peak overpressures at the TOKAI MARU and other sunken vessels have been calculated to be less than one atmosphere. Although it is not known exactly what effect these pressure waves would have on any particular structure, a structure with no void [air] spaces is not particularly vulnerable to structural deformation and resultant damage. Void spaces are unlikely to exist in vessels that have been submerged for many years. This fact, the infrequent occurrence of detonation events, and the low pressure exerted on sunken vessels' metal structures from the detonations indicate that impacts of underwater detonation on such vessels' is not significant. Previous detonation of up to 20 pound charges at the same site and vicinity has not triggered oil releases or set off depth charges at the sunken vessels.

Revision to DEIS: The revised DEIS clarifies the above information in section 4.2.2.1.

c. Comment: Endangered species, notably sea turtles, are regularly present in Apra Harbor.

Response: Agreed. However, there is no record of any sea turtle takes resulting from five years of underwater detonation at the Outer Apra Harbor mine countermeasures site. Ongoing pre-blast survey protocols have ensured that no sea turtles were in the blast site vicinity during an exercise.

Revisions to DEIS: None.

d. Comment: Landings by landing craft air cushion (LCAC) may damage coral in shallow water. More information is required to verify that no risk to coral is present.

Response: A LCAC fully up on its air cushion does not disturb coral under the water. However, a test landing performed at Dadi Beach in 1997 showed that an LCAC which has slowed for a turn or landing may create surge wave, and the wave itself may be capable of moving large rocks and breaking off coral heads.

Revisions to DEIS: The DEIS now clarifies the above-described situation and proposes, as mitigation, that LCACs may only cross shallow reefs if they remain

fully up on cushion. All turns must be conducted on land, and no landings will be conducted on beaches with more than a six degree grade. All landing beaches with shallow offshore reefs will be surveyed by exercise personnel no more than one week in advance of a planned landing, to ensure that beach conditions allow the LCAC to remain fully up on its air-cushion during landings and turns.

e. Comment: More thoroughly address potential impacts on tree snail communities in Haputo.

Response and Revisions to DEIS: The only activity in Haputo is small special operations groups hiking up on the established trail and proceeding on foot out of the Haputo Ecological Risk Assessment. Accordingly, no disturbance of trees or tree snails are anticipated. The DEIS clarifies this situation.

f. Comment: More fully disclose constraints in Sasa Bay, including the mangrove areas.

Response: No training is proposed in Sasa Bay. Therefore there is no relevance to discussing existing conditions or constraints.

Revision to DEIS: None.

Other Issues

a. Comment: Maps may be inaccurate as to environmental systems, particularly in Pati Point area.

Response: We have reviewed the figures of Andersen Air Force Base (AAFB) and believe that the information is correct. The figures and text are not intended to be encyclopedic as to natural or cultural resources, but are focused on resources which might be affected by the proposed action. The only activities proposed in the vicinity of Pati Point are continued use of the main runway of AAFB (i.e., overflight of the area). All flight activities at AAFB have been discussed in detail with U.S. Fish and Wildlife Service (USFWS) and occur in compliance with established USFWS Section 7 guidance.

b. Comment: Rapid runway repair at Northwest Field (AAFB) is inconsistent with DoD's nomination of the area to the National Register of Historic Places. Consider using Orote Point airfield instead.

Response: Rapid runway repair at AAFB will be restricted to a designated area once used as a parking apron and devoid of cultural site potential. No impact is anticipated.

Revision to DEIS: Orotè Point has been added as a potential rapid runway repair area.

c. Comment: Consider preserving public access to the hiking trail passing through the Ordnance Annex.

Response: Concur.

Revisions to DEIS: The proposed sniper range has been adjusted so that the surface danger zone will not impact the trail.

We trust that these responses adequately address your concerns. Should you have any questions, point of contact is Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by E-mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
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GOVERNMENT OF GUAM
AGANA GUAM 96910

MAR 24 1997

Mr. Fred Minato (Code 231FM)
Pacific Division Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

I have the following comments on the Draft Environmental Impact Statement (DEIS) for Military Training in the Mariana Islands.

In general, the draft is set up to assume that additional training must take place in the Mariana Islands regardless of impacts. This impression arises from the lack of explanation in the document as to why there are increased demands for training activities, including an increase in frequency of the types of activities already taking place and interims of new activities. This increased demand for training comes at a time when, especially on Guam, there are fewer Naval facilities because of the recent BRAC decisions.

The impression also arises because of the way in which the decision has been structured in the alternatives presented. The three alternatives do not represent the actual decision-making flexibility being faced in this situation. Each training activity as presented in the document appears to be largely independent of the others, and to pose its own unique sets of environmental risks and mission benefits. Where actual alternatives in decision-making present themselves to planners are in the alternate locations, configurations and mitigation to be considered, the sets of "alternatives" do not present the actual choices that need to be made.

The DEIS does not indicate how coordination with the National Historic Preservation Act will be accomplished, or whether the determinations and proposed mitigation for each training activity are intended as determinations of effect and consultation as required under NHPA. At what point for each of these training activities will comment be sought from the Advisory Council on Historic Preservation? How will changes a result of that consultation process be incorporated with any Record of Decision resulting from the final EIS?

Beyond these more general and impressionistic considerations, there are more specific concerns raised by some provisions of the DEIS.

The SMS Cormoran, scuttled in Apra Harbor is stated as being on the Guam Register of Historic Places but not on the National Register. This is incorrect. The SMS Cormoran was listed in the National Register on April 4, 1975.

The Tokai Maru, also listed on the National Register is known to have old depth charges still in place on it. These have been considered dangerous and in previous years have been proposed for removal by Navy divers as a training exercise, and more recently there were proposals to mount a cage around them to prevent sport divers from exploring them and possibly causing a detonation. The presence of these potentially dangerous explosives has not been mentioned or considered in the proposal to detonate 20 lb. charges in Apra Harbor as part of the augmented set of training activities. The possibility of these setting off the charges on the Tokai Maru ought to be considered. The DPR representative also asked in the public hearing at COMNAVMAR whether the Navy might consider removal of these potentially dangerous depth charges from the locations of the two frequently visited wrecks as an opportunity for training in use of submersible robot vehicles or other methods.

The listed option for rapid runway repair at Northwest Field in Anderson Air Force Base does not seem consistent with the Navy's previous determination that Northwest Field is eligible for listing in the National Register of Historic Places, nor is it consistent with the Cultural Resource Management Plan adopted by Anderson Air Force Base for this property. It is noted that rapid runway repair training is already included among the training activities available on Tinian. The need for damage to a property considered eligible for inclusion in the National Register of Historic Places has not been well-justified within this document.

The proposed river insertions at the Talofofo, Ylig, and Atantano rivers are not described with enough detail for potential effects on cultural resources along these rivers to be determined. There are archaeological sites and some historic sites in the vicinity of all of these rivers.

The potentials for archaeological deposits at Dadi Beach, and the potential for the LCAC landings to expose and/or disturb them, needs to be better specified.

A last concern which was noted by the Department of Parks and Recreation is not specifically a historic site's concern, but still is a very major issue with respect to public outdoor recreation. The existing trail from an overlook in the Territorial Seashore Park connects to the summit of Mount Humuyong Manglo' and continues south on the southern ridgeline trail. This trail sees a considerable amount of public

use throughout the year. The proposed sniper training firing range at the Ordnance Annex would require that this trail be closed. The use of the summit of Mount Humuyong Manglo' as the destination of an Easter procession is the only use of the trail acknowledged or accommodated by the proposed mitigation in this DEIS. The drastic impacts of permanent closure on a wider public recreation activity of long standing, needs to be reassessed. The Department of Parks and Recreation urges, on the strongest terms, that the full southern ridgeline trail be left open and available to the public as it currently is.

In closing, thank you for the opportunity of commenting on the DEIS.

Sincerely,

for RICHARD D. DAVIS
Guam Historic Preservation Officer

cc: Bureau of Planning

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/2582

13 JUL 1998

Mr. Richard Davis
Government of Guam
Historic Preservation Officer
Department of Parks and Recreation
P.O. Box 2950
Agana, GU 96932

Dear Mr. Davis:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter of March 24, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in June 1998. A copy will be forwarded for your review.

Those issues raised by you, as well as a number of reviewers, are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: DEIS did not adequately justify the purpose and need for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required).

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: You also commented that "the actual alternatives are alternative locations, configurations, and mitigation." Several other reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a full range of alternatives, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a NEPA document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use*, *less use*, *no change in use*, and *no use* of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigates all potentially significant impacts on FDM. If there are any training land uses that have not previously been subject to adequate NEPA review, the impact of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training uses is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The **Preferred Alternative** consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The Maximum Land Use Alternative includes proposed new training land uses, which are not desirable because of significant impacts which, cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. DoD has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

GUAM HPO COMMENTS

Our responses to your specific comments are as follows:

a. Comment: The DEIS should indicate how coordination with the National Historic Preservation Act (NHPA) will be accomplished and how changes resulting from consultation with the Advisory Council on Historic Preservation will be incorporated with the Record of Decision.

Response and Revisions to DEIS: The DEIS has been reconfigured to focus on the particular land areas being considered for training use. In that context, consultation under NHPA Section 106 will be accomplished specifically as the proposed training uses may affect cultural resources at each site. The results of the consultation will be included in the Final EIS and in the Record of Decision (ROD).

b. Comment: The SMS CORMORAN is incorrectly listed as not being on the National Register of Historic Places

Response and Revisions to DEIS: This error has been corrected in the revised DEIS

c. Comment: The presence of potentially dangerous World War II depth charges on the TOKAI MARU which might be triggered by underwater demolition training is not mentioned or considered in the DEIS. Would the Navy consider removing these depth charges?

Response: Peak overpressures at the TOKAI MARU and other sunken vessels have been calculated to be less than one atmosphere. Although it is not known exactly what effect these pressure waves would have on any particular structure, a structure with no void [air] spaces is not particularly vulnerable to structural deformation and resultant damage. Void spaces are unlikely to exist in vessels that have been

resultant damage. Void spaces are unlikely to exist in vessels that have been submerged for many years. This fact, the infrequent occurrence of detonation events, and the low pressure exerted on sunken vessels' metal structures from the detonations indicate that impacts of underwater detonation on such vessels' is not significant. The Navy has no current plans to remove any "depth charges."

Revisions to DEIS: The revised DEIS clarifies the above information in section 4.2.2.1.

d. Comment: Justify the need to perform rapid runway repair at Northwest Field (Andersen Air Force Base (AAFB)), which is inconsistent with DoD's nomination of the area to the National Register of Historic Places. This activity is already performed on Tinian.

Response and revision to DEIS: Rapid runway repair (RRR) training is required on Guam, as Seabee units are based on Guam and may not have adequate funds to travel to Tinian to perform this type of training. Rapid runway repair at AAFB will be restricted to a designated area once used as a parking apron and devoid of cultural site potential. No significant impact is anticipated.

e. Comment: River insertion training is not described in enough detail to determine potential impacts on archaeological and historic sites along the Talofofo, Ylig, and Atantano Rivers.

Response and revision to DEIS: River insertion training are no longer proposed at Talofofo and Ylig Rivers. The DEIS only addresses Atantano as a potential river insertion training site and is being better described in section 2.3.3.1. It involves personnel swimming/paddling on combat rubber raiding craft (CRRC), periodically brought ashore and hidden for the duration of an exercise. Once ashore or on a bank, personnel move to their objective on foot. There should be no potential impacts to archaeological and historic sites from this type of exercise.

f. Comment: The impacts of LCAC landings at Dadi Beach on archaeological deposits needs to be better explained.

Response: No impacts are expected to archaeological deposits, since LCAC activity are limited to the beachfront area, which is away from known cultural resources.

Revisions to DEIS: The revised DEIS provides a clearer description of LCAC activity.

g. Comment: Reassess impacts of closing the existing hiking trail passing through the southwest portion of the Ordnance Annex.

Response: The hiking trail will not be closed.

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Revisions to DEIS: The proposed sniper range has been adjusted so that the surface danger zone (SDZ) will not intersect the trail.

We trust that these responses adequately address your concerns. Should you have any questions, point of contact is Mr. Fred Minato at (808) 471-9338, by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Stanley Y. Uehara

STANLEY Y. UEHARA
Director
Environmental Planning Division
Acting

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Forestry & Soil Resources 735-3949/50; Fax 734-6571
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Plant Protection & Quarantine 472-3952; 477-9522

Carl T. C. Gutierrez
Governor

Madeleine Z. Bordallo
Lt. Governor

Michael W. Kuhlmann
Director

Joseph G. Sablan
Deputy Director

April 10, 1997

Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command,
Pearl Harbor, Hi. 96860-7300
FAX (808) 474-5909

Dear Mr. Minato:

The Guam Department of Agriculture has reviewed the *Draft Environmental Impact Statement, Military Training In the Marianas* (DEIS) and has the following comments:

General Comments

The DEIS fails to evaluate an adequate range of alternatives. The "no action" alternative includes all existing military training activities, although a number of these activities, i.e., explosive training in Apra Harbor, have not been subject to adequate environmental impact assessment in the past. The DEIS also does not include a reduction in training activity as an alternative for evaluation. Eventual publication of an approved Final EIS should not be construed as blanket approval of all training activities; every training activity will still require some level of case-by-case evaluation for impacts on endangered species, because the endangered species situation is fluid and will always need to be reviewed. Some training activities may require additional evaluation of general environmental impact under NEPA.

Agriculture generally supports Alternative 3, the "mitigated" alternative, but not all parts of it.

Terrestrial Concerns

Page ES-4. While the DEIS refers to a buffer area with a radius of 0.9 km around "...any crow nesting site...", elsewhere (Page 4-5), the reference is to maintaining this buffer area around "...all known crow nesting areas..." Agriculture now recommends references to crow nesting sites or areas should be changed to crow nesting territories, and the .9 km radius (1.85 km diameter) buffer area requirement be dropped. Avoidance of entire nesting

territories is a more appropriate and safer approach to protecting the birds during the nesting season than avoidance of the nest sites themselves. Also, it should be noted that the crow breeding season runs from October 1 to April 30. Recent studies on Rota indicate that nesting may occasionally occur outside of this time period.

Pages ES-4, 5. The paragraph on Guam's endangered and threatened species fails to mention that some of the lizards and plants listed as endangered by the Government of Guam occur on Ordnance Annex, NAVACTS, and NCTAMS. These species also need to be considered in the military's planning of training exercises.

Fig. 2-8. The greatly expanded Surface Danger Zone depicted on this map resulting from expanded small arms training at Orote Point is perhaps merely misleading, but is of great concern if there is any real intent to enforce this zone during small arms exercises. The ocean areas within these zones are heavily utilized by recreational and commercial boaters, fishermen and divers, and it would be unreasonable, and impractical, to attempt to enforce these safety zones when the ranges are in use. Historically, the smaller Surface Danger Zones from Orote Point, NCTAMS, and Tarague (AAFB) (see Figures 2.2 and 2.3) have not been enforced (or at least not overtly). This may be only a paper concern, because the topography of the Orote Peninsula and the NCTAMS cliffline provides protection to those users of the nearshore areas. Bullets that overtop the range backstops must eventually reach sea level, however, and there is some risk, however slight, to vessels operating at or beyond the limits of the Surface Danger Zones. That being the case, perhaps the best alternative would be to centralize military small arms training at the range with the least intrusive Surface Danger Zone, the AAFB range at Tarague, which is parallel to the coastline rather than perpendicular. Such an increase in the volume of use of the AAFB facility would require evaluation with regard to possible endangered species impact, however. Little information on the anticipated volume of use of the various ranges was provided in the DEIS.

Fig. 2-9. This figure indicates that confined area landing (CAL) exercises are planned for two sites within the Conventional Weapons Storage Area on Andersen AFB. This type of training is not appropriate for this area because it will occur in close proximity to existing crow territories. Two other sites are indicated near the north taxiway at Northwest Field that may be acceptable. It must be noted that crows and fruit bats may frequent all of Northwest Field at times, and conceivably crows could choose to nest anywhere in the area. For this reason, case-by-case evaluation of training activities is necessary, and effective communication and close coordination with Agriculture's Aquatic and Wildlife Resources Division and the Fish and Wildlife Service is needed to ensure that military training and other mission requirements are compatible with resource protection requirements.

Fig. 2-17. This figure excludes the small island swiftlet colony at Fachi Cave from the map of constrained areas on Ordnance Annex. An attachment showing the cave's location and the surrounding area that needs to be designated as No Wildlife Disturbance (NWD) and No Ground Disturbance (NGD) zones is included with these comments. Because of their sensitivity of swiftlets to human disturbance, Agriculture strongly recommends that the two active swiftlet caves, a large nearby abandoned cave (which offers important habitat for future population expansion), and an appropriately sized area surrounding each cave be given off-limits (OL) status as well.

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Fig. 2-18. The mangroves at the mouth of the Atantano river represent the best habitat of this type on the island. It and other nearby wetland areas on Navy property should be given off-limits (OL) status.

Pages 1-8 (Table 1-1), 2-18, and 4-4. Page 2-18 makes a rather vague reference to "Navy/Marine Corps fighter aircraft simulate close air support to ground force maneuver [sic]...", and Table 1-1 lists 22 F/A 18 and 20 F-14/EA-6B aircraft that "...may be deployed ashore at AAFB and used as close air support for ground unit training." On Page 4-4, however, although it states "The only type of training activity at AAFB that has potential to cause significant impacts [to endangered species] is aircraft training...", there is no mention made of high speed, low level fighter aircraft exercises in the Northwest Field area. Only C-130 and helicopter activities are described. Agriculture staff have heard from other sources, however, that there is a definite possibility of low level, high speed flights of F/A 18 and similar aircraft over portions of Northwest Field. Should this be true, the DEIS inadequately evaluates the possible impacts of such activity.

Fig. 2-19. An NWD zone should be designated for the Pati Point area, which provides important roosting and feeding habitat for fruit bats. In addition, some level of NWD/NGD designation should be indicated for Northwest Field and the Conventional Weapons Storage Area because of the crow population that is found there. Also, the "No cutting..." constraint in Northwest Field should be extended to the Haputo area to protect native tree snails.

Recommendations for the boundaries of these areas are provided on an attachment to these comments.

Page 2-22. Agriculture is concerned that use of the proposed sniper range will affect public safety and restrict civilian activities on neighboring Government of Guam and private lands because of the threat of occasional stray bullets. Some assurance is needed in the DEIS that stray fire will not occur. A popular public hiking trail runs along the crest of the mountain ridge (known as the Spanish Ridge) from Mt. Jumullong Manglo to Mt. Schroeder. Use of the trail occurs year-round, not just on Good Friday, as stated in the EIS. Other trails leading to the Mt. Lamlam area and the interior of Ordnance Annex are also used by hikers and other recreationists. More than placing of signs on these trails is needed. A security guard should be posted at the top of the ridge at the trail junction near Mt. Jumullong Manglo when the sniper range is in use. This should be done at least 24 hours in advance of any training period because overnight trips may be made in the area.

More information is necessary in the DEIS regarding the planned number of days per year that the sniper range will be used. Extensive use of the range may possibly affect the operations of Agriculture's Aquatic and Wildlife Resources Division and other resource agencies by preventing staff (i.e., biologists and conservation officers) from working in the area.

Section 3.3.1.3. As noted above, this section does not give an adequate description of the occurrence of endangered lizards, tree snails, and plants on Guam's military bases. It also fails to mention the presence of the Fachi Cave swiftlet colony on Ordnance Annex.

Page 4-4. The statement that Mariana fruit bats forage only along the cliffline between Pati and Ritidian Points is incorrect. It should be noted that the bats occur throughout Andersen

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AFB and northern NCTAMS, with important nighttime feeding areas found in the Tarague Basin, Conventional Weapons Storage Area, and Northwest Field.

Page 4-4. The results of the U.S. Fish and Wildlife Service's study on the effects of aircraft overflights on crows need to be restated, and consideration given to the impacts of increased levels of air traffic. Was the impact of nocturnal helicopter NVG training directly evaluated in that study? The actual report should be appended to the next DEIS for the benefit of reviewers, as well as to the Final EIS.

Page 4-5. The Night Vision Goggle (NVG) training exercises that apparently are on-going at AAFB need further explanation. Agriculture is particularly concerned about the statement on Page 4-5 that "...Helicopters are the only aircraft that may fly lower than 305 m AGL *along the limestone cliff bat foraging area...*" (emphasis supplied). This is an example of the previously discussed inadequacy of the "no action" alternative, in that it assumes existing activities have been properly subject to impact assessment.

Pages 4-19, 20. The lack of current crow nesting at specific locations, such as the bivouac area or in the vicinity of the south runway at Northwest Field is not necessarily a reflection of the future condition. If on-going crow recovery efforts (which include brown tree snake control) are successful, crows conceivably could forage or nest throughout the area, as they historically have. Likewise, fruit bats may forage, and occasionally roost, throughout this area. Therefore, it is imperative that the EIS process not be construed as granting blanket approval for any activity. Because of the fluid situation with respect to endangered species, the various training activities must necessarily be subject to some level of case-by-case review, and flexibility built into exercise planning.

As previously stated, Agriculture now recommends references to crow nesting sites should be changed to crow nesting territories, and the 0.9 km radius (1.85 km diameter) buffer area requirement be dropped. Avoidance of entire nesting territories is a more appropriate and safer approach to protecting the birds during the nesting season than avoidance of the nest sites themselves. Also, it should be noted that the crow breeding season runs from October 1 to April 30. Recent studies on Rota indicate that nesting may occasionally occur outside of this time period.

Also, it is imperative that crow nesting territories be determined by DAWR staff, rather than Air Force environmental personnel, who lack the training and time to do this type of work. Effective communication and cooperation between Agriculture's Aquatic and Wildlife Resources Division and the AAFB environmental staff is essential to ensure that military training and other mission requirements are compatible with resource protection requirements.

Page 4-20. The EIS states that there will be minimal hiking and no clearing of trees in the mangroves along the Atantano River during river insertion training. The report also notes that the mangroves are a protected habitat. Mangroves are indeed an important but delicate habitat. Hiking in the mangroves could injure trees by damaging their exposed root systems. Therefore, it is important that all foot traffic be limited to the river bank during these exercises.

Appendix C, Figure C-1. The use of the animal and plant symbols to show the occurrence of certain endangered species is overly simplistic and implies the absence of many species

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from areas where they in fact occur. A number of species such as the various tree snails, the tree *Heritiera longipetiolata* and the tree fern *Cyathea lunulata* are not displayed on the figure. Agriculture recommends that the use of animal symbols be dropped from the figure and range maps be shown instead for each endangered species. Also, please note that the fee simple portion of the Guam National Wildlife Refuge is omitted from the map.

Coastal Concerns

1. Use of Explosives

For many years Agriculture and Guam EPA together have been involved in reviewing the use of explosive in Apra Harbor for military training. Although adequate justification for the use of explosives has not been provided in the past, the use of 10 lb. charges has been reluctantly approved by Agriculture and Guam EPA. Now, according to the DEIS the desire is to increase the training charge in Apra Harbor to 20 lbs., but the DEIS fails to provide adequate justification for the increased explosive charge, to describe the types of charges to be used, or the methods to be employed.

The historic use of explosives for training in Apra Harbor has resulted in a number of extensive fish kills, even with the "reduced" 10 lb. charge that has been used. There is a great potential to injure or kill sea turtles by conducting explosive training in Apra Harbor. Such activity also poses risk to recreational swimmers, snorkelers, and divers. In addition, there is the unevaluated potential of shock waves from explosive training detonating WWII depth charges known to exist on the sunken Tokai Maru, itself a popular dive site.

The Navy has repeatedly been asked to pursue alternative means of conducting required explosive training, such as practicing every aspect of the exercise in the field short of actual detonation, and then significantly reducing the size of the charge or eliminating the blast entirely by using simulators or other mechanisms. The usual response has been that "certification requirements" dictate the use of at least a ten lb. charge.

Agriculture continues to oppose the use of explosives within Apra Harbor. Any training requiring actual detonation of significant charges should be conducted in open water, deep enough and far enough off-shore to preclude damaging shock waves affecting coral reefs.

Because of the risks to sea turtles in Apra Harbor and other near-shore areas (i.e. Dadi Beach), all exercises involving the use of explosives in the water should be subject to case-by-case review and approval by local agencies (Agriculture and Guam EPA) and the National Marine Fisheries Service.

2. Amphibious Assaults

There is general concern for the use of assault craft on reef flats and beaches. These craft have a known potential to cause reef damage and degrade beaches, and they could be very damaging to sea turtle nesting, if any was taking place. The

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beach at South Tipalao, which was used as a dump site after the war, may be a more appropriate location for this type of exercise that Dadi Beach. Because of the potential for interference with sea turtle nesting, amphibious assault exercises should continue to be subject to review and approval by the appropriate local and federal agencies on a case by case basis.

3. Marine Resource Assessment

In general, submerged land and marine resources were not adequately described for assessment of impacts.

Agriculture staff are available to meet and discuss any of these issues further if needed.

MICHAEL W. KUHLMANN
Director

Attachment

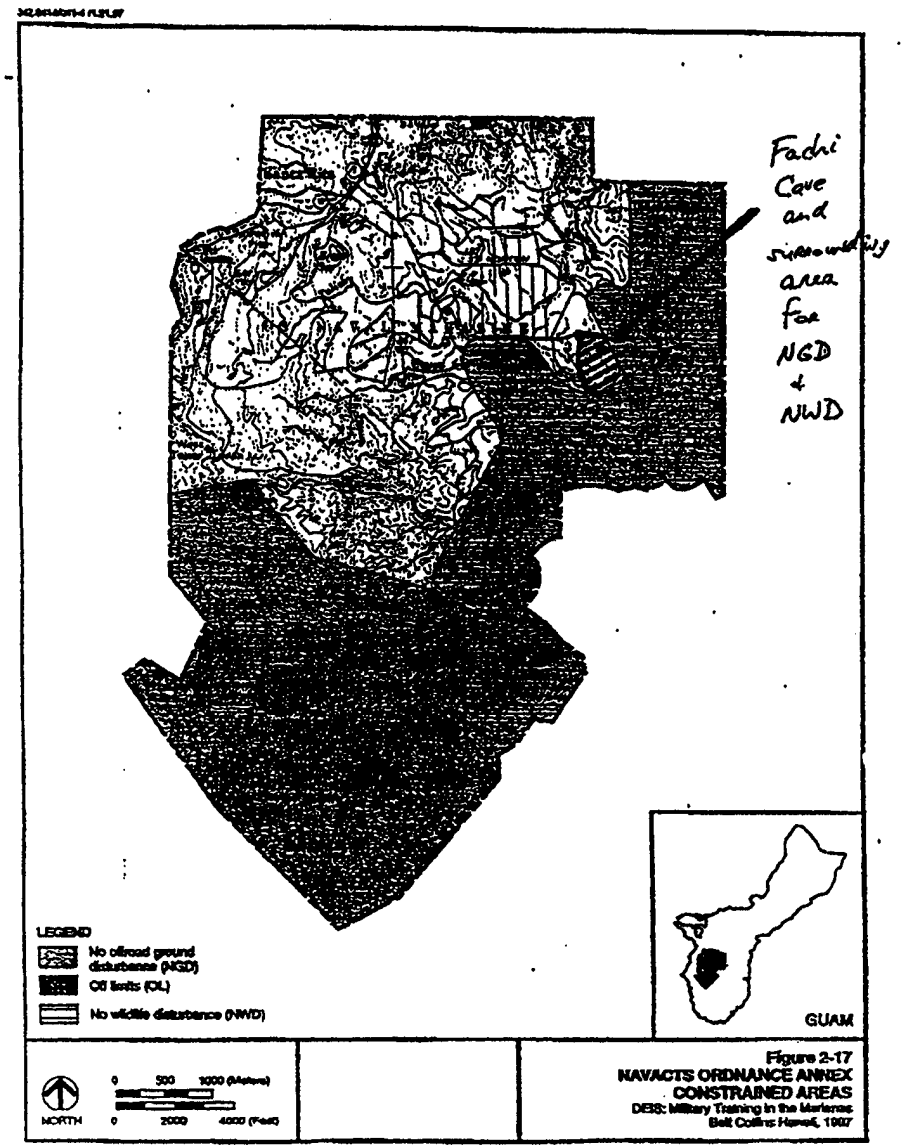


Figure 2-17
NAVACTS ORDNANCE ANNEX CONSTRAINED AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

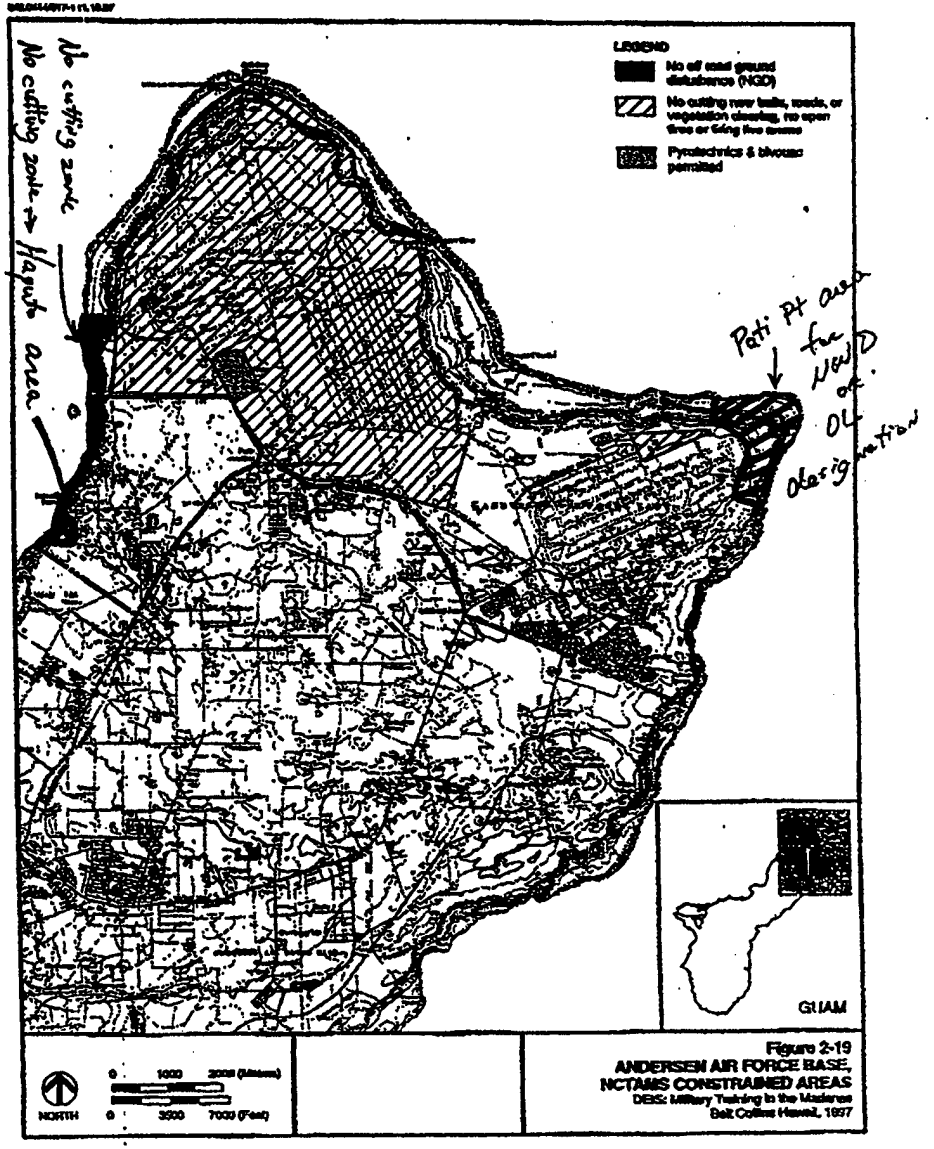


Figure 2-19
ANDERSEN AIR FORCE BASE, NCTAMS CONSTRAINED AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/2612
14 JUL 1998

Mr. Michael W. Kuhlmann
Director
Department of Agriculture
192 Dairy Road
Mangilao, GU 96923

Dear Mr. Kuhlmann:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated April 10, 1997, regarding the subject Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS. A copy will be forwarded for your review.

Those issues raised by a number of reviewers are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the purpose and need for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required).

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: More detail was requested on the proposed training activities, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a full range of alternatives, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use*, *less use*, *no change in use*, and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The Preferred Alternative consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The Maximum Land Use Alternative includes proposed new training land uses which are not desirable because of significant impacts that cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense (DoD) has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

DOA COMMENTS

Our responses to your comments are as follows:

General Comments

a. Comment: The DEIS fails to evaluate an adequate range of alternatives.

Response and Revisions to DEIS: (See paragraph c under Common Issues). The revised DEIS will have a fuller range of alternatives in Chapter Two.

b. Comment: Publication of an approved Final EIS should not be construed as blanket approval of all training activities; every activity will still require some level of case-by-case evaluation because the endangered species situation is fluid.

Response and Revisions to DEIS: In cases where it is clear that impacts cannot be fully known and evaluated prior occurrence of a particular training activity, mitigation proposed in the revised DEIS includes periodic survey and review of a situation. However, one of the intentions of the EIS is to provide comprehensive evaluation and review of impacts of most training activities, in order to reduce paperwork and delays associated with case-by-case review. The revised DEIS attempts to balance the concerns of agencies with the need for the DoD to plan and conduct training exercises on a regular basis for some years into the future.

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Terrestrial Concerns

a. Comment: Recommend changing references to crow nesting sites or areas to territories and drop all references to 0.9 km radius buffer areas in favor of avoiding such territories. Territories should be determined by Guam Department of Aquatics & Wildlife (DAWR) staff, not by the Air Force. Crow breeding season is October 1 to April 30.

Response and Revisions to DEIS: Agreed. The revised DEIS will reflect your above recommendations.

b. Comment: Executive Summary paragraph on Guam's protected species fails to list certain lizards and plants in the Ordnance, Waterfront, and Communications Annexes. These species should be considered in planning training exercises.

Response and Revisions to DEIS: The intent of the Executive Summary is to present a brief and concise abstract of the DEIS, highlighting the major issues and not necessarily cite all details. Proposed training should not significantly affect these species and therefore will not be listed in the Executive Summary. No revisions made.

c. Comment: The expanded SDZ shown in figure 2-8 will impact large numbers of recreational users, if it is enforced. A better alternative might be to use the AAFB small arms range, which is parallel to the shoreline and would have a more confined SDZ.

Response and Revisions to DEIS: We note your concern but have not changed the Preferred Alternative, which includes the overwater SDZ shown in Figures 2-2 and 2-8. The fire-and-maneuver range, i.e., the range with the expanded SDZ, is in the same location as an existing range and will have about the same intensity of use. It is proposed to be used approximately three weeks each quarter (or about one week per month). The size of the SDZ is a function of the weapons being employed and their direction of fire. Although backstops exist to contain the majority of rounds fired, shots over the backstop and ricochets may occur. The same number of theoretical ricochets which potentially occurred in the old, narrower SDZ would in the future be spread over a larger area (the larger SDZ); the net result would be less likelihood of a ricochet landing in any given area. The DEIS has not been revised regarding this proposed training. Notices to mariners and warning flags will be posted when the range is in use.

d. Comment: Two CAL sites at Andersen Air Force Base (AAFB) will be in close proximity to existing crow territories. Note that crows and fruit bats may frequent all of Northwest Field at times and could conceivably choose to nest/roost anywhere in the area. For this reason, case-by-case evaluation of training and coordination with DAWR is necessary.

Response and Revisions to DEIS: The Air Force in consultation with USFWS has designated specific flight tracks and approach and departure altitudes, confining aircraft to areas outside known crow nesting territories. Other aviation training is constrained to avoid low-level flights over crow territories during nesting season. Crow territories will be identified by DAWR, who will notify AAFB environmental staff so that the latest situation with the crows can be briefed to the air crews and the AAFB flight tower.

e. Comment: Fig 2-17 should constrain the small island swiftlet colony at Fachi Cave with no wildlife disturbance and no ground disturbance [map attached].

Response and Revisions to DEIS: The figure has been revised as requested (to be Figure 2-9 in revised DEIS).

f. Comment: Mangroves at the mouth of the Atantano River should be off limits, as they represent the best habitat of this type on Guam.

Response and Revisions to DEIS: The mangrove swamps will not be significantly impacted by hiking activities. Personnel will move ashore only at existing cleared areas along the river bank upstream of the mangroves. This will be clarified in the revised DEIS.

g. Comment: DEIS should evaluate the impacts of low level, high speed flights of F/A-18 and similar aircraft over portions of Northwest Field.

Response and Revisions to DEIS: The Navy has already sponsored a three-year USFWS overflight evaluation of low level high speed flights during field carrier landing practice by FA-18, F-14, A-6, EA-6B, and E-2C aircraft, night vision goggle training by HC-5 helicopters, and overflights by other aircraft. The study was inconclusive as to effects of noise on crows. The crows responded to some low-altitude overflights with distress and flight, but there was no evidence that overflights contributed directly to nest abandonment or failure. The DEIS reports this information; no further revisions have been made.

h. Comment: Pati Point should have a no wildlife disturbance zone [map attached], as should Northwest Field and the MSA. Also, "no cutting" should be extended to Haputo, to protect native tree snails.

Response and Revisions to DEIS: Under the recent agreement with USFWS, helicopters are required to remain 0.9 km from the perimeter of the fruit bat colony at Pati Point, with the exception of flights originating from the end of the runways. No other training is proposed in this area, so there is no need for an off-limits constraint. The no wildlife disturbance area marked at Haputo has been redefined to include No Vegetation Clearing in the revised DEIS.

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i. Comment: Regarding the Ordnance Annex sniper range SDZ, a guard should be posted at the trail junction when the range is in use, to protect hikers. Some assurance is required that stray fire will not occur. More information is required concerning the number of days per year that the range will be used; range use may prevent DAWR and other agency staff from working in the annex.

Response and Revisions to DEIS: The sniper range has been adjusted so that the SDZ does not intersect the trail and there is no need to close the trail or post a guard. Personnel using the range would be expert snipers maintaining existing skills (not beginners) and marksmanship is expected to be excellent. Revised Table 1-1 clarifies that the range will be used approximately 5 days per month. Agency staff will continue to be able to request access permission to the annex for biological studies.

j. Comment: Chapter Three should give better description of endangered lizards, tree snail, and plants on the military bases and should mention the Fachi Cave swiftlet colony in the Ordnance Annex.

Response and Revisions to DEIS: Chapters Three and Four in the revised DEIS will now identify the Fachi Cave colony and identify the presence of Marianas eightspot butterfly, tree fern, tree snail, and lizards. Detailed information is not provided on species that are not expected to be affected by the proposed action.

k. Comment: Revise Chapter Four statement that bats forage only along cliffline between Pati Point and Ritidian Point. Bats occur throughout AAFB and northern Communications Annex, with important nighttime feeding areas in Tarague Basin, MSA, and Northwest Field.

Response and Revisions to DEIS: The revised DEIS will reflect your above comments.

l. Comment: Results of the USFWS overflight study should be restated with consideration to impacts of increased air traffic. Was impact of nocturnal helicopter NVG evaluated in that study? Actual report should be appended to EIS. Provide further explanation of NVG training, with attention to statement that helicopters may fly lower than 305 meters above ground level (AGL) along limestone cliff bat foraging area. This is an example of inadequate evaluation of impacts from No New Action.

Response and Revisions to DEIS: The results of the USFWS overflight study were not conclusive, and the impact of increased air traffic cannot be extrapolated from inconclusive data. NVG training (which is only conducted at night) was evaluated in the study, which is known to be available to agencies (including DAWR) and is not reproduced in the DEIS due to space considerations. DAWR should have a copy of this report. Helicopters are required to remain 0.9 km

from the perimeter of the Pati Point fruit bat colony, with the exception of flights originating from the end of the runways. NVG training is described in Chapter Two. The DEIS has been revised to include new altitude restrictions negotiated among AAFB, USFWS, and DAWR.

m. Comment: The absence of crow nests at a location such as Northwest Field's south runway does not necessarily reflect future conditions. Crows could nest throughout the area if recovery efforts are successful. Likewise, fruit bats may forage and occasionally roost throughout this area.

Response and Revisions to DEIS: Recent negotiations with USFWS and DAWR have resulted in changed mitigation for overflight impacts. Flights are constrained to avoid low-level flying over crow territories during nesting season, as identified by DAWR. These changes will be reflected in the revised DEIS.

n. Comment: Hiking in the mangroves could injure trees by damaging their exposed root systems. It is important that all foot traffic be limited to the river bank during riverine training.

Response and Revisions to DEIS: Riverine training will not involve hiking through mangroves. Personnel only come ashore at cleared areas on the river banks. The mangrove area has been designated a No Training Area in the revised DEIS.

m. Comment: Figures C-1 through C-3: Use of symbols is overly simplistic and fails to note presence of some species such as tree snails, the tree *Heritiera longipetiolata* and the tree fern *Cyathea lunulata*. Recommend dropping the symbols and instead showing ranges for species. Also note that the fee simple portion of the Guam National Wildlife Refuge (NWR) is omitted from C-1.

Response and Revisions to DEIS: The figures are meant to be simple representations of key protected species affected by the proposed action. The EIS is not supposed to be encyclopedic, the figures and the text of Chapter Three are intended to focus on certain existing conditions, and are not meant to represent a complete description of all natural resources on Guam. The outline of the Guam NWR has been revised as suggested.

Coastal Concerns

a. Comment: The DEIS does not justify need to increase underwater training charge to 20 pounds and does not describe the types of charge or the methods employed. The past use of explosives in Apra Harbor has resulted in a number of extensive fish kills, and there is a great potential to injure or kill sea turtles. Training poses public safety risks to recreational users, and the potential for demolitions to detonate depth charges on the TOKAI MARU. The Navy has repeatedly been asked to use simulators and to discontinue use of explosives in Apra Harbor. Alternative sites should be deep enough and far enough offshore to avoid damage to

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coral reefs. All underwater demolition exercises should be subject to case-by-case review by local agencies and the NMFS.

Response and Revisions to DEIS: Live charges are required to train personnel under controlled conditions in the heightened safety awareness, detailed procedures, and self-confidence that must be maintained to safely deal with explosives of various types which may be encountered in uncontrolled situations. Simulated devices fail to prepare personnel mentally and emotionally for the conditions and after-effects of setting off such charges. A 20-pound charge is used for different combat situations than a 10-pound charge. Personnel require training in identifying the correct charge to use, how it should be rigged and fused, safe handling, and redeployment to a safe distance. Both 10-pound and 20-pound charges have been used in Outer Apra Harbor in the past, and the environmental impacts of such activity were evaluated in the *Final EIS for Proposed Facilities Development and Relocation of Navy Activities to the Territory of Guam from the Republic of the Philippines* (U.S. Navy, July 1993).

Peak overpressures at the TOKAI MARU and other sunken vessels have been calculated to be less than one atmosphere. Although it is not known exactly what effect these pressure waves would have on any particular structure, a structure with no void [air] spaces is not particularly vulnerable to structural deformation and resultant damage. Void spaces are unlikely to exist in vessels that have been submerged for many years. This fact, the infrequent occurrence of detonation events, and the low pressure exerted on sunken vessels' metal structures from the detonations, indicate that impacts of underwater detonation on such vessels' is not significant. The revised DEIS clarifies the above information in section 4.2.2.1.

We will include in the revised DEIS a new site offshore of Dadi Beach as a preferred alternate site for training with the 20-pound charge instead of within Apra Harbor. Impacts to recreational users are not expected at either location, since pre-training inspections are conducted to exclude civilians from areas that might be unsafe. However, the advantage of using Dadi beach will be that Apra Harbor can remain open to the public. The areas remain under observation throughout the training to prevent civilians from entering the area until training is concluded.

Existing protocols require case-by-case notification and coordination for every deepwater demolition exercise. The DEIS does not propose a change to that system.

b. Comment: Amphibious assault craft have a known potential to damage reefs and degrade beaches and could be damaging to turtle nests. South Tipalao may be a more appropriate site than Dadi Beach. All exercises should continue to be subject to case-by-case review and approval by appropriate local and federal agencies.

Response and Revisions to DEIS: An LCAC fully up on its air cushion does not disturb coral under the water. However, a test landing performed at Dadi

Beach in 1997 showed that an LCAC which has slowed for a turn or landing may create wave surges, and the wave itself may be capable of moving large rocks and breaking off coral heads. The situation was discussed at length by the Navy, DAWR, and GEPA.

The DEIS now clarifies the above-described situation and proposes, as mitigation, that LCACs may only cross shallow reefs if they remain fully up on cushion. All turns must be conducted on land, and no landings will be allowed on beaches with more than a 6-degree grade. All landing beaches with shallow offshore reefs will be surveyed by exercise personnel or SEALs no more than one week in advance of a planned landing, to ensure that beach conditions allow a fully on-cushion landing and turn over land.

c. Comment: In general, submerged resources are not adequately described for assessment of impacts.

Response and Revisions to DEIS: Existing reports have been supplemented by reports on additional surveys (July and September 1997) of the marine environment at Guam and FDM in the revised DEIS

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
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Belt Collins Hawaii
680 Ala Moana Boulevard, First Floor
Honolulu, HI 96813-5406

BRAC '95 GOVGUAM STEERING COMMITTEE
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Administrator

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Project Director

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

April 1, 1997

Hafa Adai Mr. Minato:

Enclosed are comments on the draft Marianas Training Plan prepared by our consultant, GMP Associates.

Two major issues still concern us and should be addressed in the final EIS. The first is the need for the EIS to address the option of assessing Air Force training areas as joint use training areas for both the Air Force and the Navy. We believe that environmental impacts can be minimized if joint use occurs.

The second deals with the need for training areas as a result of the possible location of a carrier battle group here on Guam. We understand that a decision on this possibility will be issued sometime this month and believe that training needs of a carrier battle group should be incorporated in the EIS to provide a comprehensive picture of the military's training needs, their impacts on the environment and the need to retain lands on Guam.

Thank you for the opportunity to provide comments.

Sincerely,

JOE T. SAN AGUSTIN
Administrator

Enclosure

cc: Guam Environmental Protection Agency
Commander Dave Willis, BTC

4-01-1997 8:03PM FROM GMP ASSOCIATES INC 415 4094

Post-it® Fax Note 7671	Date 4.1.97	# of pages ▶ 1
To MIKE CRUZ	From L. MEANYK	
Co./Dept. BRAC	Co. GMP	
Phone # 564-1009	Phone # 477-4094	
Fax #	Fax #	

SUMMARY OF CONCERNS
BRAC '95 - APRA HARBOR
DRAFT ENVIRONMENTAL IMPACT STATEMENT
MILITARY TRAINING IN THE MARIANAS, JANUARY 1997

The following comments are made in reference to Mr. Cruz's preliminary concerns, dated December 5, 1995:

Mr. Cruz's four preliminary comments regarding environmental concerns, specifically socio-economic, with respect to the BRAC '95 process and prospective property transfer were submitted December 5, 1995. The following items outline Mr. Cruz's concerns and the inability of the DEIS to address all four of his issues throughly.

ITEM 1: M. Cruz: "....training sites within Apra Harbor Complex will have significant impacts on the socioeconomic environment..... given the nature of these activities, they will either prevent civilian reuse of training areas or ... adversely affect civilian operations.

The DEIS fails to asses the existing socioeconomic nature of Apra Harbor, as well as assess what the impacts of proposed activities will have.

Chapter 3, page 3-18, Harbors. The last sentence states, "..... Guam continues to ship in approximately 90 percent of its commercial goods, the port stands as one of the busiest and most important areas on the island."

If the DEIS is stating Apra Harbor serves as the most important area on Guam, why is there no economic summary of its daily importance, and no assessment made into what kind of socio-economic impact temporary closure would have when proposed underwater demolition activities are conducted.

ITEM 2: "Use of alternative training locations is not applicable to this project" was stated in the Notice of the Intent. Mr. Cruz requested that the DEIS justify this statement by comparing site characteristics, costs and benefits of other possible locations for proposed activities, specifically within Apra Harbor.

The DEIS fails to portray a comprehensive alternative analysis that would specifically outline alternative sites for proposed activities, specifically underwater demolition and shallow water mine countermeasures within the outer Apra Harbor.

The DEIS incorrectly portrays Apra Harbor as entirely DOD property, with the exception

of submerged lands (Figure 2-8). The Figures and text throughout the entire DEIS should portray the northern portion of Outer Harbor belonging to the Government of Guam, and is within jurisdiction of the Port Authority of Guam (PAG). Once these physical boundaries have been correctly defined, the existing use of the outer harbor may be fully comprehended to encompass the activities related to commercial use, tourism, recreation, and conservation (Western Shoals).

ITEM 3: Mr. Cruz requested that cost and benefits to both the military and civilian users must be evaluated in the DEIS with regards to BRAC '95 properties.

The DEIS fails to provide any type of cost-benefit analysis for impacts created during proposed activities, for both military and civilian uses. The DEIS also fails to provide an assessment of socio-economic impacts for the GovGuam's current and future investments in Apra Harbor.

Chapter 1; section 1.2.2.2; page 1-18; "The BRAC release affects but does not eliminate training conducted at Naval Activities Guam (NAVACTS) ...Proposed training will occur on areas of land that are compatible with adjacent non-training activities"

The above statement confirms that BRAC decisions will "affect" training, then why are BRAC decisions of property transfer and future activities not assessed (ie: economic losses during closure of commercial, recreational and tourism related activities during underwater demolition and other training)?

Existing uses of the outer Apra Harbor, including underwater submarine (Nautilus), and other tourist attractions, are not compatible with the proposed underwater demolition and shallow mine countermeasures. The transfer of Drydock Island, and proposed uses of this property (ie: aquarium, cultural center, tropical animal exhibits) are also not compatible with the proposed activities in the area.

Chapter 1; section 1.3.1.3, page 1-24 states that the issues of socioeconomic impact of BRAC'95 were eliminated from further study based on:

> "the impact of such releases (of property) e.g. job loss, is not within the scope of this document ....The proposed action identifies training internal to the military and occurring on lands already controlled by the military. It will not create or decrease jobs, reduce land available for civilian activities, affect housing availability, or generate fiscal impacts on the Government of Guam."

The above statement incorrectly refers to Apra Harbor as being controlled exclusively by

the military. Once the correct definition of Apra Harbor is established, then the assessment that proposed actions will not impact jobs, reduce land availability, or generate fiscal impacts can be correctly analyzed.

In addition, the above statements do not justifiably eliminate the assessment of the socio-economic impacts created by temporarily closing port-commercial and tourism activities due to underwater detonation, shallow mine countermeasures, and other proposed training activities. Section 4.6.2.2 states that Apra Harbor Underwater Demolition "may interfere with commercial and pleasure boating and scuba diving ..." THEREFORE, creating an impact socially and economically and is one reason why it should not be eliminated from this assessment.

Job loss is not the only socio-economic impact created from BRAC '95. Other impacts include the civilian reuse of SRF, and other financial investments into the GovGuam properties that may not be compatible with proposed military training.

Proposed mitigation for the underwater demolition practices include:
1) notification; 2) Guam EPA existing protocol (DEIS does not examine what this is and whether it meets the needs of the locale), Apra Harbor Survey Plan; and, 3) potential closure of activities.

Socio-Economic consequences are not addressed by the proposed closure or delay in daily commercial port, tourist and recreational activities. Nor do the above mitigative measures address these potential impacts.

BRAC '95 must be a part of the DEIS for the proposed training within Apra Harbor based on the above criteria. Alternative sites for proposed underwater demolition, shallow mine countermeasures and helicopter training activities also need to be assessed because they occur on GovGuam property, and may be incompatible with existing and future land and marine uses of Apra Harbor.

In summary of Mr. Cruz's comments, December 1995, the DEIS fails to address the importance of the potential impacts associated with BRAC '95 transfer of properties. The exclusion of these issues have been eliminated from the assessment unjustifiably.

APRA HARBOR'S ENVIRONMENT:

The following issues pertain only to the Apra Harbor and are identified as they appear in the chronological order found within the DEIS. Several comments may be repeated, however, they are mentioned several times so that the lack of a full assessment, or problematic contradictions within the DEIS can be acknowledged.

The environment is defined by three characteristics 1) biological resources; 2) socio-cultural resources and 3) economic resources. The DEIS does not address these three aspects with respect to Apra Harbor's environment. The following comments are supportive to the above summary, and identify other issues that the DEIS has failed to define.

The Abbreviations listing is incomplete.

1. DEIS incorrectly defines Apra Harbor as DOD property. Please acknowledge the portion of the outer Harbor that belongs to Government of Guam (Exhibit 1, for the correct physical boundaries. The corrections should be incorporated into every Figure and applicable text.

   Apra Harbor is identified in section 3.5.1, Harbors: "as the busiest and most important areas on the island (Guam)". Apra Harbor also needs to be defined by the daily uses of commercial port, tourism related activities, and recreational areas, both socially and economically. The Western Shoals and Glass Breakwater are examples pristine environments which needs to be addressed.

2. Table 1-3, Screening Process to Identify Significant Issues, page 1-29. Under the "General Topic" column, "Harbors" does not address Apra Harbor as a potential issue. The proposed training activities, as outlined in Table 2-1, will impact Apra Harbor's commercial, tourism and recreational operations and is later stated in Table 4-8. This contradiction amplifies the lack of assessment that potential and anticipated socio-economic impacts may occur in Apra Harbor.

3. The three Alternatives are 1) No Action; 2) Augmented Set of Training Alternatives; and 3) Mitigated Set of Training Activities. The DEIS fails to identify which alternative is preferred in the Alternative analysis sections, but later states that the Mitigated Set is the preferred alternative. This ambiguity confuses the reader. The poor definition for training activities' frequency, duration of time and correct location within Apra Harbor also confuses the reader and does not allow for a comprehensive assessment of impacts.

   No Action - Many of the activities that are included in the "No Action" alternative will not be able to continue with the transfer of GLUP and BRAC properties, and should be acknowledge in the DEIS.

   Figure 2-2 shows land craft air cushioned (LCAC) landings, swimmer insertion and improvised explosive devices (IED) adjacent to Drydock Island. IED performed at Uniform Wharf and Drum Lot, both of which are transfer properties from Navy to GovGuam. Underwater demolition of less than 10 lbs. charges needs to be recognized that as occurring on the Government portion of Outer Harbor. The Apra Harbor Training of helicopter paradrops, cast & recovery, mine

3-30-1997 6:56PM FROM GHD ASSOCIATES, INC. 477 4004

countermeasures, drown proofing, fire bucket, search and rescue activities are indicated as occurring in the Outer Harbor regions, possibly GovGuam property.

The above activities are not compatible with the surrounding GovGuam uses, both existing and proposed. The location, time duration and frequency of Apra Harbor training activities needs to be incorporated into the description. Also, an assessment of whether the Outer Apra Harbor sites of these activities are compatible with the existing and future GovGuam uses of the Outer Harbor.

Augmented Set - This alternative describes additional activities in conjunction with ongoing training described in 'No Action" alternative. The proposal of shallow mine countermeasures adjacent to Drydock Island, and Breakwater Beach are not compatible with existing and proposed uses the areas (especially when the impact of these activities are not know, reference: Appendix I) The increase of underwater demolition from 10 lbs to 20 lbs. on the GovGuam's portion of Outer Harbor is also not congruous with the daily activities of the Outer Harbor, which the DEIS unsuccessfully defines.

Mitigated Set - This alternative is very similar to the Augmented alternative and the same concerns apply.

4. The DEIS fails to successfully portray the frequency and duration of each exercise. Chapter one does describe frequency in terms of "quarterly" and "where applicable", however, a comprehensive interpretation of the anticipated and associated impacts from training activities are difficult to assess when the frequency and duration is questionable.

5. With respect to the above comment and the lack of assessment of frequency, the DEIS fails to consider the impacts associated with ongoing activities, within a specific area, for a long period of time. An example is the failure of the DEIS to assess the direct and indirect impacts to marine species, over a period of time due to monthly/quarterly underwater demolition practices. The DEIS can not successfully assess the impacts due to the lack of knowledge to what exists in terms of fish, algae, macrointervabrates, molluscs and crustaceans types of populations, and their characteristics within the marine ecosystem. The DEIS can not determine impacts when "No information appears to exist describing the radius of impact of such charges (shallow water mine countermeasures) that might affect corals or other biota." (Appendix I).

   Questions: Do the fish populations (and other species) have a transient or migratory behavior? What other species depend on the small or large populations for food, in other words what is their significance within the food chain? If the fish populations are transient (meaning they do not migrate), and using the GEPA fish kill data (which lacks indication of weight in pounds), losing 103 fish every month for a year would be 1236 fish - how would this impact a community of fish

that do not migrate from the Outer Harbor area? Would long term impacts, compounded with other activities within the Harbor (cumulative impacts), eventually eliminate a population that does not leave the Harbor?
And how would this affect the threatened and endangered species that do inhabit the Harbor?

The DEIS simply fails to recognize the biological characteristics of the marine environment. With a majority of activities and impacts associated with marine use, a two sentence paragraph on the marine environment for Guam is not sufficient to fully assess what exists, how activities will impact marine resources, both directly and indirectly.

6. The DEIS only assess the potential direct impacts to endangered and threatened species. Are these the only species found within Apra Harbor? For example, a significant impact does occur to a population of fish, but these species are not threatened or endangered, and therefore the impact is it not considered "significant" enough to be addressed in the EIS document? This is the conclusion the reader receives based on the given assessment.

7. Page 3-18 states "busiest and most important areas ...", a reference made to GovGuam's Outer Apra Harbor, and more specifically the Port Authority of Guam. If the DEIS is going to make this statement then a socio-economic assessment of the Harbor is valid. Included in this assessment should be the transfer of properties from the military to the GovGuam.

8. The definition of Harbors, p. 3-18 needs to include the fact that Apra Harbor is jointly used by GovGuam and the Navy. Activities related to commercial port uses, tourism, and recreational need to be included and the assessment of impacts made based on the full understanding of what exists, as well as future transfer of properties.

9. Section 4.1.2.2 mentions that proposed underwater training with 20 pound charges will have potentially significant impacts. "Possibly affected species are the Hawksbill sea turtle and Green Sea turtle". The sentence should read; "Possibly affected endangered species...". The DEIS currently reads that the only species that exist, and may be affected are those that are endangered or threatened. There are many other species affected by underwater demolition, as the GEPA survey shows in Appendix D.

The same paragraph states, "At a minimum, potential impacts to these turtles will be mitigate by compliance with the protocol established by the Guam EPA and USFWS for charges up to 10 pounds..." Firstly, the DEIS fails to appendix the GEPA and USFWS protocol and assess whether it is applicable and sufficient for this activity.

Secondly, why does the DEIS stop at the "minimum" mitigative measure? What is a maximum mitigative measure? DEIS fails to outline correct mitigative procedures for many training

activities, and this is portrayed through the entire document.

Thirdly, the DEIS proposed to use 20 pound charges for both Augmented and Mitigated Training Alternatives, so why is "up to 10 pounds" only referred to? Lastly, no assessment of turtles and their relation to other species within the Harbor, don't turtles eat? Is there a loss of algae, molluscs or crustaceans? Appendix I states that "no information appears to exist describing the radius of impact of such charges (shallow water mine) that might affect corals and other biota." Will activities affect "other biota" which feed the endangered species?

10. Section 4.1.3.2: What referenced survey or study has indicated that no protected species or corals are present at Dadi Beach? DEIS needs to reference so that the statement that no significant impacts will occur is justified. Appendix I describes the locations for proposed shallow mine countermeasures and underwater demolition with 20 pound charges. This reports lacks a thorough baseline survey of species at the allocated sites, does not describe how or when it was conducted (did the author even dive or inventory the described sites?), therefore, is not adequate for a thorough investigation of anticipated and associated impacts. No alternative sites were investigated.

The DEIS uses the marine assessment to justify site allocation for underwater demolition and shallow mine countermeasures within Apra Harbor and does not consider the socio-economic factors of the proposed locations.

11. Shallow Mine Countermeasure Training (p. 4-16). What are the differences in impacts between live charges to blanks? The marine survey in Appendix I states "No information appears to exist describing the radius of impact of such charges that might affect corals or other biota". Can the DEIS describe potential/ anticipated impacts ..... biological and socially. For example, how would the frequency of such an exercise impact adjacent tourist, recreational activities?

12. Page 4-17, first sentence - "If DAWR finds that turtles have returned to this area, they will notify the Navy, and LCAC training will be mitigated by surveying and flagging turtle nests prior to exercise" How does flagging a nest protect it from potential damage? This mitigative measure does not demonstrate a sense of security that the nests will be protected once the training activities commence. How does the Navy propose to obtain their objective if they have to move around turtle nests? Or is this mitigation measure simply used to determine how many nests are destroyed by activities?

Perhaps a more thorough mitigative measure would be to remove eggs from nest, which is not suggested since turtles return to their nesting site, and such a measure may contribute to unsuccessful nestings in the future. Perhaps a halt in training exercises until hatchlings are successful may be a more sustainable mitigative measure.

13 Section 4.2 Impacts on Cultural Resources; section 4.2.4 Potential Impacts and Mitigation for Particular Areas of Concern; see section 4.2.4.2 - NAVACTS Waterfront Annex.

a. Section 4.2 and section 4.2.4 discuss "existing" cultural resources within Apra Harbor as WWI and WWII Navy structures, which are mostly submerged archaeological features. The assessment of impacts only pertains to these features.

What about the cultural resources above land, including socio-economic resources of Apra Harbor for Guam's commercial, recreational uses and tourism economy? The DEIS needs to incorporate this aspect of the "environment" into the assessment.

14. Table 4-8 Comprehensive Table of Significant and Non-Significant Potential Impacts and Mitigation.

a. Page 4-83 Harbors. 'Possible Impacts' column lists 'interference with civilian ports of entry' and, 'an increased demand on Customs and Immigration' for the first time in the DEIS. These anticipated impacts could have an economic cost for the Government of Guam, therefore, an assessment of the socio-economic climate of Apra Harbor is valid.

b. Page 4-84 Land Use: 'Safety risks to neighboring areas and inhabitants from use of firing ranges and established EOD sites on land, in and near Apra Harbor'. How will this affect the socio-economic factors of Apra Harbor's commercial, tourist, and recreational activities, both short-term, long-term and cumulative impacts relative to the frequency of training activities.

c. Page 4-85 'Commercial watercraft periodically denied access to areas of Apra Harbor or ocean area within ranges SDZs during underwater demolition or use of firing ranges'; and, 'Danger to civilians inadvertently entering ranges and runways'.

Proposed mitigative measure for economic impact is to publish advance notification? These anticipated impacts could have an economic cost for the Government of Guam, therefore, an assessment of the socio-economic climate of Apra Harbor is valid

3-30-1997 6:59PM FROM GIP ASSOCIATES, INC. 477 3094

CONCLUSION:

The following list can be used to summarize the issues that have been outlined.

1. The DEIS lacks the socio-economic assessment of Apra Harbor.
2. The DEIS lacks a correct definition of joint ownership of the Harbor. A description of current uses of the GovGuam's portion of the Outer Harbor needs to include commercial, recreational and tourist related activities.
3. The transfer of properties related to BRAC '95 and GLUP '94 will impact the three alternatives outlined. The decision to exclude this information from the DEIS has been made unjustifiably.
4. Alternative analysis lacks an assessment of alternative sites within Apra Harbor.
5. The alternative analysis should address preferred alternative if the document is going to address one alternative as more favorable than the other latter in the text.
6. Description of training activities lack information that will allow for a responsible impact assessment. Specifically, describe exact location of activity within Apra Harbor, and the expected frequency and duration in time in which the activities will occur.
7. The baseline survey (Appendix I) serves as an inadequate assessment of the marine environment for Apra Harbor. The Marine Environmental Assessment (Marine Research Consultants, Sept. 1996) lacks in both inventory of species, and examining alternative sites for proposed activities.
8. The only species assessed as having any significant impacts are the endangered or threatened species. These are not the only species that may be significantly impacted when a true assessment is applied that incorporates frequency and time duration.
9. Mitigative Measures are less than adequate for several impacts within Apra Harbor.

EXHIBIT 1

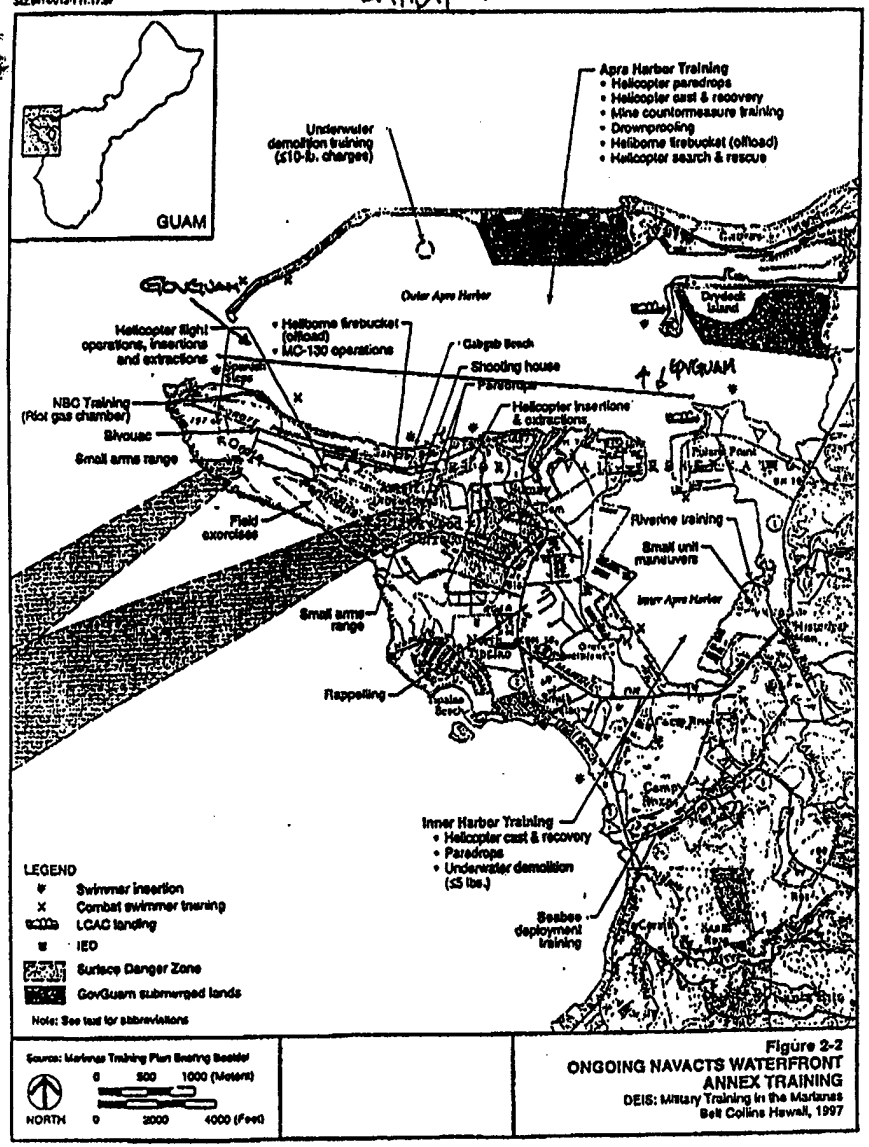


Figure 2-2
ONGOING NAVACTS WATERFRONT ANNEX TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

5090P.1G03
Ser 2317 2359

22 JUN 1998

BRAC '95 GOVGUAM Steering Committee
Attn: Mr. Joe T. San Agustin, Administrator
Office of the Governor
P.O. Box 2950
Agana, GU 96932

Dear Mr. San Agustin:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated April 1, 1997, regarding the subject Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in June 1998. A copy will be forwarded for your review. Our responses to your specific comments are as follows:

Major Issues

a. Comment: DEIS must address option of using Air Force lands as joint (USAF and USN) training areas.

Response and Revisions to DEIS: The revised DEIS text and tables will indicate that much of the training on USAF lands will be performed by Navy, Army Reserve, and Marine Corps personnel.

b. Comment: Incorporate the needs of a carrier battle group, which might be based in Guam in the near future.

Response and Revisions to DEIS: There are no official plans to homeport a carrier battle group in Guam at this time. In the event such an activity is desired, it would constitute a new major federal action requiring the preparation of a separate environmental document.

Mr. Cruz's Comments

a. Comment: DEIS should address the economic impacts of training on Apra Harbor, which is an economically very important area on Guam.

Response and Revisions to DEIS: The revised DEIS addresses the socioeconomic impacts of temporary harbor closures due to underwater demolitions training (section 4.2.5 of revised DEIS).

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b. Comment: The DEIS should address all alternative locations for specific activities, especially demolitions training planned for Apra Harbor. Figures and text of the DEIS should portray the northern portion of Outer Harbor as belonging to GOVGUAM and more fully describe the economic importance of this portion of the harbor.

Response and Revisions to DEIS: The DEIS discusses the issue of submerged land ownership in Apra Harbor. If there is any disagreement by GOVGUAM, it is beyond the scope of the DEIS to resolve. Training is conducted on federal lands whenever possible, including submerged lands in Apra Harbor. The DEIS has been revised to more explicitly compare alternative training lands, and a socioeconomic analysis of Apra Harbor activities has been added.

c. Comment: Evaluate costs and benefits of training with respect to properties transferred under BRAC '95. The military does not control Apra Harbor and proposed training land use will affect existing and planned future commercial uses of the harbor. Assess socioeconomic impacts of training on GOVGUAM's current and future investments in the harbor. The transfer of Drydock Island and proposed commercial uses (e.g., aquarium, cultural center, tropical animal exhibits) are not compatible with proposed training. Alternative sites may also be on GOVGUAM lands and may also impact commercial land use in the harbor. BRAC '95 must be a part of the DEIS. Mitigation should include notification, GEPA existing protocol (DEIS should explain details), an Apra Harbor survey plan, and potential closure of activities.

Response and Revisions to DEIS: Military training is not planned for properties released under BRAC 95. Training impacts on commercial uses of Apra Harbor have been evaluated in the revised DEIS. The DEIS is not required to evaluate speculative effects, including such issues as potential uses of possible future, but unplanned surplus lands.

Apra Harbor's Environment

a. Comment: DEIS incorrectly defines Apra Harbor as DOD property; please correct all text and figures per attached exhibit [*shows line from center of harbor entrance to northern tip of Polaris Point, identifies all waters north of line as under GOVGUAM jurisdiction*]. Identify daily commercial uses, both socially and economically. Address pristine environments of Western Shoals and Glass Breakwater.

Response and Revisions to DEIS: Both civilian and military water borne traffic operate over submerged lands owned by the United States. Control of the submerged lands in the outer harbor is currently in dispute. However, it is the federal government's position that no transfer of submerged lands from federal control is contemplated. Daily commercial uses with the potential to be impacted by training activities have been described in a 1997 socioeconomic study and in the revised DEIS. Popular commercial and recreational dive sites are identified in Figure 4-5 of the revised DEIS. No impacts to Western Shoals or any other coral reefs are predicted; the revised DEIS includes a detailed explanation of the effects of underwater demolitions in section 4.2.1.1.

b. Comment: Table 1-3 should address Apra Harbor as a potential issue.

Response and Revisions to DEIS: The table has been revised to include socioeconomic impacts on Apra Harbor businesses (will be in section VI of the table).

c. Comment: The alternatives require more description as to frequency, duration, and correct location. The preferred alternative must be more clearly identified. Activities occurring in the GOVGUAM portion of the harbor should be so indicated and are incompatible with surrounding existing and future GOVGUAM uses, notably underwater demolition with 20-lb charges and shallow water mine countermeasures at Drydock Island and Breakwater Beach.

Response and Revisions to DEIS: Chapter Two has been extensively rewritten to better describe components of training activities, relative to their impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

Activities occurring in the harbor are indicated on Figure 2-2 of the Revised DEIS, which identifies submerged areas in the vicinity of the Glass Breakwater and Drydock Island as GOVGUAM submerged lands. As stated in item a above, control over submerged lands in the northern portion of Outer Apra Harbor is currently in dispute. Impacts of deepwater mine countermeasures in that portion of the harbor are addressed in Chapter Four of the revised DEIS. Shallow water mine countermeasures at Drydock Island and Breakwater Beach will occur under stealth conditions and will not impact or be noticed by civilian users of the harbor.

d. Comment: DEIS should portray frequency and duration of each exercise.

Response and Revisions to DEIS: Revised Table 1-1 provides the frequency for every exercise. Duration is variable for many activities; text descriptions in Chapter Two provide duration information.

e. Comment: DEIS must assess impacts of ongoing activities and must acknowledge situations where data are inadequate to properly assess impacts. Are fish species transient or migratory, what is their significance in the food chain, and what is impact on Apra Harbor fish population of losing 103 fish every month due to underwater demolitions? Would cumulative impacts eventually eliminate the population? How would this affect protected species living in the harbor?

Response: The National Marine Fisheries Service (NMFS) endorsed the protocol to allow underwater detonation in Apra Harbor. They are cognizant of the fish kill data and have deemed the impact to be insignificant. Commercial and recreational fishing activities are considered to be the major contributor to depletion of fishes. The contribution from underwater detonations is not expected to be cumulatively significant (i.e., will not harm the population as a whole). Protected

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turtles living and foraging in the harbor do not eat fish. They forage on a variety of foods including jellyfish and algae, which are not significantly damaged by deepwater demolitions.

f. Comment: The DEIS should assess impacts to non-protected species in the harbor. Why are such impacts not "significant"?

Response and Revisions to DEIS: Federal regulations direct that an EIS should focus on significant issues and should not attempt to be encyclopedic regarding less than significant issues. The rationale for identifying significant issues is provided in Chapter One, and criteria for defining significant impacts are provided in Chapter Four.

g. Comment: DEIS should include a socioeconomic study of the harbor.

Response and Revisions to DEIS: A study of socioeconomic effects of temporary harbor closure has been performed and is included in the revised DEIS.

h. Comment: The description of Apra Harbor in section 3.5.2 should state that it is jointly used by the Navy and GOVGUAM. Activities in the harbor should be described, including future land transfer.

Response and Revisions to DEIS: Section 3.5.2 is intended to describe infrastructure. It has been revised to state that both Navy and civilian facilities operate in Outer Apra Harbor and that control of outer harbor submerged lands is currently in dispute.

i. Comment: Clarify that not only protected species will be affected by underwater demolition training (Chapter Four). Append the GEPA protocol and assess whether it is applicable and sufficient. Why does the DEIS stop at a "minimum" mitigative measure? Throughout the document, correct mitigation measures are not identified. What is the relationship between turtles and other species? Will loss of food supply result from training? Appendix I states that there is no information describing radius of impact of shallow water mine countermeasures charges on corals and other biota--will the activity affect biota that feed the endangered species?

Response and Revisions to DEIS: (See response to item e.) The NMFS protocol is included in Appendix I of the revised DEIS. The protocol has been deemed sufficient by NMFS, which is chartered to protect marine species. Juvenile green sea turtles eat shrimp and jellyfish; adults eat only algae. Neither food supply is expected to decrease by training. Shallow water mine countermeasures training involves detonating extremely small charges (¼ pound); live charges will not be used on or near coral. Activity by training personnel is expected to scare fish and other motile species away from the immediate area.

j. Comment: Appendix I lack methodology and does not indicate if data are based on observations or literature search. It should provide a thorough baseline survey

of species at the sites. The DEIS does not consider socioeconomic impacts of underwater demolitions.

Response and Revisions to DEIS: An additional survey of the area was performed in 1997 and the reports contain brief methodology descriptions. Socioeconomic impacts are addressed in section 4.2.5 of the revised DEIS and a study report is appended.

k. Comment: What are the impacts of blank versus live charges used for shallow water mine countermeasures training? How would the frequency of such an exercise impact adjacent tourist activities?

Response and Revisions to DEIS: Live one-pound charges are proposed for shallow water MCM training only at Tipalao and Breakwater beaches. At other locations, personnel will go through the motions but will not use "blank charges." Training involves a small number of personnel operating under stealth conditions; they are extremely unlikely to be noticed by tourists and will not impact tourist activities.

l. Comment: How does flagging a turtle nest protect it from damage by Landing Craft Air Cushion (LCACs)? How will training proceed if nests must be avoided? Suggest halting training until hatchlings are successful.

Response and Revisions to DEIS: Flagging a turtle nest is the mitigation requested by local and federal wildlife agencies. LCACs and other vehicles are required to avoid flagged nest areas and will manage to travel around such areas. Disturbed beach topography will be restored after each exercise, to ensure no interference with hatchlings' progress toward the ocean.

m. Comment: DEIS should address impacts on cultural resources of Apra Harbor, including socioeconomic resources.

Response and Revisions to DEIS: The revised DEIS discusses all potentially significant impacts on cultural resources of the Apra Harbor area, including socioeconomic impacts of temporary harbor closures. Impacts on cultural resources and the local economy are identified, and proposed mitigation measures are in revised Table 2-11 Potential Impacts and Mitigation.

n. Comment: DEIS should discuss in detail certain impacts and mitigations presented in the Comprehensive Table of Significant and Non-Significant Potential Impacts and Mitigation. These are: (a) economic cost to GOVGUAM of possible interference with civilian ports and increased demand on customs and immigration; (b) socioeconomic impacts of live fire ranges on Apra Harbor commercial and tourist facilities; and (c) socioeconomic impacts of temporary harbor closure during underwater demolition.

Response and Revisions to DEIS: These impacts were evaluated in the EIS process, and impacts (a) and (b) did not meet the criteria for significance and

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therefore were not described in detail in the DEIS. Item (c) has been addressed in a recent socioeconomic study, the results of which are included in the revised DEIS.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406

CIVIL DEFENSE
GUAM EMERGENCY SERVICES OFFICE

GOVERNMENT OF GUAM
P.O. BOX 2877
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CARL T.C. GUTIERREZ
Governor Guam

MADELEINE Z. BORDALLO
Lt. Governor

JUAN B. ROSARIO
Director

BENEDICT J.G. REYES
Deputy Director

TRANSMITTAL SHEET

PAGES 02

DATE: 4-3-97

TO: PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
PEARL HARBOR, HI 96860-7300

ATTENTION: MR. FRED MINATO

FROM: BENNY J. CABRERA

SUBJECT: DEIS FOR MILITARY TRAINING IN THE MARIANA ISLANDS

ORAL COMMENTS PRESENTED DURING THE GUAM HEARING ON THURSDAY, MARCH 6, 1997 DURING THE 3:00 P.M. SESSION.

Signature: Doris S. Olson
DORIS S. OLSON

PUBLIC HEARING MARCH 1997
MILITARY TRAINING IN THE MARIANAS
Draft Environmental Impact Statement

Comments

Name: BENNY J. CABRERA
CIVIL DEFENSE/GESO

Address: P.O. BOX 2877, AGANA, GUAM 96932

Issues that should be addressed in the EIS (be as specific as possible):

REFERENCE DEIS MILITARY TRAINING IN THE MARIANAS DATED JAN. 1997
TAB ABSTRACT, PAGE A-2, ITEM # 5
PUBLIC SAFETY ISSUE:
- o PROPOSAL - ENTIRE ISLAND OF GUAM (AIR-SPACE) BE DESIGNATED AS NO-FLY ZONE AREA FOR ANY MILITARY EXERCISE MISSIONS.
- o MITIGATION - TO AVOID ANY POTENTIAL AIRCRAFT MISHAPS.

Benny J. Cabrera
Signature

MARCH 13, 1997
Date

Note: This form is supplied for your convenience. You are not required to use this form. Comments of any length may be submitted to the address on the reverse side of this form.

RECEIVED TIME APR. 2. 2:39PM PRINT TIME APR. 2. 2:40PM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 2311986
20 MAY 1998

Mr. Benny J. Cabrera
Civil Defense/GESO
P. O. Box 2877
Agana, GU 96932

Dear Mr. Cabrera:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated May 6, 1997, regarding the Draft Environmental Impact Statement (DEIS) for the above-referenced action. In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in May - June 1998 timeframe. A copy will be forwarded for your review.

a. Comment: You requested that the entire island of Guam be designated as a no-fly zone for any military exercise missions.

Response: It is not possible to meet the purpose and need for military training without conducting military air missions over selected Guam training lands. We have evaluated potential public safety impacts associated with such training and feel confident that all reasonable precautions have been and will continue to be taken to protect public health and safety.

We trust that this response adequately addresses your concern. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406

Marianas Audubon Society
P.O. Box 4425
Agana, Guam 96932

March 31, 1997

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

The Marianas Audubon Society wishes to submit comments on the *Draft Environmental Impact Statement Military Training in the Marianas*, which describes the impacts of military training exercises proposed for Guam, Rota, Tinian, and Farallon de Medinilla in the Mariana Islands. We expect that many of the exercises will produce few serious environmental impacts, however, we do have major concerns regarding some of the exercises and the preparation of the EIS itself. These are summarized as follows:

1) One of the major shortcomings of the EIS is the limited scope of its proposed alternatives. Essentially, we find it unacceptable that the only alternatives are the status quo and expansion of the exercises with and without trying to reduce environmental impacts. Honest consideration also needs to be given to moving some of the training exercises to other islands or canceling them entirely. For example, we believe that a complete termination of bombing exercises on Farallon de Medinilla is the preferred alternative, for reasons explained below.

2) The EIS is extremely vague in presenting important details on many of the proposed exercises. Information on the frequency, duration, number of personnel involved, etc. are omitted for many exercises, making it quite difficult to evaluate impacts. This hurts the military's position on some exercises, when in fact, it might be easily determined that the exercises would have few or no impacts if more complete information was provided.

3) The military commands must remember that they need to constantly work with the U.S. Fish and Wildlife Service to meet the management goals of the overlay segments of the Guam National Wildlife Refuge located on Andersen Air Force Base and the various Naval installations on Guam. The refuge was designated on military lands a few years ago in lieu of the establishment of Critical Habitat for several endangered species. The military must make an honest effort to assist in the conservation and recovery of endangered species or risk renewed efforts on the part of conservation organizations to have Critical Habitat declared as a necessary management tool.

4) As noted in the draft EIS, the Mariana Islands are home to a relatively large number of endangered animal and plant species, especially on Guam. It must be realized that many endangered species face continually changing situations and that it is impossible to give advance approval for some activities without a current evaluation of their

impacts on each affected species. For some activities, environmental review will still be needed each time before final approval for an activity can be given. The military commands must always work closely with local and federal natural resource agencies to ensure that problems and concerns are addressed in an adequate manner. It is simply impossible to predict and plan around certain issues too far in advance.

5) Of all the training exercises noted in the draft EIS, we are most concerned about the impacts of bombing on Farallon de Medinilla. The presence of large numbers of Masked Boobies makes the island one of the most important seabird nesting sites in all of Micronesia. It appears from our review of the available documents that the military's bombing of the island over the last 25 years has induced a significant decline in seabird use. Based on this and other concerns, we think there should be a drastic curtailment or complete termination of bombing activities on the island. Detailed comments and concerns on this topic are given below.

6) We believe that the underwater detonations planned for Apra Harbor and Dadi Beach should be moved to other locations or use much smaller explosive charges. This will avoid accidental killing of sea turtles, coral, and fish. It will also result in fewer conflicts with civilian users of the harbor. Additional concerns are given below.

Many of our comments in this letter are directed at Farallon de Medinilla. We trust that detailed comments about problems in the EIS pertaining to Guam will be brought to your attention by the appropriate Government of Guam agencies. But we are less satisfied that the Commonwealth of the Northern Mariana Islands government will make a thorough review of the EIS. Below are a list of detailed comments concerning the EIS.

Detailed Comments

Pg. ES-5 - We think it should be presumed that Micronesian *Megapodes* nest on Farallon de Medinilla until a thorough search of the island proves otherwise.

Pgs. 3-14, 15 - The biological description of Farallon de Medinilla is too brief and ignores some important points. Most importantly, it fails to note the significance of the breeding colonies of Masked Boobies and Great Frigatebirds found on the island. The colony of 750 Masked Boobies represents by far the largest known nesting site for this species anywhere in the Mariana or Caroline Islands. Also, the breeding colony of frigatebirds is the largest and one of only two known nesting locations for this species in the Marianas, the other being at the far northern end of the archipelago on Mang. Also, the presence of Mariana fruit bats on the island is not noted here. This species is a candidate for listing under the U.S. Endangered Species Act. In light of the brief surveys that were conducted, it would be appropriate for the EIS to indicate that the island may possess other significant species pending further investigation.

Pg. 4-3 - Table 4-1 seems quite incomplete and ignores other animal species that may be impacted by loud noises and visual disturbances. The military needs to consider its effects on all species, not just those that are federally listed as endangered. The table should note that loud noises may disrupt or cause roost or nest abandonment by seabirds on Farallon de Medinilla and Rota, and by Mariana fruit bats on Guam and Rota. The appearance of aircraft flying too close to bird and bat colonies may also trigger these responses.

Pgs. 4-5, 6 - The Navy's proposed underwater demolition training in Apra Harbor and at Dadi Beach concerns us. We believe that the Navy should strongly consider moving all demolition training to deepwater sites outside the harbor and that efforts be made to reduce

the size of the 10 and 20 pound charges to lessen impacts. We also believe that the protocol to determine the absence of sea turtles at a blast site is inadequate. This was proved on Rota in 1996 when the Navy's EOD personnel killed turtles at two sites after having supposedly made pre-detonation inspections. Accidents of this sort can be expected to occur in Apra Harbor and at any nearshore site on Guam because of the regular presence of turtles. We also strongly suggest that EOD personnel consult with the fisheries staff of the Guam Division of Aquatic and Wildlife Resources for appropriate methods of reducing blast impacts before each exercise.

Pg. 4-10 - The EIS mistakenly reports that Mariana fruit bats occur only around the Sabana of Rota. However, this is only where most colonial roosting take places. At night, bats can be expected to forage over nearly the entire island, including the vicinity of the airport.

Pg. 4-11 - Fig. 4-2 should clearly indicate that this is only a partial map of crow nests known for Rota and that nests can be expected to occur in many additional locations, including the forest adjacent the north side of the airport. Based on crow sightings made by biologists north of the airport in 1995, it can be expected that nests will occur under the proposed NVG helicopter flight area, probably on an annual basis.

Pg. 4-12 - We consider the brief surveys of wildlife and plants conducted by the Navy's contractors on Farallon de Medinilla to be entirely inadequate for meeting the needs of preparing the EIS. Much more survey work needs to be conducted on the island, especially for seabirds, which we believe are very likely the island's most important biological resource. Monthly information on seabird numbers should be collected by ground-based observers for at least two full years to determine seasonal trends in populations and breeding activity. The quarterly surveys suggested on Page 4-15 using photographs taken from aircraft are entirely inappropriate for gathering accurate information. Monthly visits to the island to collect seabird data would also allow researchers to gather further data on other species, such as megapodes and fruit bats. We also believe that a thorough survey for brown tree snakes needs to be done. To obtain the best baseline data from these surveys, we believe that no bombing of any type should occur during the two-year period that the surveys are conducted.

Pg. 4-12 - The EIS incorrectly states that Mariana fruit bats are not a protected species on Farallon de Medinilla. Fruit bats are fully protected from hunting in the CNMI by commonwealth laws. They are also a federal candidate for endangered species listing throughout the CNMI.

Pgs. 4-12, 15 - We strongly disagree with the EIS's attempt to discount the 1975 estimate that 50,000 boobies resided on Farallon de Medinilla. The 1975 environmental assessment (EA) states that "boobies nest as a colony which is fairly evenly distributed over the vegetated top of the island at a rate of about 100 nests to the acre." The floral section of that report states a 12-foot-high forest overstory covered the island, which would have provided ideal nesting habitat for boobies, particularly if the trees were *Pisonia grandis* (see the 1997 EIS's comment on tree species identification). The 1997 EIS indicates that this canopy is entirely gone from the upper plateau of the island now. This evidence strongly suggests to us that the island formerly held much good booby nesting habitat. Even if one argues the 1975 estimate 50,000 birds was perhaps too high, somewhat reduced estimates of 10,000-30,000 birds are still entirely reasonable, given the habitat conditions and the information presented in the 1975 EA. This information indicates, therefore, that a huge loss of birds has indeed occurred since 1975.

Further, we disregard the survey reports cited in Footnote 28 as being irrelevant to this argument. Population estimates after 1979 may simply show that heavy bombing of the

island between 1975 and 1979 quickly decimated the booby colony and destroyed the tree cover, making Farallon de Medinilla considerably less suitable for nesting. It seems likely that this vegetation change also lessened the island's suitability for fruit bats and megapodes, causing a reduction in their numbers as well.

With this information in mind, we strongly believe that the so-called "equilibrium" referred to on page 4-15 is obviously being kept artificially low by the bombing and that a termination of exercises would result in a significant recovery of bird numbers over a sufficient time.

Claims in the EIS that bombing can continue while further wildlife surveys take place are completely nonsensical. We fail to understand how any of the suggested mitigative bombing measures will avoid affecting the existing bird populations. Targeting the western side of the island will directly harm birds nesting on that side. According to Figure 2, Appendix H-2, much of that side of the island is used by nesting Masked and Red-footed Boobies and Great Frigatebirds. Targeting the southern part of the island will obviously harm Masked Boobies in that area (Figure 2, Appendix H-2). Further, these mitigative measures do not correspond with the proposed targets shown in Figure 2-14. All of this tells us that all bombing must be stopped entirely for two entire years while baseline surveys are conducted.

The CNMI Division of Fish and Wildlife also needs to be consulted in all decisions regarding mitigation for megapodes. The USFWS and National Marine Fisheries Service cannot make management decisions of this type without agreement from the Commonwealth government.

Also, under this section, there is no discussion of the potential impacts that bombing may have on marine resources. Bombs falling off-target into the ocean may cause heavy damage to the existing reef and kill animals such as sea turtles. The EIS fails to present any assessment of reef conditions around the island. This is vital information needed for a proper evaluation of impacts.

Pgs. 4-59, 60, 64 - We worry that the proposed sniper range at Ordnance Annex is dangerous to public safety because of the threat of occasional stray bullets. The EIS fails to acknowledge that a fairly popular public hiking trail runs along the mountain ridge (popularly called the Spanish Ridge) from Mt. Jumullong Manglo to Mt. Schroeder. The trail is used throughout the year by hikers, not just at Easter as stated by the EIS. Hikers, betel nut collectors, and poachers also use other trails leading toward Fena Lake and Mt. Lamlam. The Navy needs to take much greater precautions to keep people out of the area during range use. In addition to the placing of marker signs, the Navy needs to post a security guard at the top of the ridge at the trail junction north of Mt. Jumullong Manglo prior to and during all range use. We ask that the sniper range not be used on weekends so that the Spanish Ridge trail can remain open on the days of most public recreational use.

Pg. 4-69 - Section 4.8.1 is a poor summary of the many potentially significant impacts that may result from the military's proposed training exercises. Many problems are glossed over or entirely ignored here. For example, almost no impacts are described for the bombing exercises proposed for Farallon de Medinilla.

Figure C-3 - As already stated above, fruit bats occur throughout the island of Rota, especially at night when animals are foraging. The distribution of bats shown on this map is quite wrong and needs to be corrected.

Appendix H-1. The entire avifaunal survey report written by the contractor is poorly prepared and inadequate for the military's needs. Its worst problem is that it fails to put into greater context the significance of the island to the various animals recorded on it, especially the three booby species, Great Frigatebirds, Micronesian Megapodes, and Mariana fruit bats. The report makes no mention that Farallon de Medinilla has the largest colony of Masked Boobies in the Mariana and Caroline Islands and that Great Frigatebirds nest on only one other island in the Marianas. These are very important facts that need to be considered when evaluating the importance of the natural resources of Farallon de Medinilla. Omission of this information is inexcusable in a report of this type. Considering that just three older references are cited in the entire report, omissions of this sort are not surprising. Further, as already noted above, we disagree entirely with the report's attempt to discount the information on seabird numbers presented in the 1975 EA. The military should demand reports of better quality from its contractors if it expects to defend its proposed training exercises.

Thank you for seeking our comments on the military's draft Environmental Impact Statement. We hope that many of these problems can be corrected so that the proposed training exercises can proceed with minimal impacts to the islands involved.

Sincerely,

Gretchen R. Grimm

Gretchen R. Grimm
President

RECEIVED TIME MAR.31. 1:42PM PRINT TIME MAR.31. 1:45PM

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P.1G03
Ser 231/ 2751

24 JUL 1998

Ms. Gretchen R. Grimm
President
Marianas Audubon Society
P.O. Box 4425
Hagatna, GU 96932

Dear Ms. Grimm:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR MILITARY TRAINING IN THE MARIANAS

Thank you for your letter of March 24, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS. A copy will be forwarded for your review.

Issues raised by a number of reviewers, are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the **purpose and need** for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required.)

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

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b. Comment: More detail was requested on the **proposed training activities**, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a **full range of alternatives**, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use, less use, no change in use,* and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses are being evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The **Preferred Alternative** consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The **Maximum Land Use Alternative** includes proposed new training land uses which are not desirable because of significant impacts that cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense (DoD) has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

MARIANAS AUDUBON SOCIETY COMMENTS

Our responses to your comments are as follows:

General Comments:

a. Comment: The military commands must make an honest effort to assist in the conservation and recovery of endangered species and to meet management goals of the overlays, or risk renewed efforts by conservation organizations to have Critical Habitat declared.

Response and Revisions to DEIS: The Air Force and Navy commands on Guam have worked closely with U.S. Fish and Wildlife Service (USFWS) and Guam's Department of Aquatics and Wildlife Resources (DAWR) to identify and minimize impacts on endangered species. The revised DEIS presents mitigation conforming to USFWS Biological Opinions regarding training at Andersen Air Force Base (AFB).

Comment: As the endangered species situation on Guam is in flux, it is impossible to give advance approval for some activities without a concurrent evaluation of impacts on affected species. Commands must work closely with local and federal natural resource agencies to address all concerns in an adequate manner.

Response and Revisions to DEIS: DoD recognizes that several endangered species populations are in flux and also recognizes that impacts of certain training activities are not obvious.

Discussions are ongoing among the Navy, federal and local natural resource agencies regarding potential impacts of the proposed action. The Navy and Air Force have consulted with USFWS and Guam DAWR on limitations on aviation activities at Andersen AFB. DoD will work with DAWR and formally request a Section 7 consultation with USFWS, upon publication of the revised DEIS.

c. Comment: There should be a drastic curtailment or complete termination of bombing activities on FDM, as review of available documents indicates 25 years of bombing has induced a significant decline in seabird use. The presence of large numbers of masked boobies makes it one of the most important seabird nesting sites in all of Micronesia.

Response and Revisions to DEIS: The use of FDM is mission-critical to military units deployed in the Pacific; drastic curtailment or termination of bombing is not acceptable given the importance of the military missions involved and the lack of any alternative sites. The revised DEIS provides additional information on long term changes to the island, as well as results of current monitoring. The DEIS acknowledges potential impacts to seabirds (including masked boobies) from military training, although monitoring before and after major bombing exercises in 1997 failed to demonstrate significant bird mortality. Post-bombing surveys detected a maximum of two dead birds near new bomb craters. A Navy biologist will assist with target placement so that the majority of ordnance delivered will avoid the most sensitive areas for nesting and roosting birds.

d. Comment: Underwater detonations at Apra Harbor and Dadi Beach should be moved or should use much smaller charges to avoid accidental killing of sea turtles, coral, fish and result in fewer conflicts with civilians.

Response and Revisions to DEIS: Live charges are required to train personnel under controlled conditions in the heightened safety awareness, detailed procedures, and self-confidence that must be maintained to safely deal with explosives of various types which, in operational contexts, will be encountered in uncontrolled situations. Simulated devices fail to prepare personnel mentally and emotionally for the demands of safely setting off such charges. A 20-pound charge is used for different combat situations than a 10-pound charge. Personnel require training in identifying the correct charge to use, how it should be rigged and fuzed, safe handling, and redeployment to a safe distance. Both 10-pound and 20-pound charges have been used in Outer Apra Harbor in the past, and the environmental impacts of such activity were evaluated under the NEPA and found to have no effect requiring further analysis. No coral is within the projected area of effect of the existing site. Explosives Ordnance Disposal personnel do comply with the existing

National Marine Fisheries Service protocol requirements to survey the area for sea turtles prior to conducting this type of training. There have been no takes in past exercises.

The revised DEIS will identify a second alternative mine countermeasures site offshore of Dadi Beach, which would be more accommodating than the Apra Harbor site for the 20-pound charge. Use of the proposed Dadi Beach site would not require any closure of the harbor to commercial or recreational activities.

Detailed Comments:

a. Comment page ES-5: It should be presumed that Micronesian megapodes nest on FDM until a thorough search of the island proves otherwise.

Response and Revisions to DEIS: The November 1996 survey was cut short by an approaching typhoon, and the discovery of cluster bomblets in scattered locations resulted in the island being declared unsafe for any personnel on the ground. Therefore, no additional ground-based surveys are possible. The USFWS April 6, 1998 Biological Opinion indicates that exercises in July through September 1997 may have taken all the megapodes that occurred on FDM at the time and "burned to bare earth" a large section of an area believed to represent megapode habitat. It indicates that exact analysis of the remaining megapode population (if any) is not possible. Proposed mitigation is enhancement of megapode habitat on other islands in the Marianas, in cooperation with CNMI Division of Fish and Wildlife (DFW) and the USFWS.

b. Comment page 3-14ff: The biological description of FDM is too brief.

Response and Revisions to DEIS: The biological description has been supplemented with results of a July 1997 marine survey and with data obtained from historical reports and photographs. Reports from aerial surveys of FDM bird populations before and after 1997 exercises are included in an appendix to the revised DEIS.

c. Comment page 4-3: Table 4-1 should consider effects on all species, not just endangered species. The table should note specific effects on seabirds and fruit bats.

Response and Revisions to DEIS: The table is a listing of evaluation criteria for determining significance and is not intended to identify impacts on specific species. Impacts on seabirds and fruit bats will be addressed in Table 2-11 (Potential Impacts and Proposed Mitigation) in the revised DEIS.

Comment pages 4-5, and 6: Navy should consider moving all underwater demolition training to deepwater sites outside the harbor and should reduce the size of the charges. The protocol for

protecting sea turtles failed to protect two turtles at Rota. Navy should consult with DAWR fisheries staff to reduce blast impacts.

Response and Revisions to DEIS: (See paragraph d under General Comments for response to underwater demolition training.) For Rota, the turtles were killed during detonation of a live WW II 500 pound bomb, as requested by the local government to protect safety of recreational divers. This Rota incident was **not** an underwater training exercise. The physical situation was entirely different and the range of impacts was much greater than would ever be experienced in Apra Harbor.

e. Comment page 4-10: Fruit bats forage over all of Rota, not just Sabana.

Response and Revisions to DEIS: The text has been corrected. However, night vision goggle (NVG) training on Rota is no longer included as a Preferred Alternative and therefore training impacts to fruit bats are no longer an issue.

f. Comment page 4-11: Figure 4-2 should clearly indicate that crow nests may occur in many other locations on Rota. Nests can be expected under the proposed NVG flight area.

Response and Revisions to DEIS: There is no further need to list all of the potential crow nesting locations on Rota in the revised DEIS, since NVG training is no longer a Preferred Alternative.

g. Comment page 4-12: The brief surveys of wildlife and plants on FDM is inadequate. More survey work needs to be conducted on FDM. Bombing should be halted for two years while ground surveys are conducted.

Response and Revisions to DEIS: As mentioned in paragraph a under Detailed Comments, no further ground-based surveys are possible on FDM. Therefore, USFWS has agreed to allow aerial surveys of the island, to monitor the effects of military activities on endangered species and seabirds (Biological Opinion of April 6, 1998). The Navy recognizes that aerial surveys provide less information than ground-based surveys; however, because of the high risks and liability issues, only military personnel trained to handle explosive ordnance are allowed on the island on a limited basis. The lack of alternative locations for aerial bombardment makes continued military use of FDM, essential to the training of operational and mission-ready units. (See paragraph c under General Comments.)

h. Comment page 4-12: The EIS incorrectly states that fruit bats are not a protected species on FDM. Fruit bats are fully protected from hunting in the CNMI and are a candidate species for federal listing throughout the CNMI.

Response and Revisions to DEIS: The text in the revised DEIS has been corrected.

i. Comment pages 4-12 and 4-15: We disagree with discounting the 1975 EIS's estimate of 50,000 boobies on FDM ... somewhat reduced estimates of 10,000-30,000 birds are reasonable given habitat conditions presented in the 1975 EIS. This indicates that a huge loss of birds has occurred since 1975. The 12 foot high canopy referenced in the 1975 EIS would have been ideal nesting habitat for boobies (as well as fruit bats and megapodes) and is apparently now gone. The "equilibrium" referred to is kept artificially low by bombing, and we believe a termination of bombing would result in significant recovery of bird numbers. The suggested mitigative bombing measures will directly harm birds in the targeted areas and do not correspond with proposed targets shown in Figure 2-14. The CNMI DFW must be consulted in decisions regarding mitigation for megapodes. Also, this section has no discussion of impacts on marine resources and fails to assess reef conditions around the island.

Response and Revisions to DEIS: The areas proposed for targeting have been revised to consist of those areas recommended by the USFWS in their April 6, 1998 Biological Opinion (i.e., "the central interior portion and/or southern tip of the island and the western cliff faces, to the extent possible.") In addition, a Navy biologist will assist in target placement, to prevent major seabird colonies from being directly targeted. The word "equilibrium" has been deleted from the text, in recognition that it may be artificially imposed. The target areas formerly shown in Figure 2-14 are not part of the preferred alternative and therefore are not in contradiction of the mitigation proposed. The CNMI DFW has been involved in discussions regarding mitigation. A marine survey was performed in July 1997, and multiple reports of the survey are included as appendices to the revised DEIS.

j. Comment pages 4-59, 60, and 64: The proposed Ordnance Annex sniper range may affect hikers on the Mt. Jumullong Manglo–Mt Schroeder trail throughout the year. Hikers, betel nut collectors, and poachers also use other trails leading toward Fena Lake and Mt. Lamlam. In addition to marker signs, Navy should post a security guard at the trail junction of Mt. Jumullong Manglo prior to and during all range use. The sniper range should not be used on weekends (to allow the trail to remain open during heavier usage.)

Response and Revisions to DEIS: The proposed sniper range has been reconfigured so that the surface danger zone does not intersect the Mt. Jumullong Manglo trail.

k. Comment page 4-69: Section 4.8.1 glosses over or misses many potentially significant impacts, including impacts of bombing on FDM.

Response and Revisions to DEIS: The referenced section is intended as a brief summary of significant impacts identified and evaluated in detail in previous sections of the DEIS, including impacts on endangered Micronesian megapodes on FDM. Revised Chapter Four includes a

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similar summary. The DEIS acknowledges impacts to seabirds on FDM from bombing and proposes measures limiting target areas to minimize such impacts.

l. Comment Figure C-3: Fruit bats occur throughout Rota, which should be corrected on figure.

Response and Revisions to DEIS: Our response is covered under paragraphs e and f above. (Refer to comments to 4-10 and 4-11.)

m. Comment Appendix H-1: The avifaunal survey report fails to put significance of the island fauna into greater context. It does not mention that FDM has the largest colony of masked boobies in the Mariana and Carolina Islands and that great frigatebirds nest on only one other island in the Marianas. It cites only three older references. We disagree with its attempt to discount the 1975 EIS bird numbers.

Response and Revisions to DEIS: We appreciate your concern for FDM as a seabird habitat. The avifauna report is based on an awareness on the part of the researcher of the extent there is literature on the subject. As you may be aware, the literature based on primary research for the population distribution of seabirds in the Marianas is not substantial.

We have addressed the 1975 estimated population on FDM above, and reiterate that this number is not corroborated by any other source, nor is it consistent with reports of other researchers. The Navy does not believe this population figure to be representative of any specific "original" condition on FDM. With regard to frigatebirds and masked boobies, the avifaunal report mentions the existing condition at the time of the survey. Neither bird is endangered, threatened, rare, or endemic to the Marianas. Based on the bird census being taken before and after range events, and the large numbers of birds presently inhabiting the island following years of military use similar to the proposed, the navy finds no impacts from the proposed action to warrant changing the existing range of conditions on the island.

We trust that these responses adequately address your concerns. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338, by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division



SIERRA CLUB LEGAL DEFENSE FUND, INC.

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March 31, 1997

Fred Minato, Planner-in-Charge (Code 231FM)
Environmental Planning Division
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawai'i 96860-7300

Re: Comments on Draft Environmental Impact Statement, Military Training in the Marianas

Dear Mr. Minato:

On behalf of Friends of Animals, the Sierra Club Legal Defense Fund submits the following comments on the January 1997 Draft Environmental Impact Statement (DEIS) for Military Training in the Marianas, prepared by the U.S. Pacific Command of the Department of Defense (Pacific Command).

INTRODUCTION

The DEIS sets out "to provide comprehensive National Environmental Policy Act (NEPA) documentation for all military training in the Mariana Islands which is likely to be required for some years into the future." DEIS at ES-1. Such an analysis is long overdue. In the nearly three decades since NEPA was signed into law, the military has prepared NEPA documents for only three of its operations in the Mariana Islands: the Farallon de Medinilla Bombardment Range (1975 Final EIS), Tandem Thrust '93 (1993 EA) and Tandem Thrust '95 (1994 EA). Personal correspondence with Fred Minato (March 20, 1997). In the meantime, a host of other operations have been carried out without environmental review, despite potentially significant individual and cumulative impacts on biological, cultural, socioeconomic and other resources.

It is encouraging that the Pacific Command is now attempting to comply with NEPA's mandate to "insure that planning and decisions reflect environmental values." 40 C.F.R. § 1501.2. Unfortunately, the DEIS falls far short of satisfying the military's legal obligations under NEPA. As we discuss below, the DEIS fails: (1) to evaluate an adequate range of alternatives to the proposed expansion of military training in the Marianas; (2) to provide adequate analysis of the impacts

associated with the alternatives presented; and (3) to obtain and present adequate information regarding potentially significant adverse impacts associated with both ongoing and proposed training activities.

SPECIFIC COMMENTS

I. FAILURE TO EVALUATE REASONABLE ALTERNATIVES

NEPA identifies five core issues that an EIS must address to satisfy the law's mandate. See 42 U.S.C. § 4332(2)(C). Of these, the evaluation of alternatives is considered "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. To pass muster under NEPA, an EIS must "[r]igorously explore and objectively evaluate all reasonable alternatives" to the proposal. 40 C.F.R. § 1502.14(a). As part of the required alternatives analysis, an EIS must consider "the alternative of no action." 40 C.F.R. § 1502.14(d).

NEPA imposes an additional duty to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E). This requirement exists in addition to the alternatives analysis required by NEPA in the context of an EIS, and is:

> supplemental to and more extensive in its commands than the requirement of 102(2)(C)(iii). It was intended to emphasize an important part of NEPA's theme that all change was not progress and to insist that no major federal project should be undertaken without intense consideration of other more ecologically sound courses of action, including shelving the entire project, or of accomplishing the same result by an entirely different means.

Environmental Defense Fund v. Corps of Engineers of the U.S. Army, 492 F.2d 1123, 1135 (5th Cir. 1974).

In the context of this DEIS, unresolved conflicts undeniably exist between military, ecological, commercial and recreational uses of resources in the Mariana Islands. For example, the Guam National Wildlife Refuge overlies segments of Anderson Air Force Base and various naval installations on Guam. These and other sites for ongoing and proposed training activities are home to threatened, endangered and sensitive species and contain fragile native ecosystems. In addition, many training activities

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interfere with civilian use of harbors, fishing grounds, hiking trails and other resources.

For the foregoing reasons, NEPA's mandate to explore the full range of reasonable alternatives applies with particular force here. Rather than comply with this statutory command, the DEIS engages in a cramped discussion of three similar options: (1) continuing all training activities conducted in recent years in the Mariana Islands (improperly labeled the "no action" alternative); (2) augmenting ongoing training activities with all new training that the military would like to conduct (the "augmented set of training activities"); and (3) something between the first two (the "mitigated set of training activities"). DEIS at 2-1.

The mission of the proposed action -- "to develop war fighting skills and to maintain a state of combat readiness in troops stationed in Guam, Commonwealth of the Northern Mariana Islands (CNMI), Asia, Hawaii, and Alaska" -- is extremely broad. DEIS at ES-1. Accordingly, the Pacific Command was legally obligated to consider in the DEIS an equally broad range of reasonable alternatives to its proposal to increase training in the Marianas. At a minimum, NEPA requires the DEIS to consider a true "no action" alternative, as well as alternatives that propose reducing the level of operations in the Marianas by scaling back some training activities, moving them to locations outside the Marianas, or eliminating them altogether.

A. No True "No Action" Alternative.

The DEIS fails to provide a true "no action" alternative, in violation of the express requirements of the NEPA regulations. 40 C.F.R. § 1502.14(d). On the contrary, the DEIS dismisses out of hand eliminating training altogether from the Marianas, claiming it "is not a reasonable alternative in light of the military services' need to maintain military readiness in the Pacific area." DEIS at 2-1. However, given that many of the military personnel who will take part in the proposed exercises are not stationed in the Marianas, but will come from other Pacific Islands, Asia and Alaska, DEIS at 1-1, it is not self-evident why combat training must take place in the Marianas. Before eliminating this true "no action" alternative from further consideration, the DEIS must spell out the military's reasons for doing so. 40 C.F.R. § 1502.14(a).

B. Failure to Evaluate Reductions in the Level of Military Training in the Mariana Islands.

Even if complete cessation of military training in the Marianas is not feasible, the DEIS improperly limits its alternatives analysis to only options that maintain or increase the level of training in the islands. Where, as here, a federal agency contemplates changes to ongoing operations, an EIS must evaluate a range of alternatives including proposals for reducing the intensity of current activity. See Forty Most Asked Questions Concerning CEQ's NEPA Regulations, 46 Fed. Reg. 18026, 18027 (Mar. 23, 1981). Thus, the DEIS was obligated to consider alternatives that would reduce operations in the Marianas by scaling back some training activities, moving them to locations outside the Marianas, or eliminating them altogether.

The failure of the DEIS to evaluate reductions in the level of training in the Marianas renders the alternatives section so inadequate as to preclude meaningful analysis. NEPA requires the preparation and circulation of a revised DEIS that addresses this omission. 40 C.F.R. § 1502.9(a).

For the following reasons, the revised DEIS should consider in its expanded alternatives analysis the complete termination of bombing exercises on Farallon de Medinilla (FDM). FDM is potentially one of the most important seabird nesting sites in all of Micronesia. Brief surveys conducted in November of 1996 reported a colony of approximately 750 masked boobies, by far the largest known nesting site for this species anywhere in the Mariana or Caroline Islands and, perhaps, in Micronesia. See DEIS, Appendix H-1 at 3; Personal correspondence with Gary Wiles, Guam Division of Aquatic and Wildlife Resources (March 24, 1997). The colony of great frigatebirds found on the island is the largest in the Marianas, and one of only two known nesting locations in the islands. Personal correspondence with G. Wiles (March 24, 1997). In addition, last year's surveys at FDM recorded an estimated 500 red-footed boobies, 200 brown boobies and smaller numbers of other seabirds and migratory birds.

A comparison of the data from the Navy's 1975 EIS for FDM with the information presented in the current DEIS demonstrates the devastation wrought by a quarter century of bombing. In 1975, an estimated 50,000 adult boobies were present on the island, 1975 EIS at 7-8, nearly 35 times as many boobies as were recorded last November. Even if the 1975 estimates are somewhat inflated, as the DEIS alleges, it is impossible to discount the overwhelmingly adverse impacts on seabird use of FDM.

In considering the alternative of eliminating bombardment of FDM, the DEIS must address the adverse impacts of current bombing exercises on endangered and threatened species that inhabit FDM and its surrounding waters. Earlier this year, the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) issued biological opinions addressing the effect of the Navy's Tandem Thrust '97 operations on the endangered Micronesian megapode, hawksbill turtle and humpback whale, and on the threatened green sea turtle. See USFWS, Biological Opinion (Log Number 1-2-97-F-01) (Jan. 29, 1997); Letter from H. Diaz-Soltero, NMFS, to M. Kaku, Naval Facilities Engineering Command (Feb. 11, 1997). These opinions concluded that this operation alone might kill all ten megapodes estimated to inhabit the island, one adult green sea turtle and one adult hawksbill turtle, and destroy two active megapode nests and four active turtle nests.

II. FAILURE TO PROVIDE ADEQUATE ANALYSIS OF THE IMPACTS ASSOCIATED WITH THE ALTERNATIVES PRESENTED

Chapter 4 of the DEIS fails completely to satisfy NEPA's requirement that the discussion of environmental consequences serve as the scientific and analytic basis for comparing the alternatives presented in the EIS. 40 C.F.R. § 1502.16. In a word, the discussion is too vague. The DEIS does not describe the types and severity of environmental impacts associated with activities of different intensity, duration or frequency. Without this information, it is impossible to make an informed choice of preferred alternative or to formulate adequate mitigation measures.

The discussion of potential impacts from bombing at FDM provides a case in point. The sum total of the analysis in the DEIS is:

> BTS [brown tree snakes] could be introduced through importation of bombing targets. Explosions from high altitude aerial bombardment could affect the endangered Micronesian megapode and migratory birds on FDM in two ways: direct contact, or alteration of habitat and/or food source.

DEIS at 4-15.

The DEIS does not even attempt to quantify the impacts associated with continued or augmented bombardment on either the megapode or the plummeting seabird populations. Moreover, the DEIS ignores completely potential impacts on endangered humpback

whales and hawksbill turtles, threatened green sea turtles and candidate Mariana fruit bats. As the biological opinions issued for Tandem Thrust '97, discussed above, graphically illustrate, even one bombing exercise can be devastating to threatened and endangered species.

Overall, the DEIS assumes, without adequate documentation or explanation, that the current level of training activity in the Marianas is acceptable from an environmental standpoint. Accordingly, the DEIS rarely suggests mitigation of adverse impacts associated with current operations.

For example, the discussion of proposed underwater demolition training in Outer Apra Harbor on Guam presents as a given that following existing protocols for detonation of charges up to 10 pounds, the current training level, has no undesirable environmental impacts. DEIS at 4-5 through 4-6. The DEIS does not quantify or otherwise describe the potential impacts on endangered hawksbill and threatened green sea turtles, fish and coral associated with detonating 10-pound charges. Instead, the proposed mitigation calls for "post-blast dives" to "determine the number of fish kills and whether sea turtles were killed/maimed as a result of the explosions, so that pre-exercise procedures can be improved." DEIS at 4-6. It is precisely this type of information that NEPA requires before an agency undertakes a proposed action, so that mitigation measures (such as alternate protocols, detonating charges out of water, or alternate underwater locations) can be implemented to prevent avoidable adverse impacts.

Taking a hard look at the environmental impacts associated with the current level of training activities in the Marianas is particularly important here. The vast majority of the operations included in the DEIS's "no action" alternative have never been subjected to environmental review under NEPA. This omission includes all ongoing operations on Rota and nearly all of the extensive training activities that take place on Guam.

Even in the few instances in which the military has conducted environmental review under NEPA, the resulting documents are inadequate to evaluate the full range of impacts associated with current training activities. The EAs prepared for Tandem Thrust '93 and '95 on Tinian are too limited in scope, addressing only operations involved in those specific exercises. The 1975 EIS for FDM is hopelessly out of date. It does not even mention possible impacts on any endangered or threatened species, presumably because their presence was not known at that time, and it predates the crash of seabird populations on the island.

III. FAILURE TO OBTAIN AND PRESENT ADEQUATE INFORMATION REGARDING POTENTIALLY SIGNIFICANT ADVERSE IMPACTS

NEPA recognizes that information regarding foreseeable significant adverse effects on the human environment will sometimes be incomplete or unavailable. However, where such information "is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant," NEPA mandates that the EIS provide it. 40 C.F.R. § 1502.22(a). The DEIS falls far short of NEPA's requirements in this regard.

The following examples illustrate the DEIS's general failure to obtain and present adequate information regarding potential adverse impacts associated with both ongoing and proposed training activities:

A. Inadequate Surveys of Farallon de Medinilla.

The DEIS's discussion of existing conditions on FDM candidly admits that the brief avifaunal surveys of the island performed in 1996 were inadequate and that "[m]ore thorough, systematic surveys are necessary to determine a more accurate picture of species abundance and distribution." DEIS at 4-12. However, the DEIS fails to explain why these surveys were not carried out prior to circulating the DEIS and incorporated in its discussion.

The reports contained in Appendix H of the DEIS make it clear that securing the necessary information would have been neither unduly time-consuming nor burdensome. Environmental consultant Phil Bruner stated that "[t]wo or three additional field days would probably be sufficient" to obtain the needed data on the abundance, distribution and breeding status of the endangered Micronesian Megapode. DEIS, Appendix H-1 at 13. Navy biologist Tim Sutterfield concurred with this estimate. DEIS, Appendix H-4 at 2. In addition, Bruner recommended night observations to determine whether petrels and shearwaters may be using the island. DEIS, Appendix H-1 at 13.

The DEIS provides even less information regarding impacts on non-avian resources. No in-water work whatsoever was conducted to assess potential impacts on marine resources such as endangered hawksbill turtles, threatened green sea turtles and fragile coral ecosystems. Marine consultant Steven Dollar confirmed that "[w]ithout doubt, future field surveys that include underwater reconnaissance will add significantly to the ability to assess the potential impacts of the proposed uses of Farallon de Medinilla." DEIS, Appendix H-2 at 2 (emphasis added).

Similarly, the half-day of preliminary archeological reconnaissance on FDM was deemed "far too limited" to determine the likelihood of prehistoric or early historic human activity on the island. DEIS, Appendix M at 8. Archeological consultant David Welch estimated that only two or three additional days of survey were needed to confirm the presence or absence of any archaeological remains and to assess the past and potential future impacts of the military use of the island.

The DEIS provides no explanation for the failure to carry out these modest, additional studies. The absence of the information they would have provided prevents the DEIS from carrying out its mandated role as an informational document regarding potential environmental impacts associated with the proposed bombing activities.

B. No Data Regarding the Impact of Night Vision Goggle Training on Mariana Crows on Rota.

The DEIS proposes adding night vision goggle (NVG) training at Rota Airport, in the heart of the largest remaining population in the Marianas of the endangered Mariana crow. DEIS at 4-9. The proposed operations would represent a major increase in the level of noise disturbance suffered by these birds. Currently, noise at Rota Airport is "sporadic and generally limited to daytime hours." DEIS, Appendix G at 1. In contrast, the proposed NVG training would take place approximately every third night, with continuous noise for a period of up to three hours. DEIS at 4-10.

There is every reason to believe that NVG training on Rota would have severe, adverse impacts on the Mariana crow, especially during the crow's six-month breeding season (mid-April to mid-October). The Rota NVG Noise study in Appendix G states that the proposed training would result in peak noise levels between 101 and 104 dBA at the nearest edge of the high density Mariana crow population area (noise greater than a jackhammer at 15 meters or a printing plant). DEIS, Appendix G at 2, Figure A-1. The nearest known crow nest (current surveys are incomplete) would suffer peak noise levels of 82 dBA, or noise greater than that produced by a concrete mixer at 15 meters! Id.

It is impossible, however, to evaluate the potential impacts on the Mariana crow because "no statistically-based data on peak sound level effects on Mariana crows are available." DEIS at 4-10. The DEIS admits that, without this crucial information, "it cannot be determined whether [NVG] training will disturb Mariana crows nesting and/or foraging in woodlands adjacent to the airport." Id. Thus, the DEIS cannot form the basis for a

rational decision to introduce NVG training on Rota, especially since "[p]otential noise impacts cannot be fully mitigated." DEIS at 4-10.

The revised DEIS must provide this key information and explain why NVG training should occur on Rota, despite unavoidable impacts on the Mariana crow, rather than on Tinian or Guam, where this training currently takes place. See DEIS at 2-19. Even if training on Tinian is impractical, as the DEIS claims (at 4-10), the DEIS must explain why Rota is preferable to Anderson Air Force Base, where Helicopter Support Squadron Five is stationed and where both the Main Base and Northwest Field have been identified as suitable training sites. DEIS at 1-6.

CONCLUSION

In summary, the DEIS is woefully inadequate. To comply with NEPA's legal mandates, the Pacific Command must consider a reasonable range of alternatives to the proposed expansion of military training in the Marianas, provide adequate analysis of the impacts associated with the various alternatives presented and obtain adequate information regarding potentially significant adverse effects associated with both ongoing and proposed training activities. As required by 40 C.F.R. § 1502.9(a), the Pacific Command must then issue a revised DEIS.

Thank you for this opportunity to comment on the DEIS. Pursuant to 40 C.F.R. section 1502.19(c) and (d), we request a copy of the entire revised DEIS and of any final EIS, when circulated. If you have any questions regarding the foregoing, please do not hesitate to contact us.

Sincerely,

David Lane Henkin
Associate Attorney

DLH\tt

cc: Eugene Nitta, National Marine Fisheries Service
Robert Smith, U.S. Fish and Wildlife Service
Friends of Animals

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DEPARTMENT OF THE NAVY
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Ser 231/ 2606
14 JUL 1998

Mr. David Lane Henkin
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Earthjustice Legal Defense Fund, Inc.
223 South King Street, Fourth Floor
Honolulu, HI 96813

Dear Mr. Henkin:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) MILITARY TRAINING IN THE MARIANAS

Thank you for your letter of March 31, 1997, regarding the subject DEIS. In response to a number of comments and questions on the purpose and need for the proposed action and the range of alternatives considered, we have made extensive revisions. A copy of the revised DEIS will be forwarded for your review.

Those issues raised by you and a number of reviewers are discussed below as common issues. Responses to your itemized concerns are provided in the second part of this letter.

COMMON ISSUES

a. Comment: Several reviewers commented that the DEIS did not adequately justify the purpose and need for increased training in the Marianas and questioned why organizations based elsewhere require training in the Marianas.

Response: Although the size of military organizations based in the Marianas has been reduced, other organizations based elsewhere are assigned military missions to respond in the "Pacific Theater" region. Many of these organizations deploy regularly to the Western Pacific and Indian Oceans and have a great need to use the Marianas for training. This training provides the last secure opportunity to practice combat skills on non-foreign soil, before soldiers encounter a real-world threat, such as Somalia. As training opportunities in Japan and Korea diminish and training in the Philippines remains suspended, the need increases to train in the Western Pacific within reasonable response distance to potential deployment locations (where landings and combat may be required).

Revisions to DEIS: Chapter One has been rewritten to clarify the increased importance of maintaining training areas in the Marianas. It explains the roles of forward-based, forward-deployed, and transiting combat units and points out the uniqueness of the Marianas as the only U.S.-controlled training area in the Western Pacific.

b. Comment: More detail was requested on the proposed training activities, so reviewers could better visualize the impacts of such activities.

Revisions to DEIS: Chapter Two has been extensively rewritten to provide more details on training activities, in order to better enable the reader to assess training impacts on the environment. The typical number of trainees and approximate frequency of each type of training at each land area are provided in a table. Photographs and illustrations of training activities and vehicles are provided in an appendix.

c. Comment: Various reviewers believed that the No Action, Mitigative, and Augmented Training Alternatives did not represent a full range of alternatives, as no alternative fully mitigated potentially significant impacts. One reviewer observed that the "no action" alternative includes many training activities which have never been subject to review in a National Environmental Policy Act (NEPA) document. A "no training" alternative was requested by some reviewers.

Response: To provide more distinguishable alternatives, we have reframed the proposed action as a set of land uses for a range of training activities. Reasonable alternative land uses to accomplish the purpose and need for training in the Marianas area include *more use*, *less use*, *no change in use*, and *no* use of each specific area proposed for training use. The No Land Use alternative is the same as the "no training" alternative requested by some reviewers.

The No New Action and Reduced Land Use alternatives fully mitigated all potentially significant impacts except those on the island of Farallon de Medinilla (FDM). Only the No Land Use alternative fully mitigated potentially significant impacts, including those on FDM. If there are any training land uses that have not previously been subject to NEPA review, the impacts of those land uses will be evaluated in the revised DEIS as part of the evaluation of the No New Action alternative.

Revisions to DEIS: Chapter Two has been rewritten, reframing the alternatives as ranges of use of specific training areas. As the actual range of training is a continuum of up to 150 different activities on multiple portions of eight military-controlled land areas, any defined alternatives will necessarily be permutations of various sets of training activities on specific land areas. For each area, all proposed training activities are evaluated for impacts. The continuum of alternatives is evaluated using these definitions:

No New Action is defined as a continuation of, or no changes to, ongoing training. The ongoing training for a particular area is described.

No Land Use is defined as not using land for a given training activity or set of activities.

Reduced Land Use is defined as using a land area for fewer training activities than those presently ongoing.

The Preferred Alternative consists mostly of ongoing training actions on Guam and Tinian, augmented with several new training land uses. At Guam locations, this alternative reduces existing use of training lands. Therefore, the Preferred Alternative has components of No New Action and Reduced Land Use, plus a few new training land uses.

The Maximum Land Use Alternative includes proposed new training land uses that are not desirable because of significant impacts which cannot be mitigated and for which alternative training venues exist which reasonably allow accomplishment of the necessary training objective(s).

The alternatives are evaluated and compared for significant impacts. The Preferred Alternative is a compromise between accomplishing the purpose and need for training and avoiding significant environmental impacts where possible. It fails to provide facilities

for various long-range or indirect-fire weapons, but it includes some land uses that have significant impacts that cannot be fully mitigated. Department of Defense has done its best to mitigate significant impacts in keeping with its need for training in the Mariana Islands.

EJLDF Comments

Our responses to your specific comments are as follows:

a. Comment I: The DEIS fails to evaluate a full range of reasonable alternatives. The purpose and need is extremely broad; therefore an equally broad range of alternatives must be considered. The DEIS does not provide a true "no action" alternative…eliminating training altogether from the Marianas. The DEIS is obligated to consider alternatives that would reduce operations in the Marianas. The DEIS should consider the complete termination of bombing on FDM, in consideration of potential impacts to nesting sites of masked boobies and great frigate birds, as well as impacts on endangered megapodes and sea turtles. (This is a very brief summary of the comment.)

Response and Revisions to DEIS: (See paragraphs a and c under Common Issues) The "true" no action alternative presented in the revised DEIS is the No New Action alternative (formerly the No Action alternative) because "no action" means a continuation of existing conditions (i.e., continuation of ongoing training). The No Land Use alternative, which would eliminate training from one or more areas altogether, has been added to the analysis in the DEIS. The No Land Use alternative would be an action with substantial effects: lands not available for training would eventually be transferred to civilian control and likely development, significantly reducing the protection currently afforded to endangered species and historically significant cultural sites. The Reduced Land Use alternative represents reduced operations in the Marianas.

No Land Use on FDM, i.e., complete termination of bombing, would thoroughly fail to meet the military purpose and need for that type of training. The use of FDM is mission-critical to units with defense responsibilities in the Pacific. The revised DEIS acknowledges potential past and ongoing impacts to seabirds (including masked boobies and great frigate birds) on the island from bombing, although monitoring before and after bombing exercises in 1997 failed to demonstrate significant bird mortality. Seven post-bombing surveys in 1997 detected a total of two or three dead birds near new bomb craters. Proposed mitigation is that a Navy biologist will assist with target placement so that the majority of ordnance delivered will avoid the most sensitive areas for nesting and roosting birds.

Any megapode remaining on FDM represents a very small population on a very small island with little suitable habitat. The FDM megapode population is not a significant component (<1%) of the population of these birds in the Mariana Islands, and loss of several individuals does not constitute a threat to the species' continued survival. (USFWS April 6, 1998 Biological Opinion on Programmatic Aerial Bombardment and Naval Gunfire at FDM) As compensatory mitigation, the Navy is supporting CNMI Fish & Wildlife habitat enhancement efforts on the nearby uninhabited island of Sarigan, which is sufficiently large to support a viable and stable megapode population. No impacts are expected to nesting sea turtles, as the island's beaches are gravelly and fully wave-washed and are not suitable for successful nesting.

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b. Comment II: The DEIS does not provide adequate analysis of impacts associated with the alternatives presented. Describe the types and severity of impacts of different intensity, duration, or frequency. The DEIS does not quantify impacts of bombing on megapode or seabird populations and ignores impacts on endangered whales, sea turtles, and candidate fruit bats. Overall, the DEIS assumes that the current level of training is environmentally acceptable and rarely suggests mitigation of impacts of existing training. For example, the DEIS does not quantify impacts of detonating 10-pound underwater charges in Apra Harbor. The majority of training under "no action" has never been subject to NEPA review, particularly activities on Rota and Guam. (This is a very brief summary of the comment.)

Response and Revisions to DEIS: Additional detail has been added to Chapter Four of the revised DEIS, particularly in regard to quantifying effects, where possible. Table 1-1 identifies the approximate duration and frequency of all proposed training activities, and impacts analysis is based on maximum (i.e., "worst case") use of training lands under each alternative. In the case of FDM, the impacts and mitigation section has been expanded to identify potential impacts on specific bird species and to attempt to quantify impacts. The latter is constrained by unexploded ordnance hazards that preclude further ground-based surveys and by lack of reliable data from previous years. A historical review of all-available reports and data on FDM is included in an appendix to the revised DEIS and is the basis for developing historical and current baselines against which to measure impacts. A marine survey of the island was conducted in July 1997 with the participation of local and federal regulatory agencies; the reports are appended to the revised DEIS.

As mentioned above, the USFWS estimates that a "population" of up to 10 megapodes on FDM may have been destroyed during 1997 bombing events. However, the USFWS further observes that the loss represents less than 1% of the megapode population in the Marianas. Therefore, it is not expected to have significant impacts on megapode survival. The opinion did not indicate that it expected 10 megapodes to be destroyed during each bombing exercise. The revised DEIS reviews estimates of booby populations from various surveys. The 1975 study extrapolated a population of up to 50,000 individuals after the island had been bombed with 22 tons of ammunition per month for the preceding four years. Two other surveys cited in the revised DEIS estimated the total booby population of FDM as no more than 2,200 between 1979 and 1988. November 1997 surveys estimated 400 to 750 masked boobies, 500 to 5,000 red-footed boobies, and approximately 200 brown boobies. Of up to 6,000 boobies, only two or three dead birds were observed in seven aerial surveys in 1997, during which multiple bombing exercises occurred.

No humpback whales have been observed near FDM in ten biological surveys of the area in 1996 and 1997. Sea turtles do not nest on FDM beaches; one green sea turtle was observed in November 1996 and two were observed during the July 1997 marine survey swimming in waters near the island. The use of FDM by bats and impacts to bat populations from military training cannot be evaluated since no further on-island surveys are allowed for obvious safety reasons. Based on the limited habitat available for their use observed during the one ground survey conducted, the number of bats likely to be found on FDM and therefore at risk is relatively small.

The revised DEIS provides a 10-page detailed list of proposed mitigation actions. All training conducted on Tinian and at Andersen Air Force Base has undergone environmental

review by various federal agencies. The EA for Tandem Thrust 1995 clearly states that it is intended to cover repetition of the training activities included in that exercise. A Section 7 consultation for that EA was conducted with federal and local agencies, and mitigation in the EA includes measures deemed necessary to mitigate potential impacts to rare or protected species. Past training at the Ordnance Annex has been reviewed and, as necessary, constrained by the Navy's natural and cultural resource managers in order to protect natural and cultural resources present in the annex.

Of greatest concern to the public and to agencies is underwater demolition in Apra Harbor, which was evaluated in the *Final EIS for Proposed Facilities Development and Relocation of Navy Activities to the Territory of Guam from the Republic of the Philippines* (US Navy, July 1993). The protocol developed for avoiding harm to endangered sea turtles was approved and signed by National Marine Fishery Service (NMFS) and Guam EPA, after thorough discussions. Prior to the exercise, securing and monitoring for marine mammals and turtle activities clears the area. There is no record that any turtles have been killed as a result of these detonations. Observed fish kills have complied with the terms of the NMFS/GEPA protocol. Data on fish kills and lack of turtle kills have been submitted to these agencies on a regular basis, providing those agencies with adequate information with which to evaluate the impacts of this ongoing activity. A second site, outside of Apra Harbor, is identified in the revised DEIS and may be used in preference to the more sheltered Apra Harbor site, when weather permits. "Detonating charges out of water" would not provide the needed training in destroying enemy mines, as naval mines are invariably located in the water.

c. Comment III: The DEIS does not present adequate information regarding potentially significant adverse impacts. Surveys of FDM are inadequate, particularly the lack of a marine survey. The DEIS contains no data on impacts of NVG training on Mariana crows on Rota. (This is a brief summary of the comment.)

Response and Revisions to DEIS: The revised DEIS makes it clear that the November 1996 surveys of FDM were cut short by an approaching typhoon and that no further ground-based surveys are possible due to the discovery of extremely dangerous cluster bomblets scattered all over the island. In balancing the need for more information against the substantial risk of loss of human life in trying to obtain more information, the Navy concludes that concerns about the latter prevail. Non-Explosive Ordnance Disposal personnel are not allowed on the island. As discussed above, an extensive effort has been made to generate a baseline assessment of the island's condition from historical reports, as well as from observations made during aerial surveys of the island in 1997. A marine survey of the island's offshore vicinity was performed in July 1997, and the revised DEIS contains survey reports from that event. The survey found that FDM has no beaches suitable for sea turtle nesting, and that commercially desirable reef fish existed only in low numbers while other fish were relatively plentiful. No evidence was found that training activities are having significant effects on coral development or survival at FDM.

NVG training on Rota is not included in the Preferred Alternative and therefore its impacts will not be evaluated in the revised DEIS. Conclusive data is not available to determine what the noise impacts would be on the population, and increased lighting from development of the area near the airport would make NVG training less favorable than originally assessed.

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We trust that these responses adequately address your concerns. Should you have any questions, please contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406



P. O. Box 20721
GMF, Guam 96921
March 18, 1997

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

I am providing written comments on the Draft Environmental Impact Statement for Military Training in the Mariana Islands. This is a followup to my oral presentation on March 6, 1997 on Guam.

My basis concern is that the new sniper range on the Ordinance Annex to Naval Activities on Guam will block access on the popular Southern Mountains Trail that has had unrestricted access for decades. I would recommend that adjustments be made in the range to continue the use of the trail.

Sincerely yours,

DAVID T. LOTZ

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

5090P1G03
Ser 231/1988
20 MAY 1998

Mr. David T. Lotz
P. O. Box 20721
GMF, GU 96921

Dear Mr. Lotz:

Subj: DRAFT ENVIRONMENTAL IMPACT STATEMENT MILITARY TRAINING IN THE MARIANAS

Thank you for your letter dated May 6, 1997, regarding the Draft Environmental Impact Statement (DEIS). In response to a number of comments and questions on the purpose of the proposed action and the range of alternatives considered, we have made extensive revisions and will be publishing a revised DEIS in May - June 1998 timeframe. A copy will be forwarded for your review.

a. Comment: Recommend proposed sniper range be adjusted so that hiking trail passing through Ordnance Annex will continue to be unrestricted.

Response and Revisions to DEIS: Agree. The sniper range has been adjusted so that the surface danger zone (SDZ) does not intersect the trail and there is no need to close the trail.

We trust that this response adequately addresses your concern. Should you have any questions, contact Mr. Fred Minato at (808) 471-9338 or by facsimile transmission at (808) 474-5909 or by electronic mail at fminato@efdpac.navfac.navy.mil.

Sincerely,

MELVIN N. KAKU
Director
Environmental Planning Division

Blind copy to:
Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard
Honolulu, HI 96813-5406

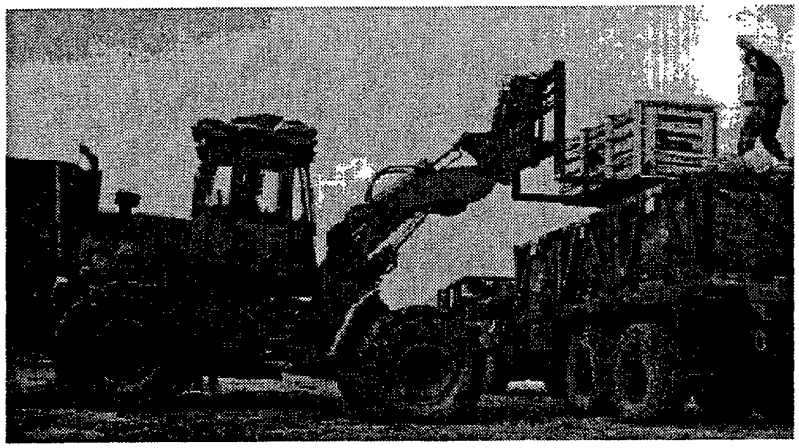
Appendix B
Technical Descriptions



Marines hike through training areas



Tactical maneuvers



Marines load a MK 48-14 logistic vehicle



Marine field communicator



Airfield security



USMC field communications

Source: MCBH Kaneohe Bay, Hickam Air Force Base, and U.S. Navy file photos

B-1: FIELD MANEUVER AND LOGISTICS PHOTOS

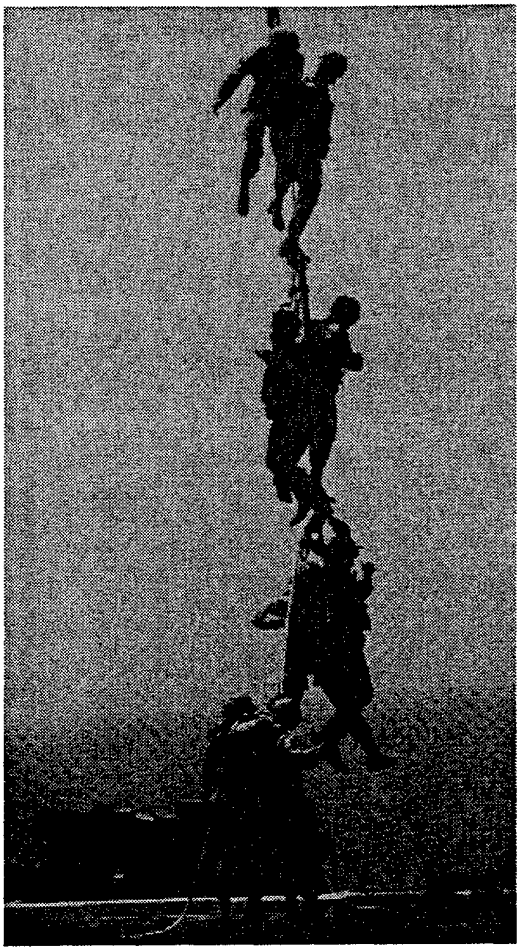
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

Table B-2 Field Maneuvers Technical Information

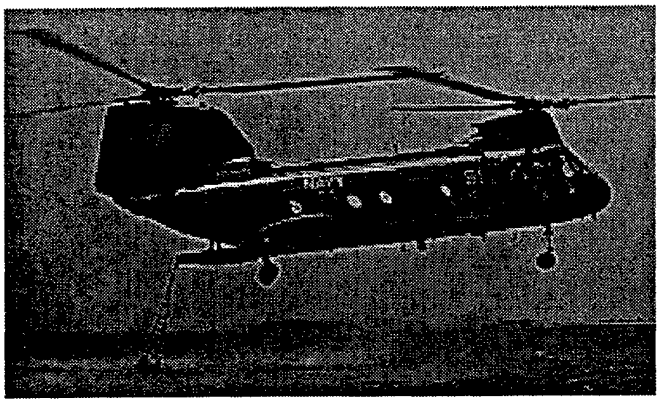
ACTIVITY	MAJOR ITEMS OF EQUIPMENT	POTENTIALLY SIGNIFICANT PROGRAMMATIC IMPACTS
Tactical field maneuvers	Rifles, pistols, machine guns (small arms) with blank ammunition	Field fires
	Signal flares and smoke grenades	Field fires
Troop movement	Fixed wing aircraft and helicopters	Field fires
	Trucks, light armored vehicles (LAV), assault amphibian Vehicles (AAV), small unit support vehicles (SUSV)	Damage to vegetation, habitat, and cultural sites; fuel spills
Defensive positions and bivouacs	Hand tools, security wire, camouflage nets, tents, generators, field kitchens and showers, portable toilets and trash dumpsters	Field fire, damage to vegetation, habitat, and cultural sites; fuel spills, waste spills
Personnel and cargo transport to and from Tinian	LCUs and barge, fixed wing aircraft and helicopters	Brown tree snake importation
Logistic support base shooting house, breaching house, security gate construction	Earth-moving equipment	Loss of vegetation or habitat, damage to cultural sites, fuel spills
All training activities	Military personnel and equipment using EMUA/MLA for training activities	Public safety



Fastrope from UH-60 helicopter



Special purpose insertion and extraction (SPIE) training



SEALs practice aerial cast recovery from bay of CH-46 helicopter. Team members seize rope ladder as it drags through the water at 5 mph.



26th MEU (SOC) marines securing an LZ as part of a TRAP exercise (tactical recovery of aircraft and personnel) executed in Bosnia.

Source: U.S. Navy file photos

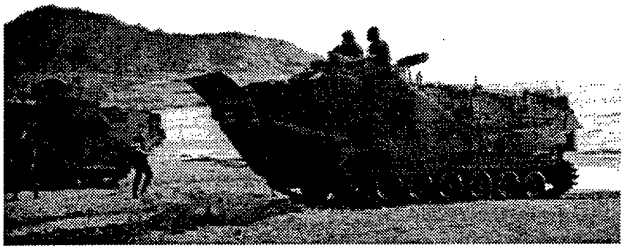
B-3: AVIATION PHOTOS

Table B-4 Aviation Training Technical Information

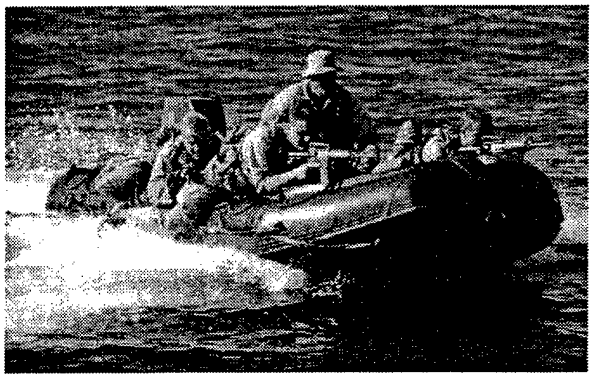
ACTIVITY	MAJOR ITEMS OF EQUIPMENT	POTENTIALLY SIGNIFICANT PROGRAMMATIC IMPACTS
Airmobile operations: Ground forces transportation Equipment and cargo lift	Fixed wing aircraft (e.g., C-141 and MC-130/KC-130) Rotary wing aircraft (e.g., CH-46E, CH-53E, UH-1N, UH-60) Tilt wing (MV-22)	Interference with commercial aviation activities Public safety in vicinity of air operations
Airborne operations: Parachute drops (personnel) Parachute drops (cargo) Fast rope (helicopter rappel) Special purpose helicopter insertion and extraction (SPIE)	Fixed wing aircraft (e.g., C-141 and MC-130/KC-130) Rotary wing aircraft (e.g., CH-46E, CH-53E, UH-1N, UH-60) Tilt wing (MV-22)	Interference with commercial aviation activities Public safety in vicinity of air operations
Close air support (simulated)	Fixed wing fighter attack aircraft (e.g., F/A-18, AV-8B Harrier) Rotary wing aircraft (e.g., AH-1W)	Interference with commercial aviation activities Public safety in vicinity of air operations
Night vision goggle training	All aircraft	Interference with commercial aviation activities Public safety in vicinity of air operations Noise at night
Firefighting	Rotary wing aircraft (CH-46E and CH-53E) and fire buckets	Interference with commercial aviation activities Public safety in vicinity of air operations Noise at night Salt water damage to vegetation
Forward area refueling points (FARP)	Portable fuel bladders, spill containment liners, and pumps	Fuel spill Fire



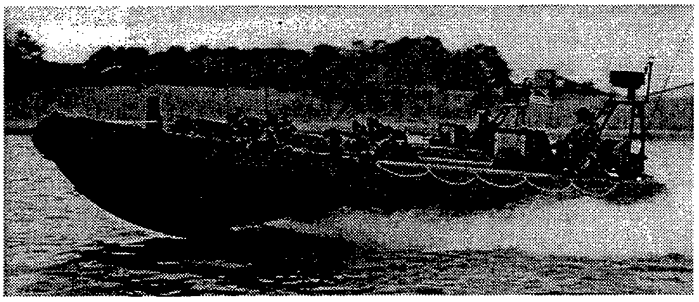
SEAL wading ashore



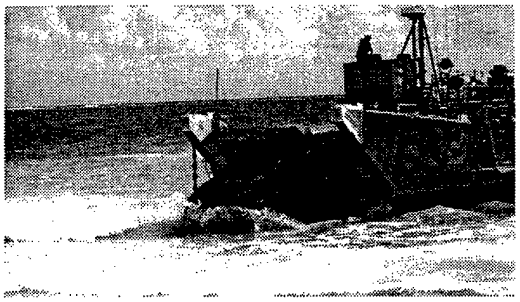
AAV lands on beach



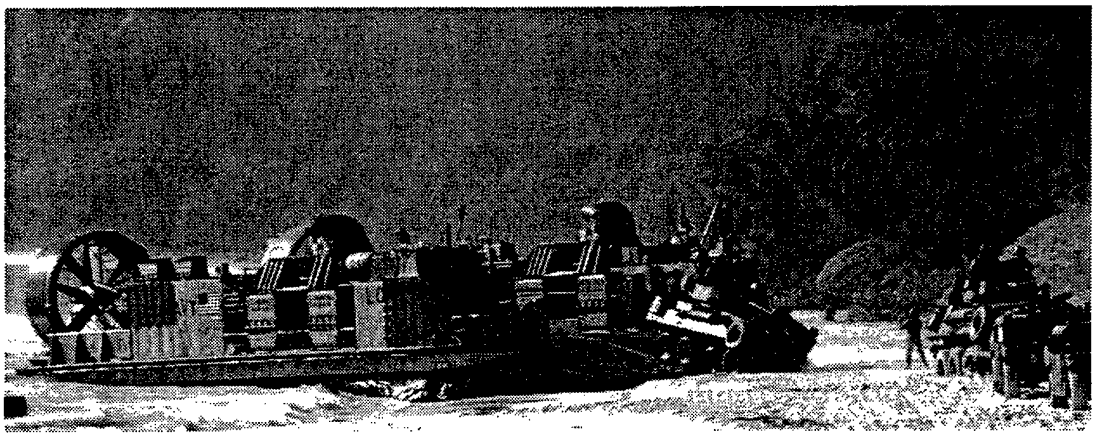
Marine reconnaissance team aboard a CRRC



SEALs aboard two RHIBs



5 ton truck debarking from LCU

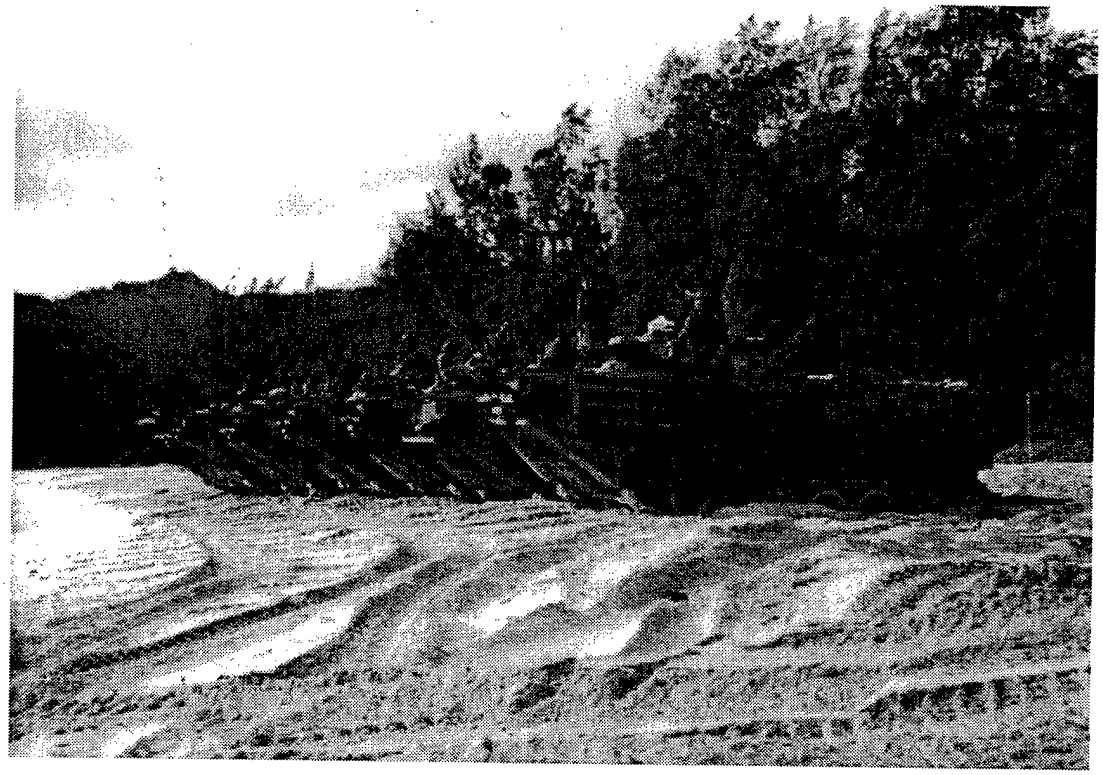


LCAC offloading LAVs

Source: Popular Mechanics, Nov. 1995, Website; U.S. Navy file photos; Belt Collins Hawaii

B-5: AMPHIBIOUS LANDING PHOTOS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

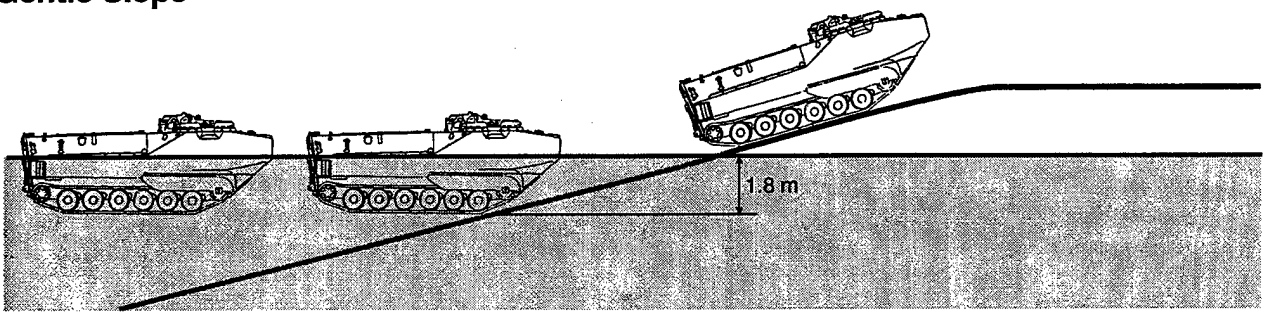


The AAV is designed to carry 21 combat-equipped troops or 4500 kg of cargo. Using an eight cylinder, multi-fuel engine, the vehicle can cruise at 30 to 50 kilometers per hour (kph) on land, and at about 10 kph on water. Its maximum speed is 70 kph on land and 13 kph on water. Armament consists of a turret mounted M2 .50 caliber machine gun, and MK19 40mm machine gun.

The AAV is 3.25 m wide, 7.9 m long, and 3.1 m high; its maximum draft is 1.7 m. Its tracks are 0.9 m wide and bottom clearance is 0.4 m. Although the AAV can climb walls one-meter-high once its tracks are in contact with land, it requires a slanting surface for initial touchdown during a water approach.

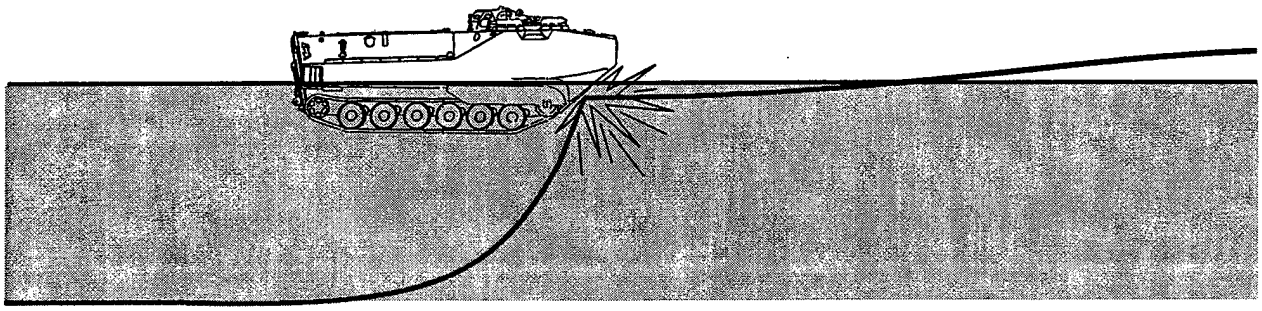
AAV CONTACTING VARIOUS SURFACES

Gentle Slope



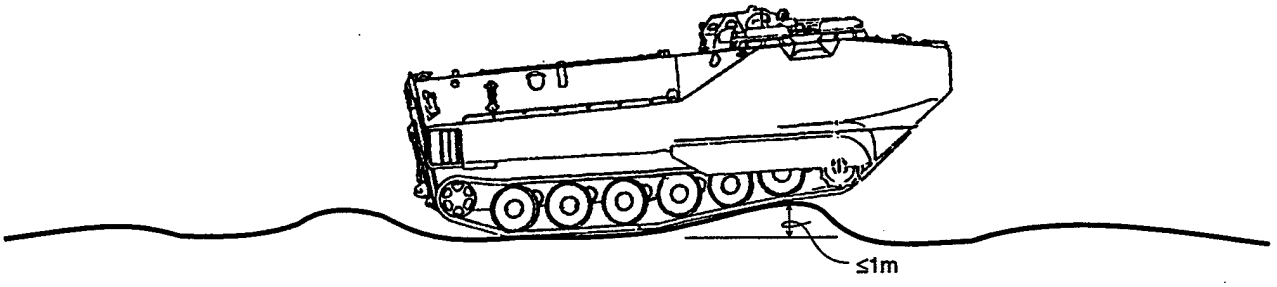
Preferable beach approach: tracks contact substrate gradually in water less than 1.8m deep.

Submerged Jutting Substrate



Poor beach approach: Hull contacts underwater ledge in water too shallow to allow tracks to make initial contact.

Land Obstacles



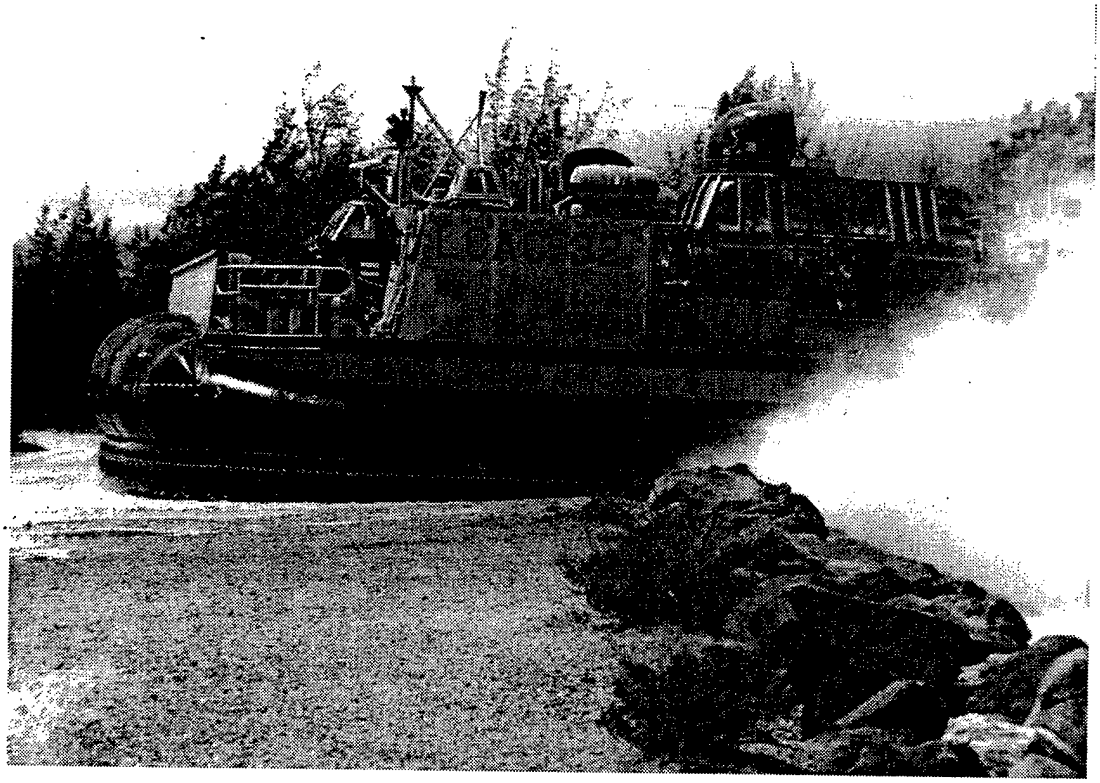
AAV track suspension allows it to climb vertical obstacles of up to 1m.

Source: USMC FMFM 9-2: "Amphibious Vehicles" dated 23 April 1981

B-7: AAV IMPACTS ON LAND AND WATER SURFACES

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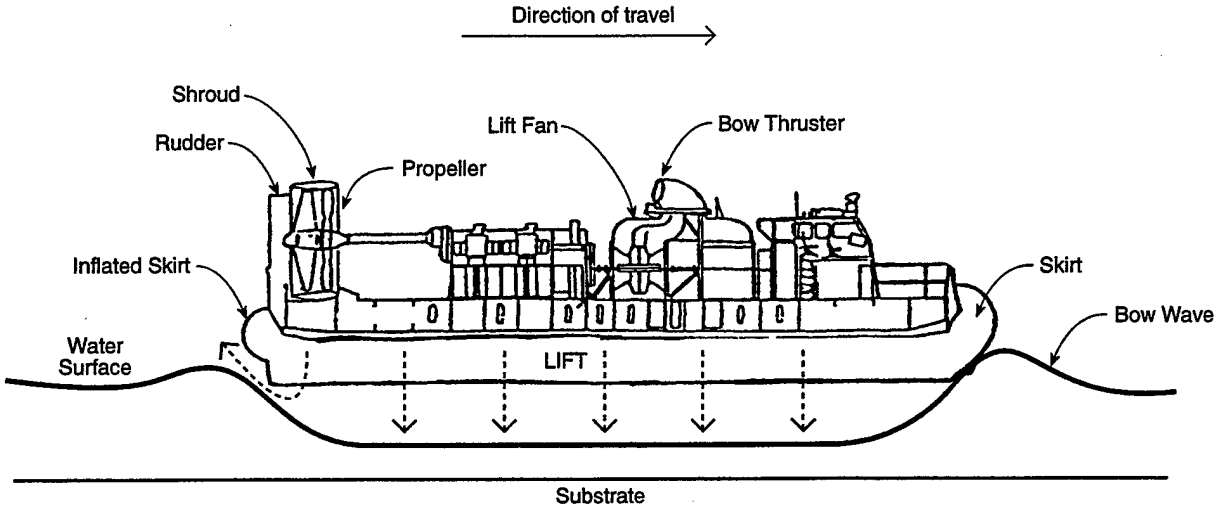




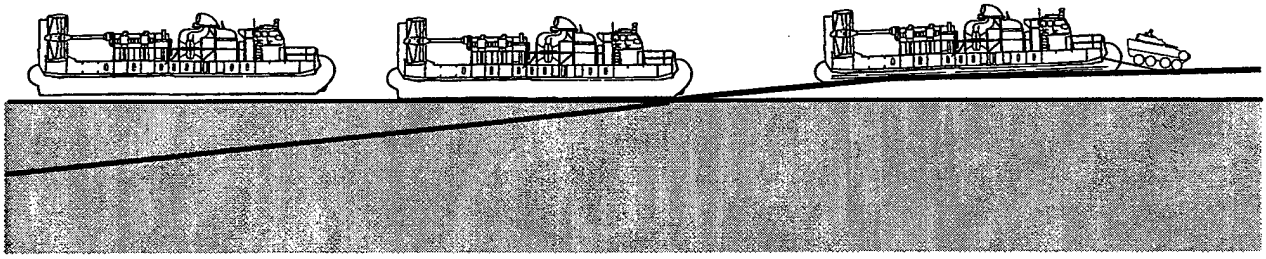
The LCAC is powered by gas turbine engines and propelled by two large propellers. It travels over both land and water on a cushion of air created by internal fans and contained by a flexible skirt. It is used to carry large vehicles, cargo, and weapons systems during ship-to-shore tactical exercises. The LCAC travels at approximately 93 kph on water and 46 kph over land.

B-8: LANDING CRAFT AIR CUSHION (LCAC)

LCAC EFFECTS ON WATER SURFACE



LCAC fans propel air downward, inflating the tube-like skirt and lifting the vehicle above the surface. At slow speeds, the LCAC rides relatively low, depressing the water surface 30 to 50 cm and generating a bow wave. As forward speed increases, the bow wave diminishes and the water is depressed only about 10 cm. (If the LCAC stopped in the water, it would draft about 85 cm.)



As an LCAC approaches shore, it may slow down, increasing the underlying water depression. At the shore, the skirt adjusts to changes in slope. (The LCAC is limited to 6° or less continuous ground slope, but can cross short areas of up to 13°.) Upon reaching its designated landing zone, the LCAC lowers to rest on its skid rails. Vehicles may offload from fore and aft ramps. To exit the beach, the LCAC rises back up on cushion, turns, and increases speed as it moves back over the water.

Source: USN Operational Handbook 7-15, "Employment of Landing Craft Air Cushion (LCAC) in Amphibious Operations" dated Nov. 1985

B-9: LCAC IMPACTS ON LAND AND WATER SURFACES

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Belt Collins Hawaii, 1998

Table B-10 Amphibious Landing Craft And Vehicles Technical Information

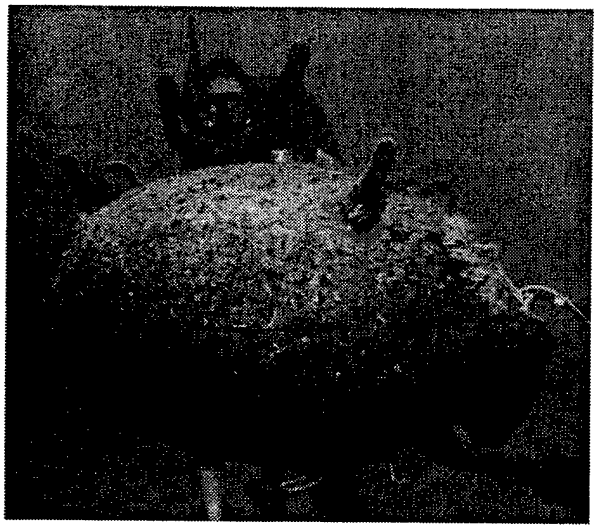
EQUIPMENT CHARACTERISTICS	LCAC	LCU 1646 CLASS	CRRC	AAV 7A1-PERSONNEL[2]	AAAV-PERSONNEL VARIANT[3]
DIMENSIONS:[1]					
Length	80 feet 5½ inches	135 feet	15 feet, 5 inches	26 feet 7 inches	29 feet 4 inches on land 38 feet 3 inches on water
Beam/Width	47 feet (on cushion)	29 feet	6 feet, 3 inches	10 feet 9 inches	14 feet 6 inches across retractable chine flaps (skirts)
Height	23 feet 6 inches (on cushion)	TBD	1 feet, 8 inches (bouyancy tube diameter)	10 feet 3 inches	10 feet 6 inches
Draft	2 feet 10 inches (landing structure off cushion)	7 feet		68.7 inches	
Weight/ Displacement	151 tons (135.9 metric tons) full load	190 tons	265 pounds (in carrying bag)	46,314 lbs empty 60,758 lbs combat equipped with cargo	61,614 lbs empty 70,925 lbs combat equipped
Speed	40+ knots in Sea State 2 30 knots Sea State 3 5-15 knots overland	11 knots (full load)	25 knots	20-30 mph (land) 45 mph maximum 8 mph (water)	45 mph (land) 23-29 mph (20-25 knots) high water speed 8-10 mph (7-9 knots) in transition
Power Train	4-Avco-Lycoming TF40B gas turbines 2 shrouded propellers and 2 bow thrusters 4-63 inch diameter centrifugal lift fans on-off cushion within 20 seconds	TBD	One or two 35 HP outboard I-MARS engines	Cummins VT400 903 cubic inch multifuel track and water jet propulsion	MTU MT883 K-523 Diesel; 2600 HP water mode 800 hp land mode water propulsion using two 23" diameter water jets retractable hydro-pneumatic suspension system
Ground Pressure	TBD	Not Applicable	Not Applicable	8.0 psi	8.9 psi
Cruising Range	200 miles at 40 knots with payload	TBD	Not Applicable	300 miles land @ 25 mph. 7 hours water 2,600 rpm	300 miles 75 miles
TERRAIN OPERATING CHARACTERISTICS	13 degree maximum grade; Up to 5 degree continuous ground slope. Up to 4 feet vertical step up. Up to 5 feet ditch traverse Up to 5 feet grass, reeds, and under-growth	None	None	8 feet trench span. 3 feet vertical step up.	8 feet trench span 3 feet vertical step up.

Notes:
1. Craft and Vehicle Data Sheets use English measurements.
2. AAV weight, on-vehicle equipment, and weaponry vary with the Communications and Recovery vehicle variants.
3. Vehicle is undergoing development. Dimensions and characteristics will vary for the Communications vehicle variant.

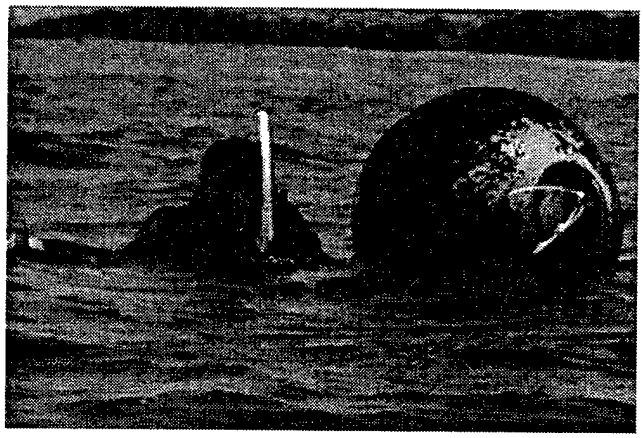
Table B-10 *(continued):*

EQUIPMENT CHARACTERISTICS	LCAC	LCU 1646 CLASS	CRRC	AAV 7A1-PERSONNEL[2]	AAAV-PERSONNEL VARIANT[3]
CAPACITIES:					
Crew	5			3	3
Troops	24 vehicle operators 80 troops or 108 stretchers using personnel transportation container. See Figure A-1	400	10 maximum, 6-8 with equipment	21 combat equipped troops	18 combat equipped troops
Cargo	Up to 75 short tons	200 tons		10,000 lbs in lieu of troops	5,130 lbs in lieu of troops
Cargo Compartment Dimensions	67 x 27 feet (1809 sf)	15 x 26 x 105 feet (2300 sf)	59 x 28.5 x 24 inches	13.5 x 6.0 x 5.5 feet	To be determined
Ramps	Bow and stern	Bow and stern	Not applicable	Stern and top troop hatches	Stern and top troop hatches
Sample Cargo Loads	1-M1AI main battle tank 3 AAVP7A1, 5 LAV, or 2 M923 5-ton trucks towing 2 M198 howitzers, and 2 HMMWV	3-60 ton M60A1 tanks	Personal combat equipment	17-55 gallon drums 400 cases of rations, or 330 5-gallon water cans	To be determined
COMMUNICATIONS	VHF, HF, navigation radar	VHF, HF, navigation radar	Man-pack radios and GPS	VHF, HF, GPS	VHF, HF, GPS
WEAPONS	No installed weapon systems	No installed weapon systems	No installed weapon system Individual small arms only	.50 caliber machine gun 40 mm grenade launcher	25mm Bushmaster cannon 7.62 mm machine gun
POTENTIALLY SIGNIFICANT PROGRAMMATIC IMPACTS	Disturb sea turtle nests, onshore vegetative habitat, and cultural sites	Coral damage by hull or stern anchor contact	None	Damage to coral, disturb sea turtle nests, onshore vegetative habitat, and cultural sites	Damage to coral, disturb sea turtle nests, onshore vegetative habitat, and cultural sites

Notes:
1. Craft and Vehicle Data Sheets use English measurements.
2. AAV weight, on-vehicle equipment, and weaponry vary with the Communications and Recovery vehicle variants.
3. Vehicle is undergoing development. Dimensions and characteristics will vary for the Communications vehicle variant.



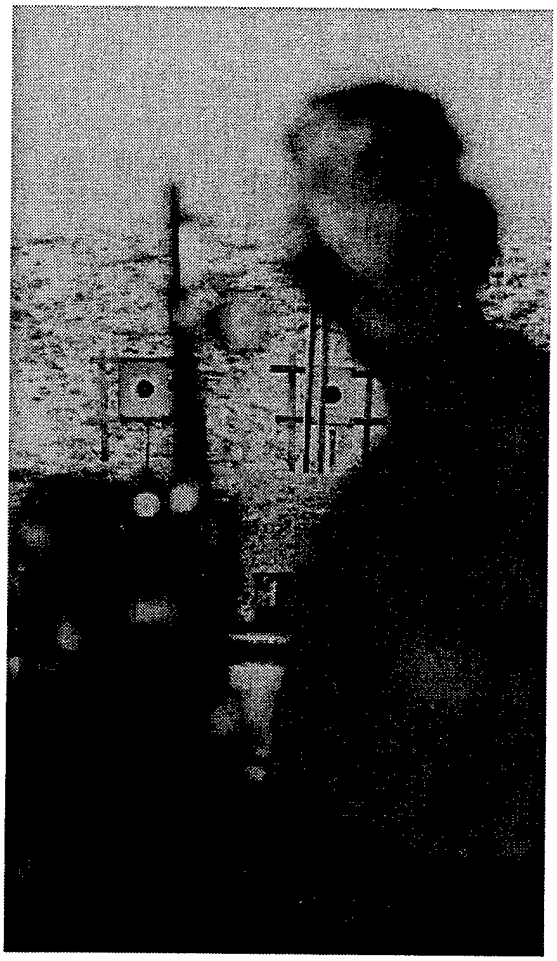
EOD mine countermeasures



EOD mine countermeasures



SEAL sniper team at rifle range



Pistol range



Marine with 60mm mortar

Source: University of Texas website; U.S. Navy file photos

B-11: LIVE FIRE AND UNDERWATER DEMOLITION PHOTOS

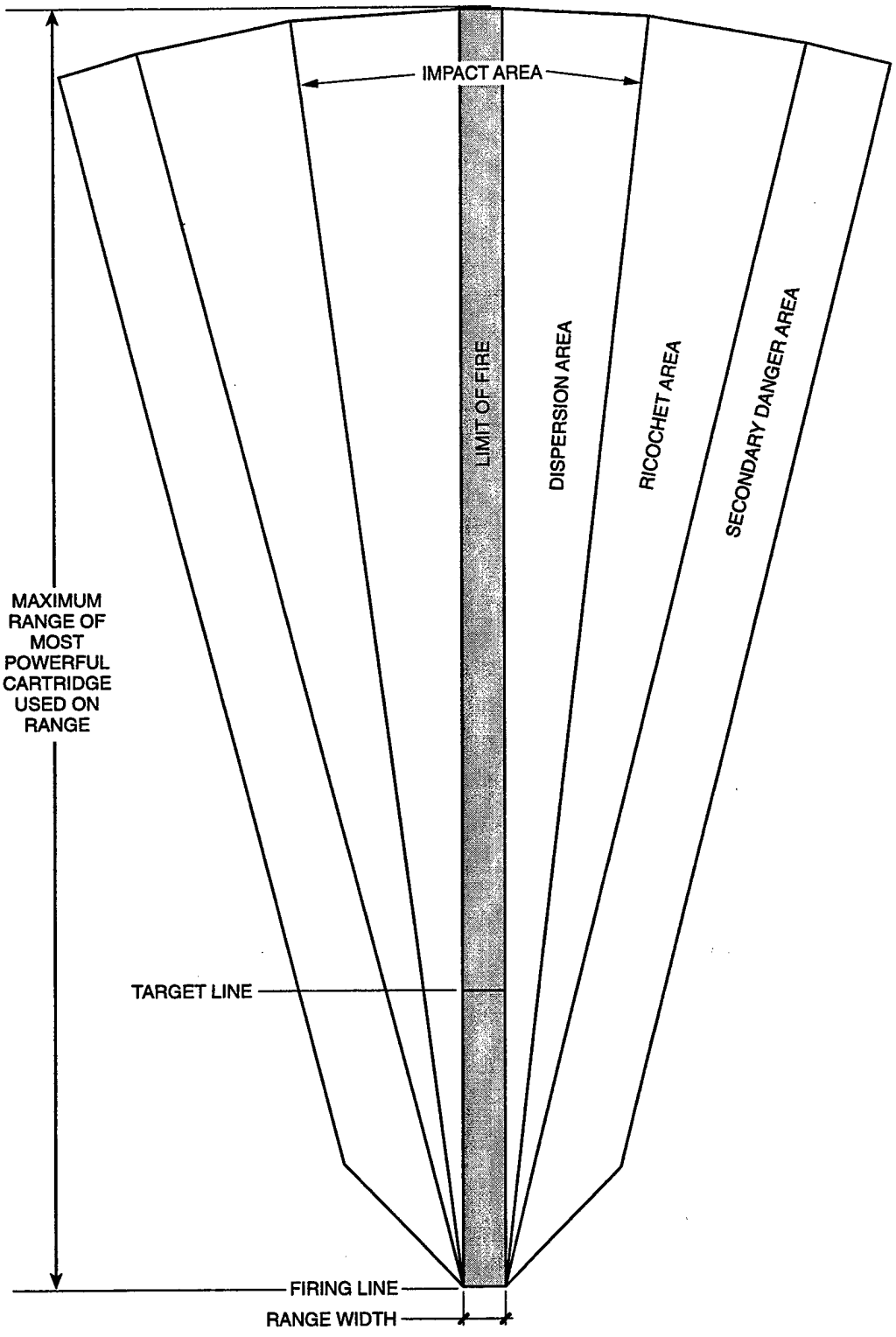
Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



A shooting house is a house equipped with bullet traps and a roof to prevent projectiles from leaving the premises. There is a space between the top of the walls and the roof to allow for through ventilation.

Table B-13 Firing Range and Weapon Technical Information

ACTIVITY	WEAPONS EMPLOYED	POTENTIALLY SIGNIFICANT PROGRAMMATIC IMPACTS
Small arms range: known distance or fire and maneuver	5.56 and 7.62mm rifles, squad automatic weapons and light machine guns, 9mm submachine guns	Effects to air and maritime navigation Fire Temporary closure of EMUA to civilian access
Mortar range	60 mm mortar	Effects to air and maritime navigation UXO
Shooting house	5.56 and 7.62mm rifles, squad automatic weapons, 9mm submachine guns	Temporary closure of EMUA to civilian access
Breaching house	5.56mm rifles and "Simunitions" 1/4 pound explosive charge	Temporary closure of EMUA to civilian access



A Surface Danger Zone (SDZ) is the area endangered by a particular type of weapons firing. It consists of an impact area, a dispersion area, a ricochet area, and a secondary danger area. All projectiles and fragments will be contained within the SDZ. The fan shape and size is specific to the weapons used on the range.

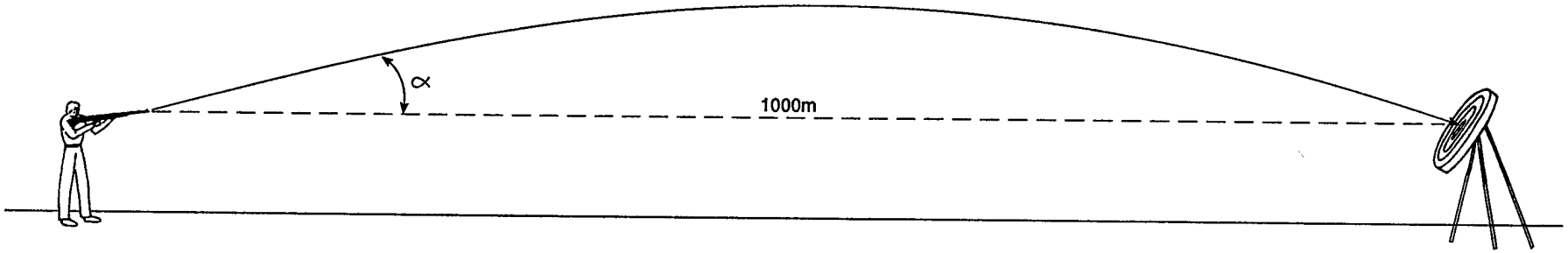
Source: *Range Facilities and Miscellaneous Training Facilities, other than Buildings,* NAVFACENGCOM, MIL-HDBK-1027/3, 1988

NOT TO SCALE

B-14: SURFACE DANGER ZONE

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

342.041/007-18 r12.9.97



∝ = Angle of fire

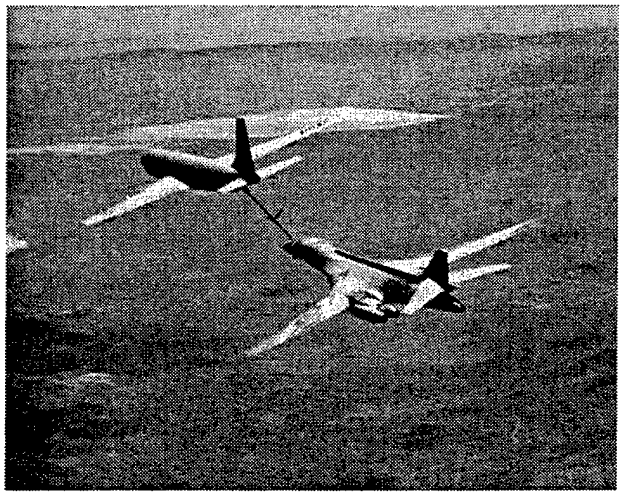
NOT TO SCALE

B-15: BALLISTIC TRAJECTORY

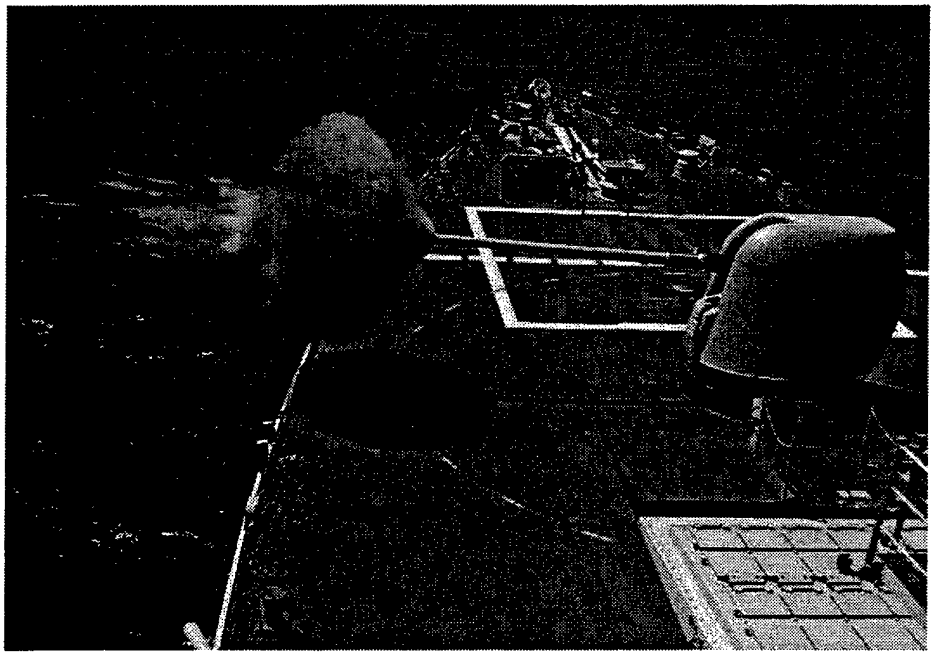
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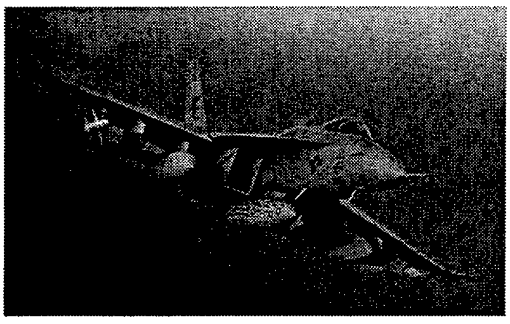
Navy ordnancemen load AIM-9 missile



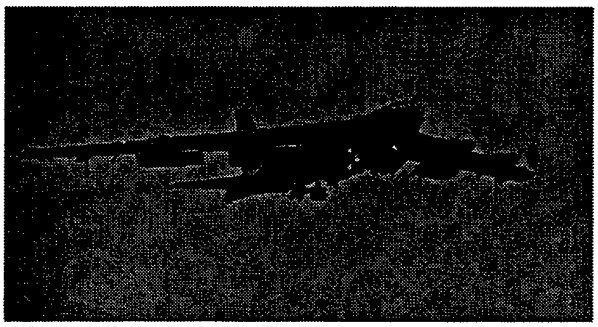
KC-10 refueling a B-1 bomber



Naval gunfire: 5" 54 caliber gun



F/A-18

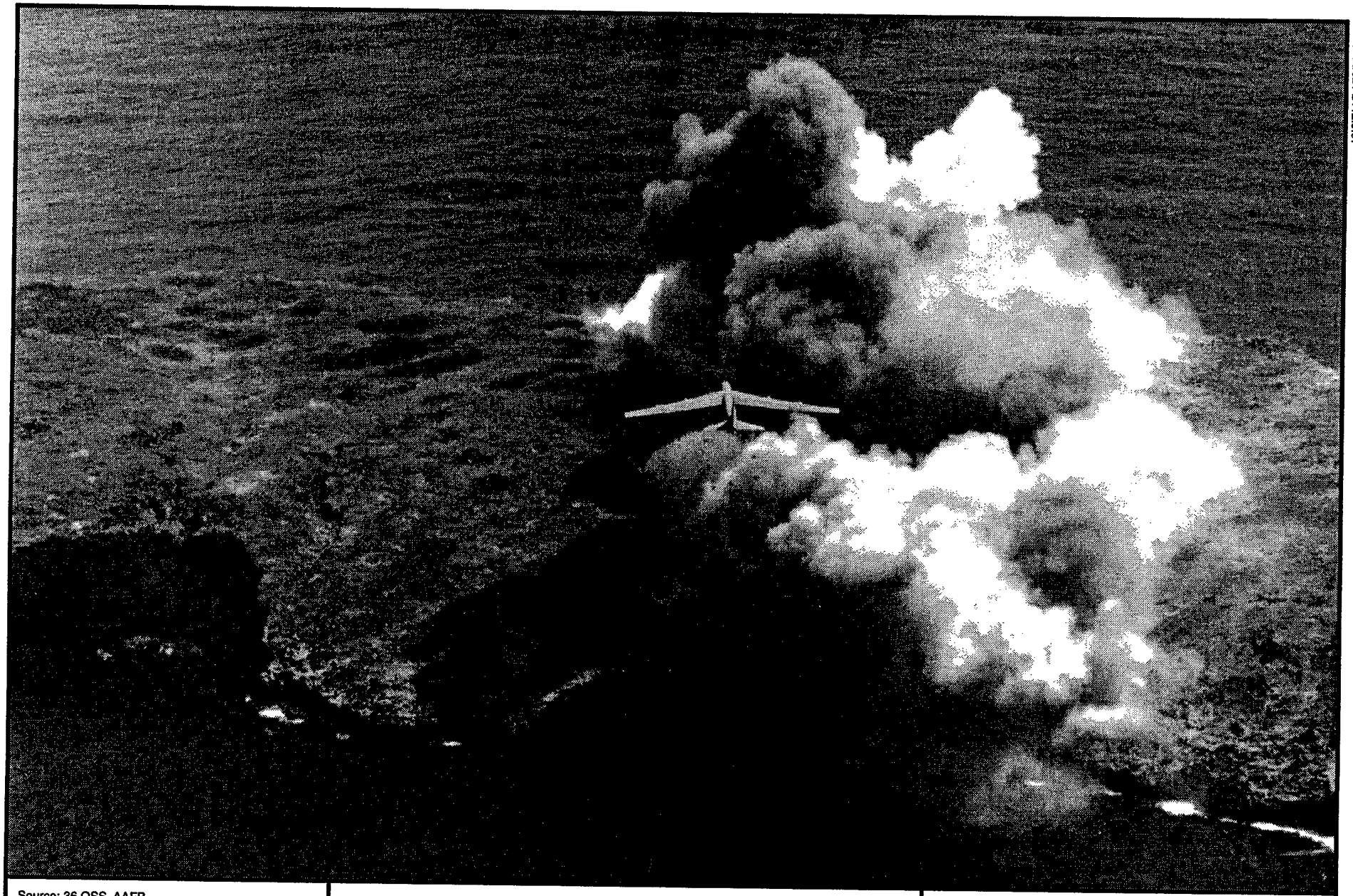


B-52 bomber

Source: U.S. Navy file photos (CHINFO): Andersen Air Force Base file photos

B-16: AERIAL BOMBARDMENT AND NAVAL GUNFIRE PHOTOS

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998



342.0414/021-2-r12.9.97

Source: 36 OSS, AAFB

B-17: FDM BOMBING PHOTO

Revised DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

Appendix C
Marine Assessments of Guam and Tinian

C-1: Preliminary Assessment of the Nearshore Marine Environments Off of Beaches on the Island of Tinian, CNMI: Potential Impacts from Amphibious Landings, Tandem Thrust 95 (September 26, 1994)

C-2: Marianas Environmental Impact Statement Marine Environmental Assessment Guam and Tinian (September 6, 1996)

C-3: Marine Environmental Impact Assessment for Military Training Exercises Off Tipalao and Dadi Beaches, Guam Naval Station, Guam, Mariana Islands (September 1997)

Appendix C-1
Preliminary Assessment of the Nearshore Marine Environments Off of Beaches on the Island of Tinian, CNMI: Potential Impacts from Amphibious Landings, Tandem Thrust 95 (September 26, 1994)

For complete report (including figures and tables) see *Environmental Assessment, Military Exercise, Island of Tinian: Tandem Thrust 95* (November 1994) Belt Collins Hawaii. Prepared for Pacific Division, Naval Facilities Engineering Command.

PRELIMINARY ASSESSMENT OF THE NEARSHORE MARINE ENVIRONMENTS OFF OF BEACHES ON THE ISLAND OF TINIAN, CNMI

POTENTIAL IMPACTS FROM AMPHIBIOUS TROOP LANDINGS TANDEM THRUST 95

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September 26, 1994

I EXECUTIVE SUMMARY

During the period of May 30-June 1, 1994, beach and nearshore environments on the Island of Tinian, CNMI, were surveyed in order to determine the potential for environmental impacts from military exercises that include amphibious beach troop landings as part of the Tandem Thrust 95 program. Beaches were ranked according to the likelihood of environmental damage to the existing biotic communities, as well as damage to landing craft.

Unai Dangkolo (Long Beach) appears to be the most unsuitable site for the proposed exercises. A shallow reef flat is separated from the open ocean by a continuous exposed limestone reef crest. Both the reef flat and reef front on the ocean side of the reef crest are inhabited by very rich and diverse biotic assemblages, primarily stony, reef-building corals. Access to the beach from the ocean would likely result in serious damage to the marine environment, as well as to the landing craft. If beach landings area required at this site, it is suggested that access takes place at the northern end of the beach in an area that appears to be dredged on the reef flat using only air-cushion vehicles at high tide.

Unai Chulu (Invasion Beach) is more suitable for landing exercises than Dangkolo owing to the lack of an exposed reef crest which could damage vehicles. However, the reef flat also is colonized by a relatively rich and diverse fauna that should not be exposed to physical rigors of tracked landing craft. The inner reef flat, however, is primarily sand which could tolerate landings with relatively little impact. Thus, if tracked or air-cushion vehicles are capable of traversing the reef while not touching the bottom until a depth of less than approximately 1 m (3 feet) is reached, safe landings could proceed with relatively little destruction of existing communities. As coral cover is substantially higher off the southern end of the beach, landings should take place toward the northern sector.

Unai Babui is a more suitable landing site than Chulu from the marine standpoint, as the reef flat is relatively barren, with little living coral at depths shallower than 2 m (6 feet). However, the extremely small size of the beach, both in terms of length and width appear to make landings impractical as there is very little room to maneuver vehicles after landing.

Kammer Beach, located adjacent to the Tinian Harbor appears to be the most suitable site for landing exercises in terms of impacts to landing craft and the marine environment. Adjacent to the sheetpiling that defines the Harbor, there is no reef flat that typifies the other survey areas. Rather, the bottom is relatively deep (>6 feet) from the open ocean to just off the beach front. The physical structure of the area appears to limit circulation to the point where active coral reef growth is not occurring; community structure is dominated by algal mats that can tolerate the poor water conditions. By virtue of the deep water close to shore,

and the lack of biotic communities that can be impacted, this region appears to be highly suitable to landing activities. However, these activities should be restricted to the area within approximately 100 m of the sheetpiling. Beyond this distance, a shallow reef platform with substantial coral reef growth extends southward. As with Dangkolo and Chulu beaches, landings across the shallow reef platform present high potential for negative impacts to both the environment and landing craft.

While no turtles were observed during the course of the preliminary survey, it has been reported that virtually all of the beaches on Tinian are sites for turtle nesting. Because of the high usage of Kammer Beach for human activites, it is likely that this location might be the least potentially hazardous area for the proposed exercises in the context of impacts to turtle nesting sites.

II. INTRODUCTION

Planning is underway to use the island of Tinian, Commonwealth of the Northern Marinas Islands (CNMI), for a variety of tactical and logistic military training exercises designated Tandem Thrust 95. The purpose of the proposed military exercises on Tinian is to increase the readiness of Pacific Command forces to respond to contingencies as directed by national command authority. Major portions of Tinian have been leased to the U.S. for the purpose of conducting such exercises.

One component of the training will involve landing troops on the Island using amphibious landing craft that are launched from ships, traverse the nearshore zone, and exit the ocean on accessible beaches. Two types of landing craft are considered for use; one type is propelled on an air cushion with minimum penetration below the sea surface; the second is propelled on tracks which are capable of driving the craft from deep water over shallow submerged surfaces to the beach landing site.

These proposed training activities present the potential to cause negative impacts to the marine and terrestrial environments where the actions will take place. In order to minimize, or eliminate, the potential for such negative impacts, preliminary surveys were conducted of the prospective beach areas that exist on Tinian. The purpose of these surveys was to qualitatively assess the marine environment in order to prioritize the existing beaches for use as amphibious landing training locations. Our prioritization ranks the beach sites in order of acceptability for the prospective activities with respect to environmental damage. Thus, the lowest ranking location (priority 1) has the lowest potential for negative impact, while the highest ranking location (priority 4) has the highest potential for damage.

As stated above, the scope of the present project was to qualitatively evaluate the effects of beach landings. This scope was achieved by conducting qualitative evaluations of the field sites, with the resulting conclusions based primarily on the investigators experience and expertise from other locales. The scope did not include quantitative assessments of community structure, including temporal variability, or detailed descriptions of cryptic biotic assemblages. Species lists assembled during the fieldwork are not intended to be exhaustively complete; they are intended primarily to provide a general picture of the community structure, and to provide relative comparisons between the survey sites. The primary goal of the assessment was to investigate components of the marine environment. However, we have also included baseline information on the terrestrial environment, specifically with respect to describing major vegetation and bird assemblages. Presented below are the methods, results, and conclusions of the investigation of the beach environments of Tinian, CNMI.

III. METHODS

Fieldwork for the present assessment was conducted during the period of May 30-June 1, 1994. Field survey methods for the marine environment consisted of diver/scientists observing the offshore area from the shoreline to a distance offshore deemed to be beyond the effects of amphibious craft. Reconnaissance swims were conducted along the length of the beaches using SCUBA equipment on the outer reef fronts. The reef flats, extending from the shoreline to the reef crests were surveyed using snorkeling gear. No time limits were imposed on any of the surveys; investigators remained in the water until it appeared that all communities had been adequately observed. During the reconnaissance surveys, species lists were recorded on waterproof writing paper. Species were also ranked according to abundance into four classes (abundant, common, occasional, and rare). Major components of the communities were also recorded photographically to provide a permanent record.

While not part of the scope of work, preliminary assessments of the terrestrial fauna and flora were made at the Dangkolo and Chulu sites. Terrestrial surveys were conducted by investigators walking the backbeach area and recording bird and vegetation types.

The surveys were conducted by Dr. Steven Dollar of Marine Research Consultants, Honolulu HI, and Mr. Ron Strong and Mr. Michael Gawel of Pacific Basin Environmental Consultants, Agana, Guam.

IV. RESULTS AND CONCLUSIONS

Figure 1 shows a map of the Island of Tinian with the locations of the four beaches that were surveyed. Unai Dangkolo (Long Beach) is located on the eastern (windward) side of the Island. Unai Chulu (Invasion Beach) and Unai Babui are located on the northern end of western (leeward) side of the Island. Kammer Beach is located in the southern end of the western coast adjacent to Tinian Harbor.

Tables 1-3 are species lists for benthic invertebrates, algae, and reef fish, respectively, compiled for each of the beach survey sites. For Dangkolo and Chulu sites, two lists were developed; one from the outer "reef front" extending from the reef crests to deep water, and one from the "reef flat" extending from the shoreline to the reef crests. Two lists were assembled for each of these areas because the composition of the biotic assemblages was distinctly different. For the Babui and Kammer sites, only one species list was compiled since the structure of the offshore environment was relatively homogeneous in the offshore direction.

Unai Dangkolo (Long Beach)

Terrestrial Environment

Beach Structure

Dangkolo (Long Beach) is the largest beach on Tinian, extending approximately 150 m between limestone cliffs. The area is actually composed of one large beach and several smaller crescent-shaped sandy areas separated by vegetation-covered limestone projections that reach to the shoreline (Figure 2). The beaches slope gently from the backbeach crest to the waterline, and are composed of medium to fine textured, white calcareous sand.

Vegetation

Several large velvet leaf trees (*Tournefortia argentea*) provide shade on the otherwise open, upper zone of Dangkolo Beach. Grasses, weeds, vines and shrubs provide ground cover, including *Bidens pilosa, Stachytarpheta indica, Lantana camara* and *Thespesia populnea*. At the time of the survey, only a very limited amount of the normally abundant beach morning-glory (*Ipomea pescaprae*) was present along the beach. It is possible that grazing by cattle, which seem to frequent the beach area, may be responsible for the reduction in cover.

The back strand and rocky limestone cliff areas that surround the beach are dominated by *Pemphis acidula, Thespesia populnea, Hibiscus tiliaceus, Bikkia tetranda, Pandanus sp., Leucaena leucocephala, Scaevola sericea,* and *Barringtonia asiatica*. Other less common species in the area include *Carica papaya, Casurina equisetifolia, Mammea odorata, vitex negundo, Sophora tomentosa,* and *Eugenia palumbis*.

Birds

The bird fauna of Unai Dangkolo consists primarily of forest and seabird species that frequent or live in the forested areas landward of the beach strand. Since the survey was conducted in late May, migratory shorebirds that would normally be present during the winter months had already left the island. It would be the shorebird habitat that would be disturbed if the proposed exercises were conducted on the beach since the forest birds live in habitats that would not be impacted, given the openness of the beach and the available access road. Therefore, an avifauna survey for shorebirds should be conducted during the appropriate time of year (October - April) in order to properly assess the shorebird population.

Common bird species observed or heard include the Philippine turtle dove (*Streptiopelia bitorquata*), observed along the beach access road, white terns (*Gygis alba*), bridled white-eyes (*Zosterops conspicillatus*), rufous fantails (*Rhipidura rufifrons*) and the Tinian monarch (*Metabolus rugensis*). Two Micronesian starlings (*Aplonis apaca*) were also observed, along with three collared kingfishers (*Halcyon chloris*) which blew back and forth over the beach. No rare or endangered species, except for the Tinian monarch, were observed or heard during the field survey.

Marine Environment

Physiographic Structure

The Dangkolo beaches are composed of white calcareous sands that slopes gently into a shallow reef flat separated from the open ocean by a reef crest that is emergent at low tide. The crest is composed of jagged coral rock, and appears to bear most of the concussive force of breaking waves (see Figures 2-4). The reef crest is continuous across the entire run of the beach, resulting in no deep passes from the shoreline to the open ocean. Because of the continuous nature of the beach crest, the area between the beach and the crest is sheltered from high wave action, resulting relatively calm conditions on the reef flat. Owing to the lack of wave stress, the inner reef flat is colonized by extensive reef communities, including diverse assemblages of stony corals (Figures 5-6). Off the northern end of the main beach, a rectangular area of the reef flat appears to be cut from the carbonate platform, forming a sand bottomed channel. The channel is visible as a light-colored swath extending from the shoreline across the reef flat in Figure 2. Inspection of the channel suggest that because of the uniform linear edges, the structure is manmade. However, if the channel was cut, it is not clear for what purpose, as the cut does not extend to the reef crest to afford access to the open ocean.

Seaward of the reef crest, there is an extensive spur-and-groove system that extends to a water depth of approximately 10 m. The grooves appear to be wave cut notches that extend with vertical walls from the upper reef surface to boulder and cobble covered floors (Figure 7). Seaward of the spur-and-grooves, the bottom slopes gradually seaward as a relatively flat carbonate platform that is densely covered with living coral colonies (Figure 8).

Marine Communities

Reef Flat

The dominant physical features of the reef flat that influence biotic community structure are the very shallow depth and relatively calm water afforded by the continuous reef crest.

Because of the sheltered environment, biota on the reef flat are abundant and diverse. The dominant organisms are a rich assemblage of stony corals. Table 1 lists 25 species of coral on the reef flat; *Porites lutea* was the only coral classed as abundant, 9 species were classed as common, 10 species were occasionally observed, and 5 species were classed as rare. Growth forms of corals were generally encrusting, lobate or corymbose (see Figures 5 and 6). Coral cover was estimated at approximately 50-70% of bottom cover in the central region of the reef flat. Coral cover decreased in the nearshore area, where the bottom was predominantly sand. At the inner edge of the reef crest, corals were nearly absent owing to the very shallow depth, and concussive force of breaking waves (Figures 3 and 4). Coral cover was richest at the northern end of the main beach area (in the region of the apparent channel cut) and decreased somewhat to the south. At the southern end of the beach, coral cover was appreciably reduced compared to the northern, while complexity of the substrate increased substantially.

The other dominant benthos on the reef flat at Dangkolo were sea cucumbers (Holothuridae). Six species of sea cucumbers were observed, primarily in the sandy areas between coral head. Species classed as abundant were *Holothuria atra* and *Actinopyga mauritiana*. With the exception of red algal turf that covered virtually all non-coral hard substratum, macroalgae were not a major component of the biota on the Dangkolo reef flat. Seven species of algae were observed; 3 were classed as common, 2 as occasional, and 2 as rare (Table 2). Reef fish were abundant on the flat; 39 species were identified. Most dominant were butterflyfish (Chaetodontidae), damselfish (Pomacentridae), wrasses (Labridae), and surgeonfish (Acanthuridae) (Table 3).

Reef Front

Because of the exposed nature of the outer reef front (seaward of the reef crest) to open ocean swells, it might be expected that coral community structure would be limited by physical rigor. However, surveys of the Dangkolo reef front revealed that this area contained as abundant and diverse coral community as the reef flat. Tops of the spurs were nearly covered with living coral colonies up to the seaward side of the reef crest (Figure 8). Directly under the breaking waves on the reef crest, the tops of the spurs were relatively barren. In addition, the rubble/boulder covered floors of the grooves were also relatively barren of attached benthos, owing to the continual movement of the unconsolidated material from wave activity (Figure 7). Thirty six species of stony corals were observed on the reef front. Also common on the reef front were "soft corals" of the families Alcyoniidae and Zoanthidae. While abundant on the outer wave-exposed area, the soft corals were rare on the more sheltered reef flat.

Coralline algae were the dominant plants on the reef front, although several genera of green algae (*Halimeda sp.*, *Chlorodesmis sp.* and *Caulerpa spp.*) and brown algae (*Dictyota*

sp. and *Ralfsia sp.*) were occasionally observed on the spurs. As on the reef flat, the reef front contained a diverse assemblage of reef fish, with 36 species observed.

In summary, the marine environment off Dangkolo Beach, including both the inner reef flat and the outer reef front constitute a well-developed reef community with abundant biota, especially in the form of actively accreting coral reefs. The continuous, exposed reef crest that defines the boundaries of the reef flat make entry to the beach from the open ocean difficult at best, for either swimmers or landing craft. Should such landings be attempted, especially from vessels which draw several feet of water, it is inevitable that damage would be inflicted on both the reef and the landing craft. If air cushion vehicles are used for beach landings, traversing the reef crest would still be problematic as the crest is often exposed. However,if such landings are attempted, the preferred location appears to be the northern end of the main portion of the beach in the area that appears to be dredged. Owing to the slightly greater water depth in this area, damage to biota would be minimized with air cushion vessels. Dangkolo Beach is rated as priority 4.

Unai Chulu (Invasion Beach)

Terrestrial Environment

Beach Structure

Unai Chulu is a much smaller and narrower beach than Dangkolo, approximately 50 m in length and 20 m in width (Figure 9). As at Dangkolo, the beach is composed of medium grained carbonate sand that extends from a beach crest to the shoreline. Beyond the margins of the beach to both the north and south are limestone cliffs that extend into the nearshore area. Most of the cliffed area can be considered Karst topography with eroded rough, jagged surfaces. The submerged nearshore region off of the beach consists of a sandy bottom.

Vegetation

The majority of the beach sand at Chulu is covered with the beach morning glory vine (*Ipomoea pes-caprea*). The back beach and beach access road are lined by large ironwood trees (*Casuarina equisetifolia*), scattered coconut palms (*Cocos nucifera*), and scattered shrubs, bushes and trees including *Scaevola sericea, Thespesia populnea*, and *Tournefornia argenta.*

Birds

No shorebirds were observed during the brief field survey on May 31. Birds seen or heard include the collared kingfisher (*Halcyon chloris*), Micronesian starling (*Aplonis opaca*), bridled white-eye (*Zosterops conspicillatus*), Tinian monarch (*Metabolus rugensis*), rufous fantail (*Rhipidura rufifrons*), Philippine turtle dove (*Strptopelia bitorquata*), and Micronesian honeyeater (*Myzomela rubrata*). In addition to the observed species, one call of the Mariana fruit dove (*Ptilinopus roseicapilla*) was heard. As with Dangkolo Beach, a shorebird survey should be conducted between October and April to properly assess the usage, populations and species of birds that utilize Unai Chulu. No rare or endangered species of birds, except for the Tinian monarch, were observed during the field survey.

Marine Environment

Physiographic Structure

The offshore area of Unai Chulu is made up of several very distinct zones, each with a characteristic physical make-up and corresponding biota. The zone nearest to the shoreline can be termed a sand flat, and is composed of white calcareous sands. The predominant biota on the nearshore sand flats are sea cucumbers, which are extremely abundant (Figure 10). Corals, and most other motile invertebrates were rare on the sand flat fronting the beach. Approximately 25 m from the beach face, the sand flat grades into a flat limestone platform predominantly covered by an algal turf, and colonized by scattered colonies of coral, sea urchins, sea cucumbers, and macroalgae (Figure 11). Coral cover on the inner flat is substantially lower than in the corresponding area of Unai Dangkolo; at Chulu coral cover of the inner flat was estimated at 2-5%, while at Dangkolo cover was greater than 50%.

Unlike Unai Dangkolo, the reef flat at Chulu is not separated from the reef front by a distinct reef crest that absorbs the force of breaking waves (note the difference in white water at the reef flat margins in Figures 2 and 9). Rather, the nearshore reef flat continues as a shallow limestone platform with increasing coral cover with distance seaward. The outer reef crest remains shallow in depth (approximately 1 m), and is the area that is exposed to normal wave forces. Coral cover on the outer reef flat is relatively high (estimated at 20-40% of bottom cover), composed primarily of finely branched species of Acropora (Figures 12 and 13). It is somewhat surprising that the cover of relatively fragile corals is as high as was observed in a shallow area that is not sheltered from waves. In addition to the inshore-offshore zonation, there was also a considered gradient in coral cover in the alongshore axis of the

beach. Coral cover was substantially higher in the southern region off Chulu beach than the northern section.

Seaward of the flat reef platform crest at Chulu, there is an extensive spur-and-groove system that extends to a water depth of approximately 10 m. Figure 9 clearly shows the extent of the reef flat and the spur and groove system. Cut into the grooves are numerous caves, undercuts and ledges, making the topographical relief of the area much higher than at Dangkolo. The grooves appear to be formed from wave cutting as well as possibly dissolution of carbonate by freshwater, and extend with vertical walls from the upper reef surface to boulder and cobble covered floors. The top surfaces of the spurs are covered with a diverse assemblage of corals, predominantly with stubby, densely packed branching growth forms (Figure 14). Seaward of the spurs and grooves, the bottom slopes gradually seaward as a relatively flat carbonate platform that is densely covered with living coral colonies. Military debris, apparently dating back to the 1944 invasion on Chulu, including landing craft and large anchors (Figure 15) was abundant in the deeper offshore areas.

Marine Communities

Reef Flat

The dominant benthos on the inner reef flat at Chulu were sea cucumbers (Holothuridae). Six species of sea cucumbers were observed on the sandy flat. The most common cucumbers were of the species *Holothuria atra*, *H. leucospilota*, and *Actinopyga mauritiana*. In some areas, the density of sea cucumbers on the sand flat was on the order of 10 per square meter (Figure 10).

Table 1 lists 25 species of coral on the Chulu reef flat; no species were classed as abundant, 5 species were classed as common, 10 species were occasionally observed, and 10 species were classed as rare. Growth forms of corals were encrusting, lobate or finely-branched corymbose (see Figures 12 and 13). Coral cover was estimated at approximately 25-35% of bottom cover in the outer northern region of the reef flat, and 50-60% of bottom cover at the southern region of the outer reef flat. Coral decreased in the nearshore area, where the bottom was predominantly sand.

Macroalgae were more abundant on the reef flat at Chulu than Dangkolo. Thirteen species of algae were observed, with all but one classed as common or occasional in occurrence (Table 2). The most dominant forms were encrusting red coralline algae growing on limestone substratum, and a variety of green algae including *Halimeda spp.*, and *Caulerpa racemosa*. Reef fish were less abundant on the flat at Chulu compared to Dangkolo; 27 species

at Chulu compared to 39 species at Dangkolo. No fish species were classed as abundant, 4 species were classed as common, 13 species were classed as occasional and 10 were assessed as being rare in occurrence (Table 3). Most dominant were damselfish (Pomacentridae) and wrasses (Labridae). Butterfly fish (Chaetodontidae) and surgeonfish (Acanthuridae), which were abundant on the reef flat at Dangkolo were rare at Chulu (Table 3).

It is also interesting to note that the communities on the reef flat are probably all recolonizers since the invasion of Tinian that took place in 1994. Inspection of photographs of the amphibious landings conducted by the U.S. armed forces suggests that much of the coral growth on the reef flat was probably destroyed by impact from landing craft. Thus, the existing communities provide an idea of the extent of recolonization and recovery can take place from such an event.

Reef Front

Surveys of the Chulu reef front revealed that this area contained as abundant and diverse coral community as the reef flat. Tops of the spurs were estimated to have approximately 50% cover of living coral colonies (Figure 14). The rubble/boulder covered floors of the grooves were relatively barren of attached benthos, owing to the continual movement of the unconsolidated material from wave activity. Thirty-one species of stony corals were observed on the reef front. Also common on the reef front were "soft corals" of the families Alcyoniidae (Table 1). As at Dangkolo, the soft corals were rare on the more wave-sheltered reef flat.

Coralline algae were the dominant plants on the reef front; frondose algae were relatively rare compared to the reef flat area. As on the reef flat, the reef front contained a diverse assemblage of reef fish, with 43 species observed (Table 3).

In summary, the marine environment off Chulu Beach, including both the inner reef flat and the outer reef front constitutes a well-developed reef community with abundant biota, especially in the form of actively accreting coral reefs. The lack of a continuous, exposed reef crest that defines the boundaries of the reef flat, however, make entry to the beach from the open ocean much less difficult for both swimmers and landing craft than at Dangkolo. While landings with craft that have tracks would likely result in damage to corals and other benthos on the shallow outer reef flat, such damage would likely be substantially less than at Dangkolo owing to the predominantly sandy bottom in the nearshore area. At Dangkolo, there was no such sand zone, and coral cover was high in very shallow water virtually up to the shoreline. If air cushion vehicles are used for beach landings at Chulu, it is possible that impacts would be minimal to both the environment and the vehicles, as there is no substantial exposed reef crest.

If landings are attempted at Chulu, the preferred location appears to be the northern end of the main portion of the beach as coral cover is lower in this region than off the southern end of the beach. Unai Chulu is rated as second lowest priority 3.

Unai Babui

Terrestrial Environment

Beach Structure

While not in the original scope of work as a study site, Unai Babui was investigated during a brief field survey. Survey effort at Babui was thus less than either Dangkolo or Chulu beaches. However, even with the reduced effort, a good preliminary understanding of the potential impacts from amphibious landings was obtained.

Unai Babui is a very small beach, estimated at 25 m long, located several hundred meters north of Unai Chulu. The sand component of the beach is also very small, with much of the shoreline just above the waterline composed of rough, exposed limestone. Vegetation extended much closer to the waterline than at either Dangkolo or Chulu. As a result, there is very little space for maneuvering vehicles on the beach following exit from the ocean.

Marine Environment

Physiography

The nearshore environment offshore of Unai Babui was relatively homogeneous from the shoreline to the offshore limits of the survey (approximately 50 m from shore). From the waterline, a relatively flat limestone platform grades gradually seaward. Within approximately 25 m from shore, the platform is nearly devoid of biota other than a thin algal turf (Figure 16). As at Chulu, there is no emergent reef crest separating the reef flat from the reef front. Moving seaward across the reef flat, water depth gradually increases to a reef margin with slightly more vertical relief in the form of grooves and pits in the limestone platform (Figure 17). Moving seaward, the platform takes on the spur-and-groove structure observed at the other beaches described above. The predominant difference in physiography between Babui and Chulu beaches is the near total lack of growing corals throughout the nearshore region.

Marine Communities

As stated above, it was rather surprising that there was such a dramatic variation in community structure offshore of Babui and Chulu. Only 2 species of corals were observed on the reef flat, and these were small colonies that were rare or occasional in occurrence (Table 1). Likewise, the reef flat was devoid of motile invertebrates including sea cucumbers which were extremely abundant in the corresponding zone at Chulu. Only 2 species of fish (*Chrysiptera spp.*) were observed on the reef flat (Table 3).

Farther offshore, the reef margin was more populated by both attached and motile biota. Nine species of corals were observed, although the overall coral cover was estimated at only about 10% of bottom cover. Sea urchins and sea cucumbers were also observed on the reef margin, but not to the degree of either species number or density of individuals that were noted at both Dangkolo and Chulu (Table 1). Eighteen species of fish were observed on the outside reef (Table 3).

In summary, the marine environment appears relatively suitable for the proposed activities owing to a very low component of living community components in the nearshore area that might be affected by landing craft. In addition, there is no emergent reef crest, and the reef platform is smooth and without projections that could damage landing vehicles. The disadvantage to Babui as a landing site is the very small size of the beach area, both in terms of longshore span of beach, and the width of the beach fronting the vegetation. Unai Babui is rated as priority 2.

Kammer Beach

Terrestrial Environment

Beach Structure

Kammer Beach is located just to the south of a large sheetpiled area that extends perpendicular to the shoreline, and defines the border of the deep water Tinian Harbor (Figure 18). The beach is several hundred meters long and forms a crescent, with a white sand margin approximately 20 m wide (Figure 19). Unlike the other beaches surveyed there is shoreline development landward of the beach face in the form of a park and recreational area. As with Babui, Kammer Beach was not listed in the original scope of work as a target site. Thus, the level of investigation was somewhat reduced compared to Dangkolo and Chulu.

Marine Environment

Physiography

The offshore physiography of Kammer Beach is divided into two major zones. The first zone begins at the sheet-piling and extends south approximately 100 meters. In this area the bottom is composed of sand, rubble and scattered rock (Figure 20). During the survey, water clarity in this region was relatively poor owing to suspension of fine particulate material coupled with little flushing action as a result of poor circulation. Water depth in this area dropped to about 2 m within 10 m of the shoreline and increased gradually moving seaward. Predominant biota in this zone were dense growths of macroalgae (Figures 21 and 22). Living corals were rare and predominantly occurred on rocks elevated off the bottom (Figure 22).

The second offshore zone is defined by an upraised shallow reef platform that starts approximately 100 m from the sheetpiling and extends south along the beachfront. Water clarity on the reef top was substantially better than to the north. The top of the reef was also covered by numerous living coral colonies. The dense growth of macroalgae observed in the area adjacent to the sheetpiling was not present on the reef top.

Marine Communities

The marine environment in the area to the south of the sheetpiling at Kammer Beach is completely unique compared to the other areas surveyed during this study. As described above, there is no reef flat and reef front that typifies Dangkolo, Chulu and Babui. Rather, the nearshore environment is a relatively deep sand expanse. Because of the relatively poor water quality in this area (likely a result of restricted circulation) and the lack of solid substratum, coral growth is limited to only scattered colonies growing on large fragments of rubble. The dominant component of the benthic community is the blue-green algae *Microcoleus lyngbyaceus*, which virtually covers much of the sandy surface (Figures 21 and 22). This algae has the appearance of green to yellow tufts of fine filamentous strands with very weak attachment to the bottom. The weak attachment is broken with even the slightest water motion (such as the wave of a hand), resulting in dispersal of the filamentous strands in the water column. Owing to the weak attachment, this algae can only survive in areas of minimal currents or wave action. The combination of poor water quality and extensive growth of *Microcoleus lyngbyaceus* indicates that the area adjacent to the sheetpiling is rarely flushed by wave action. In addition to *Microcoleus lyngbyaceus*, other algae that were abundant were *Caulerpa spp.*, *Halimeda spp.*, *Asparagopsis taxiformis* and *Padina sp.* Unlike the other beach sites, encrusting red coralline algae were not common off Kammer Beach.

The second zone off Kammer Beach is the upraised reef platform that originates approximately 100 m from the sheetpiling. Water clarity in this area is substantially better than in the region described above, as is benthic community structure. The massive algal coverage that characterized the northern Kammer zone is not found on the platform. Rather the platform is colonized with a relatively high cover of corals. The most prevalent coral is the branching *Acropora nasuta*, which appears as the purple corals in Figure 23. Thirteen species of corals were observed on the reef top, covering an estimated 20-40% of the reef surface. Thirty species of fish were also observed on the reef platform.

In summary, the area off Kammer Beach adjacent to the sheetpiling appears to be ideal for an amphibious landing site. The lack of a reef flat and crest results in deep water right up to the beach face. As a result, landing craft could reach the beach with a minimum of impact to either the environment or the vehicles. In addition, the dominant community in the area, algal mats, appear to essentially weed species that are able to tolerate relatively poor water quality conditions that are beyond the tolerance limits of many other biotic assemblages. As such, disruption of this community, should it occur during the landing exercises cannot be considered significant, as the weedy species would likely rapidly recolonize the area.

However, the area that appears suitable for landing exercises off Kammer Beach does not include the reef platform area to the south of the deep sand/rubble region. The shallow depth of the platform would make landing exercises difficult without damaging a substantial portion of the coral community. The area off Kammmer Beach adjacent to the sheetpiling is rated as priority 1 for beach landing exercises.

Turtles Nesting

No turtles or turtle nests were observed on any of the beaches during the course of the surveys. However, discussions with officials from the Coastal Resources Management Office indicated that most of the beaches on Tinian are the sites of sea turtle nesting. Because of the other human activities in the region of Kammer Beach, this area may be the least desirable site for nesting. However, more definitive data on sites for nesting should be assembled and factored into the priority ratings for beach landing activities before final decisions are rendered.

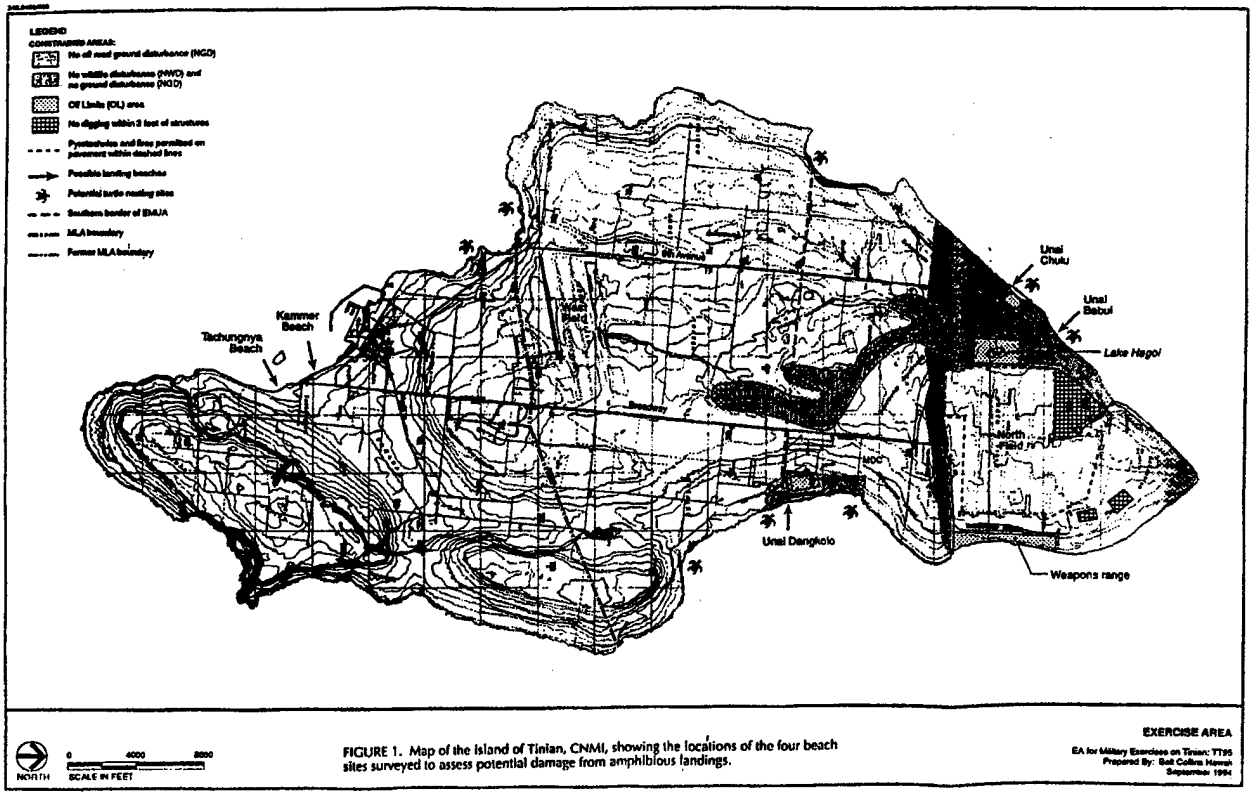


FIGURE 1. Map of the island of Tinian, CNMI, showing the locations of the four beach sites surveyed to assess potential damage from amphibious landings.

EXERCISE AREA

Appendix C-2
Marianas Environmental Impact Statement Marine Environmental Assessment Guam and Tinian (September 6, 1996)

MARIANAS ENVIRONMENTAL IMPACT STATEMENT

MARINE ENVIRONMENTAL ASSESSMENT

GUAM AND TINIAN

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September 6, 1996

A. GUAM

1. SEAL Shallow Water Mine Training Locations

Seven sites in and around Apra Harbor were surveyed for suitability for shallow water mine countermeasure training exercises by Navy SEALS. Field investigations were conducted by Dr. Steven Dollar working from a small boat. Field investigations consisted of qualitative reconnaissance of the areas under investigation using SCUBA apparatus. SEAL personnel (Petty Officer Glen Davis) assisted in the field investigations and provided input as to the description of the training exercises and the desirable characteristics of mine countermeasure training sites. Exercises consist of locating, deploying, and disarming mine charges with consisting of approximately one pound of explosive. Exercises are generally carried out at night in shallow water (less than 20 feet). No information appears to exist describing the radius of impact of such charges that might affect corals or other biota. However, because there is obviously potential to impact biota, a major criteria of evaluation was the extent of active reef growth in the surveyed areas. Locations of survey sites are shown in Figure 2.2 of Environmental Impact Statement for Military Training in the Marianas.

a. Spanish Steps

Located at the southern inner point of the Apra Harbor entrance channel, this area consists of a shallow inner reef shelf that terminates in a sharp shelf break that slopes down to the Harbor floor. The composition of the inner reef shelf consists of limestone spurs and grooves that deepen moving seaward, and are of maximum depth at the shelf break. During the survey, the area was impacted with breaking waves emanating from the north. Owing to the proximity of the Spanish Steps area to the mouth of the Harbor, it is one of the only locales within Apra Harbor that is exposed to long-period swell. Coral cover is absent in the area close to shore (water depth ~3 ft), probably as a result of impact from breaking waves. Moving seaward from the shoreline across the reef shelf, coral cover gradually increases. On the outer region of the reef shelf coral cover consists of relatively isolated colonies, with an estimated total cover of 10-20% in water that ranges from about 4-10 feet in depth. Coral cover increases moving to the east, presumably because wave stress decreases with distance into the Harbor. Because there are relatively large intra-colony areas on the reef shelf between coral colonies, it is possible that mine charges could be deployed with no major impact to corals, as long as the placement of charges was conducted with care. Beyond the shelf break, the sloping reef face is composed of high living coral cover, predominantly consisting of large lobate and branching colonies of *Porites rus*. In sum, the Spanish Steps area could be used for shallow mine training with minimal environmental impacts to reef biota, but is not an optimal area for these exercises.

b. Breakwater Beach

"Breakwater Beach" is a very small area of sand on the inner corner at the end of the Glass Breakwater on the northern side of the Apra Harbor entrance. The shoreline area is composed of large boulders that make up the breakwater. The boulders drop off rapidly to a sandy bottom at a depth of 30-40 ft. Scattered small encrusting coral colonies occur on some of the boulders. No corals or other macrobiota occurred on the sandy bottom at the base of the boulder walls. Because of the lack of biotic community structure, this area is environmentally suitable for mine countermeasure training. However, there is no region of shallow water; the sand floor of the Harbor appears to be deeper than the preferred depth of the SEAL exercises. In addition, the area delineated by the cove formed by the end of the breakwater is very small.

c. Drydock Island

This site is located in a small inlet on the landward side of a man-made peninsula at the back of Apra Harbor called Drydock Island. The entire bottom of the inlet is composed of fine calcium carbonate (limestone) sand/silt. The surface layer of fine material is white in color; several inches below the surface the sediment column is composed of black fine mud indicative of anoxic conditions. Such sediment profiles are not unexpected in areas of low circulation and water movement as is the case in the back of the Harbor. Probing the sand indicated several horizons of soft material before striking solid bottom. Grain size of sediment increases with proximity to the shoreline; at the beach sediment composition consisted of much coarser material than in the center of the cove. The sandy surface is marked by numerous burrow holes, probably from burrowing worms, shrimp or crabs. No corals or other benthic macrobiota were observed on the sediment surface. Consultation with SEAL personnel indicated that the soft sediment surface would not be a detriment to shallow water mine countermeasure exercises. Environmentally, this area appears to be ideal to conduct these exercises as there is no major biotic resources in the area that could be affected by the activity.

d. Polaris Point

This site is located approximately 4,000 feet to the southeast of the Drydock Island site within an embayment created by the man-made peninsula called Polaris Point. Bottom composition in the region is very fine grained calcareous sediment (silt/mud). There is also considerable fine particulate material suspended in the water column. The shoreline in the area is composed of dense mangroves. Much of the shoreline is also lined with concrete rip-rap and assorted construction debris. The region near the shoreline also contains numerous large lobate coral colonies. These corals appear to be impacted by the high level of suspended sediment as large parts of the colonies

are dead, and have accumulated sediment on the dead surface. Many of the coral colonies are growing on and around the concrete structures that line the shoreline. As with Drydock Island, the soft sediment area off the shoreline appears to be a suitable region for mine countermeasure training, as the water depth is shallow. This area also appears to be environmentally favorable to training exercises as long as the mines are not deployed near the shoreline where the coral colonies occur.

e. Gabgab Beach

Gabgab Beach is located on the southern shoreline of outer Apra Harbor, approximately midway between the entrance to the inner Harbor and the main entrance of the Harbor into the open ocean. The physiographic structure of the Gabgab area is similar to the structure at the Spanish Steps site described above. The inshore region consists of a relatively shallow (2-3 feet) and gently sloping carbonate reef flat cut by shallow grooves. At the seaward end of the reef flat (8-10 feet deep), there is a sharp break in slope angle and the reef forms a steep face that drops to the Harbor floor. Coral cover on the reef flat in the nearshore region is relatively low (10-20%) of bottom cover, and increases with distance from shore. At the shelf break and down the channel wall, bottom cover consists virtually entirely of coral cover. The channel wall is composed almost entirely of large growing colonies of *Porites rus*. This area appears to be one of the most well developed coral reefs within Apra Harbor, and is the site of commercial submarine tour operations. Because of the high level of coral reef development in the area, Gabgab appears to be extremely unsuitable environmentally for any training exercises that have the potential to cause any damage to the reef community.

f. Tipalao Beach

Tipalao Beach is a small inlet on the ocean-facing side of Orote Peninsula. Off the southeastern end of the inlet is Neye Island, which is a large rock separated from the main island by a narrow channel. Tipalao Beach is a crescent beach composed of white calcareous sand. From the shoreline seaward to the limits of the embayment, the sea floor is composed of a gently sloping limestone reef platform cut by large cracks and erosional pits. Blocks of old limestone reef, likely broken from the reef platform by typhoon waves litter the floor of the inlet. Very little coral cover occurred on the reef platform, and the few corals that do occur are small flat encrusting species. Previous investigations of the Tipalao Sewage Outfall indicate that this region is regularly impacted by large typhoon-generated surf. As a result coral community development is continually disrupted with little coral accretion. Because of the low degree of reef development, the nearshore area off Tipalao Beach appears to be environmentally suitable for shallow water mine countermeasure exercises with a minimum of impact.

g. Dadi Beach

Dadi Beach is a long (approximately 1 mile) strand of beach to the south of Tipalao Beach. The southern boundary of the beach marks the southern bound of the Apra Naval Base. The shoreline of Dadi Beach consists of a narrow strand of white sand backed by beach vegetation. At several points along the beach, the vegetation extends across the sand to the water line. The inner reef flat seaward of the beach is composed of limestone platform that is covered by mats of blue-green algae. In addition to the mats of blue-green algae, extensive growth of other species of macro-algae dominates the reef flat. With distance seaward, vertical relief of the reef flat increases with pitted and eroded limestone structures that appear to be old coral colonies. While there is extensive "old" coral structure, there is relatively little living coral throughout the region. Living corals that do occur are predominantly small patches of encrusting forms growing on old carbonate structures. The overall appearance of the reef (abundant algae, predominantly dead mature coral structures) suggests that some catastrophic event, or chronic stress has recently impacted the area to cause significant change in coral community structure. However, it is not clear what such an event would be other than typhoon impact. The seaward boundary of the reef platform is bounded by a region of large limestone boulders and reef fragments. Beyond this boundary zone, the bottom is composed of a plain of white carbonate sand. The demarcation between the sand plain and the boulder zone is a distinct drop-off with water depth of about 5 feet at the top of the boulders to 10-12 feet to the sand. The sandy area beyond the reef flat appears to be an ideal area for shallow mine countermeasure exercises as there is essentially no macrobiota in the area. Because of the limited coral community development on the reef flat, this area would also provide a suitable area for shallow mine training with little negative environmental consequences.

The Dadi Beach area also could be a site for landing craft exercises. The transition between the outer sand plain and the inner reef is not abrupt, but generally a gradation. In addition, while much of the reef flat is less than 6 feet deep, there is little live coral to be damaged by tracked vehicles crossing the reef flat. Beach area is abundant at present, and could be increased with removal of shoreline vegetation that extends to the waterline.

II. EOD TRAINING SITES

a. Existing EOD training site inside Apra Harbor adjacent to Glass Breakwater

Navy EOD training currently takes place at two sites inside Apra Harbor adjacent to Glass Breakwater. Training exercises consist of detonation of up to 20 lb. charges on the Harbor floor. Diving reconnaissance was conducted at the two sites in August

1996. Bottom characteristics at both areas was similar. Bottom composition consisted of very fine calcareous silt. Because of the very fine particle size, there was high levels of suspended sediment in the entire water column which resulted in poor visibility. The surface of the sediment was covered in part with a thin mat of blue-green algae. The only predominant macrobiota on the bottom were the green algae *Halimeda* and *Caulerpa*. *Halimeda* is a calcareous alga with paddle-shaped blades which form a predominant component of marine sands. Much of the sediment surface was covered with a layer of dead *Halimeda* blades in various stages of breakdown to sand-sized particles. No corals or other macroinvertebrates, or fish were observed on the reconnaissance dive. Because of the paucity of biotic communities, these areas appear to be ideal locales to conduct EOD training for underwater explosives as long as a site is required within Apra Harbor.

b. Proposed EOD Sites off Dadi Beach

The new site that was selected by EOD personnel is to the south of Neye Island off Dadi Beach. EOD personnel located the area with very precise GPS coordinates. The area is 130-140' deep and consists of a sand hole approximately 100 feet in diameter within a solid fossil reef platform. The reef platform slopes rather sharply to the sand hole from a depth of approximately 60 feet. Such a steep slope does not appear to be advantageous as equipment and charges might roll downslope. Also the walls of the sand hole are several feet high in relief, which would likely be a problem because EOD training exercises require a flat field of view to scan for charges with portable sonar guns. While the sand hole appears to be a suitable setting for detonations of explosives from an environmental standpoint, the physical characteristics of the area appeared to make the sand hole a poor choice.

However, I surveyed the area from a depth of about 80' to the shoreline off of Dadi Beach (several hundred feet to the south of the EOD selected site described above). This entire area appeared optimal for EOD work. The bottom consisted of a very flat featureless sand plain that probably extended to much deeper depths. Only isolated rocks were observed in the nearshore area (less than 20' in depth). The sand plain appeared to be very extensive, and did not have any noticeable biotic community structure. As a result, it appears that the sand plain is an ideal area for EOD exercises.

B. TINIAN

I. Beach Landing Exercises

Field reconnaissance of Chulu and Babui beaches on Tinian was conducted, primarily to groundtruth aerial photographs for feasibility of conducting landing craft exercises for both AAV's and air-cushion vehicles.

a. Chulu Beach

Detailed species lists and descriptions of physiographic structure and marine biota for Chulu and Babui beaches has been provided in previous reports. At Chulu, the offshore region consists of a very shallow reef platform that terminates in a well-developed spur and groove system. These systems consist of buttresses of coral (spurs) separated by deep channels (grooves). Such spur and groove systems are typical of fringing reefs throughout the world as the region separating inner reef flats from outer reefs, and are the areas that absorb most of the energy of breaking waves. The transition zone at the spur and grooves region is abrupt--the edges of the spurs are essentially vertical walls that rise from a depth of 15-20 feet to 1-3 feet. The entire reef crest at the inner juncture of the spur and grooves is 1-3' in depth at a high tide. This shallow reef crest is the area where waves break, dissipating energy that reaches the shoreline. Reconnaissance of the entire offshore region of Chulu revealed that there are no breaks in the reef crest. The area that appears in aerial photographs to be a deep spot off the southern end of the beach is not deeper than the rest of the reef. Rather it appears to be a region where waves focus as coral cover in the area was less than along the remainder of the reef crest.

Coral is lower at the southern end than off the central area but still significant growth estimated at 25-40% of bottom cover on the outer reef crest. Also, there are no areas where the bottom comes up gradually. There is a very distinct change in depth from the deep to the shallow (1-2' deep) reef along the entire frontage. So a tracked vehicle is going to strike the reef with little chance for easing onto the reef platform. Coral community structure on the reef platform is extensive throughout the Chulu area. Hence, should a tracked vehicle manage to negotiate the sharp demarcation between the open ocean and inner reef, it is likely that substantial damage to the coral community will occur. As a result, it does not appear to be environmentally sound to recommend Chulu Beach as a site for conducting landing exercises with tracked vehicles.

b. Babui Beach

At Babui, there is significantly less coral on the inner reef platform than at Chulu because water motion is substantially greater. Coral cover is approximately one percent or less on the reef flat, which extends approximately 60 meters from the shoreline. Coral cover is ten percent or less on the reef margin, which extends approximately ten meters beyond the reef flat. Water depth at the reef flat-margin transition is approximately three to six feet deep. There is a narrow sand channel cut in the reef rock off the beach which appears in aerial photographs, but this is pretty small to navigate through. The apparent bigger channel that appears in the aerial photographs to the south of the beach is fairly wide (25-30') and deep (25'), but it

doesn't extend all the way onto the reef platform as a channel--where it stops there is an sheer wall that is the edge of the reef platform (1-2' in depth) (see description above for abrupt transition between inner and outer reef. As at Chulu, coral growth at the spur and groove transition zone (at three to six feet deep) is considerable, and would be impacted by tracked landing vehicles. Should a vehicle manage to negotiate the channel, it would have to make a sharp turn and go approximately 500' alongshore till it reached the small sandy area at Babui to get out of the water. The non-beach shoreline is composed of jagged limestone that is 4-6' high. It does not appear that this jagged coastline could be breached by any kind of vehicle.

While environmental considerations at Babui would not be as overriding as at Chulu, it appears that there would be contact between tracked landing vehicles and the reef crest during landing exercises.

c. Tachogna Beach

Tachogna Beach is located to the south of Kammer and Taga beaches on the south coast of Tinian. Several beach pavilions are located on the shoreline. The beach consists of sloping white sand to the waters edge. At the shoreline, a beachrock slab occurs that is interspersed with pockets of sand and rubble. The zone closest to the shoreline is composed of a sand flat covered with a mat of blue-green algae. Moving seaward, corals form a well-developed accreting reef. Many of the corals occur in a massive dome-shaped growth forms that are coalesced together to form a massive reef platform. Other forms of corals include branching *Acroporas*. A result of the coalescence of colonies the formation of numerous arches. These arches form an understory that serves as the substratum for a variety of reef biota. Depth of the top of the reef is only 2-3 feet deep. At the seaward edge of the reef, there is a nearly vertical change in depth to the sandy bottom. The abrupt nature of this transition from the sand zone to the reef would provide unsuitable entry for tracked vehicles which prefer a sloping entry to shallow water. Because of the very high level of live coral and active reef growth, the Tachogna Beach area does not appear suitable for landing craft training exercises.

II. TINIAN HARBOR

A series of 12 water samples were collected within Tinian Harbor (Table 1). Water samples were collected at 6 locations, with a surface and deep water sample collected at each station (Figure 1). Samples were collected by divers opening pre-rinsed bottles at the desired locations. Samples were analyzed for inorganic nutrients (PO_4^{3-}, NO_3^-, NH_4^+, Total N (TN), Total P (TP)) turbidity, salinity, pH and Chl a. Analysis for inorganic nutrients (NH_4^+, PO_4^{3-}, and NO_3^-) were performed using a continuous flow Technicon Autoanalyzer according to standard methods of seawater and

wastewater analysis (Strickland and Parsons 1968, Technicon 1973, Clesceri et al. 1989). TN and TP were analyzed in a similar fashion following oxidative digestion. EPA methods for analyses are as follows: NH_4^+ - EPA #350.1; NO_3^-+NO_2^- EPA #353.2; TP - EPA #365.4, and TN - EPA #351.2. The level of detection for the dissolved nutrients is 7.6 g/L for TN, 4.6 g/L for TP, 0.42 g/L for NO_3^- and PO_4^{3-}, and 1.4 g/L for NH_4^+.

Turbidity was determined on subsamples analyzed with a Monitek 90-degree nephelometer, with results reported in nephelometric turbidity units (ntu). Salinity was measured with a AGE laboratory salinometer (EPA #2520B). All samples were stored on ice following collection, returned to the laboratory within 24 hours of collection and processed immediately. pH was measured in the field using a portable meter with readability of 0.01 pH units. Chl a was analyzed fluorometrically. All laboratory chemistry analyses were performed by Marine Analytical Specialists (Laboratory Certification No. HI 0009), located in Honolulu, HI.

Results of water chemistry analysis indicate that overall there is little difference in composition between any of the samples. There is little indication of vertical stratification; NO_3^- is the only constituent with consistently higher concentrations in surface relative to deep water. There is also little difference in composition between sampling stations; water within the inner harbor is similar to water near the harbor entrance. Such results suggest that exchange of water within the entire harbor is rapid, good flushing through all regions.

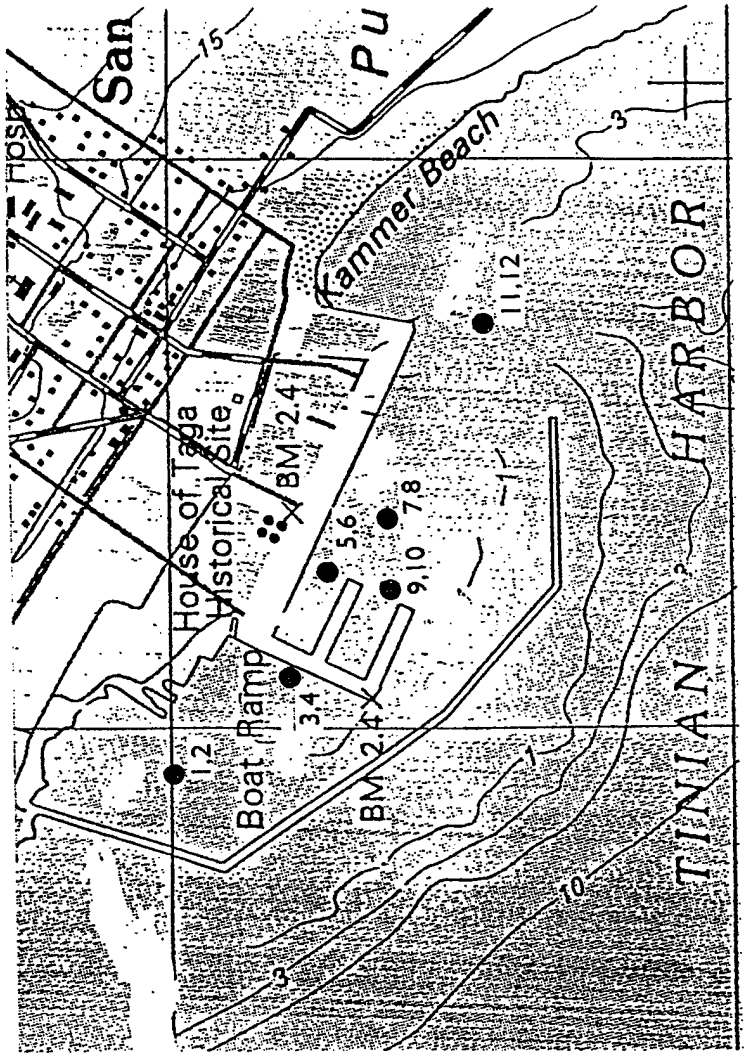


Figure 1. Map of Tinian Harbor showing locations of water sampling stations.

TABLE 1. Results of water chemistry sampling in Tinian Harbor collected on March 16, 1996. "s" denotes surface sample, "d" denotes deep sample. See Figure 1 for sampling locations.

SAMPLE NUMBER	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	DOP (µg/L)	DON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)
1 (s)	0.93	12.18	4.48	46.48	9.61	89.46	10.54	106.12	0.13	34.393	8.206	0.032
2 (d)	1.55	6.44	1.26	31.36	8.99	78.54	10.54	86.24	0.16	34.437	8.224	0.052
3 (s)	1.24	13.58	1.68	46.76	8.68	84.42	9.92	99.68	0.16	34.360	8.131	0.040
4 (d)	1.24	12.46	4.06	87.92	8.99	83.86	10.23	100.38	0.17	34.362	8.102	0.067
5 (s)	1.55	7.14	1.26	37.80	8.99	83.02	10.54	91.42	0.20	34.433	8.093	0.097
6 (d)	1.24	6.02	3.08	31.64	9.30	85.96	10.54	95.06	0.30	34.436	8.085	0.116
7(s)	1.24	5.60	3.22	31.64	8.99	84.70	10.23	93.52	0.14	34.442	8.112	0.099
8 (d)	1.24	5.18	0.84	26.88	9.30	80.22	10.54	86.24	0.12	34.440	8.113	0.101
9 (s)	1.24	4.76	1.26	44.52	8.99	82.18	10.23	88.20	0.16	34.443	8.110	0.118
10 (d)	1.24	2.52	1.26	46.48	8.99	80.50	10.23	84.28	0.17	34.426	8.115	0.101
11 (s)	0.93	12.32	2.10	53.76	8.99	84.84	9.92	99.26	0.19	34.366	8.102	0.083
12 (d)	1.24	5.32	2.38	44.52	9.30	79.66	10.54	87.36	0.18	34.441	8.110	0.088

Appendix C-3
Marine Environmental Impact Assessment for Military Training Exercises Off Tipalao and Dadi Beaches, Guam Naval Station, Guam, Mariana Islands (September 1997)

MARINE ENVIRONMENTAL IMPACT ASSESSMENT FOR MILITARY TRAINING EXERCISES OFF TIPALAO AND DADI BEACHES, GUAM NAVAL STATION, GUAM, MARIANA ISLANDS

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PURPOSE

Several proposed underwater training exercises require shallow water sites. One criteria for selection of suitable sites is the minimization or absence of impacts to the existing environmental composition. The area off of Tipalao Beach on the southwestern side of Orote Peninsula is a proposed training site for SEAL shallow water mine countermeasures. The area off of Dadi Beach, adjacent to Tipalao to the southeast is a proposed site for EOD underwater explosive training (Figure 1).

On July 12-13, 1997 qualitative reconnaissance surveys were carried out at these areas in order to assess the potential effects of the proposed training activities. The surveys, conducted from a small boat, consisted of underwater observations of the physical structure of the areas and biotic community structure of areas identified by Navy personnel as suitable for the respective exercises. Presented below are the results of these surveys, and conclusions regarding the potential effects of military training exercises.

TIPALAO BEACH

Tipalao Beach is a crescent-shaped beach approximately 500 m wide lying within a small embayment formed by two rocky headlands. Neye Island lies off the southern headland and separates Tipalao Beach from Dadi Beach. The headlands are bounded by near vertical cliffs that form the shoreline along the flanks of the embayment. Directly landward of the back-beach area of Tipalao is base residential housing.

Tipalao Beach is composed of coarse sand and coral rubble. The intertidal area is composed of a beachrock (limestone) bench that extends along the entire length of the beach. In the intertidal zone, the beachrock bench is barren of macroorganisms with the exception of short algal turfs. Crack and fissures in the bench are filled with coarse sand. Seaward of the intertidal zone, the bottom is composed of coarse sand and scattered rocks and boulders. The sand zone extends from the shoreline approximately 20 m offshore, and does not exceed 1 m in depth. Within this zone, coral were virtually absent, and the only macrobiota were scattered clumps of algae, primarily of the genera *Liagora* and *Sargassum*. With distance from shore, water depth increases gradually, and bottom cover becomes progressively rockier. By approximately 40 m from shore, bottom topography consists of a relatively flat limestone platform. The platform is marked by a small wave-cut ledge approximately 1 m in height, at a water depth of approximately 3 m. Seaward of the ledge bottom topography consists of almost featureless flat plain which extends to the limits of the investigation (~6 m water depth, 100 m from shore).

Benthic biota is extremely uncommon throughout Tipalao Bay. Living corals are

rare and comprise less than 1% of bottom cover. Benthic macrofaunal, such as sea urchins and starfish were essentially absent. Reef fish were present, but were not deemed to be abundant. Abundance of fish was greatest in the area of the platform ledge, where shelter was substantially greater than on the flat pavement. Owing to the paucity of benthic marine organisms, and the scoured appearance of the shallow bay floor, it appears that the area is commonly subjected to the destructive force of storm waves.

SEAL shallow water mine countermeasure training consists of locating, deploying and disarming mine charges consisting of approximately one pound of explosive. Exercises are generally carried out at night in shallow water (less than 20 feet). No information appears to exist describing the radii of impact of such charges that might affect corals or other biota. Tipalao Bay is characterized by a shallow inshore region that is extremely depauperate of macro-benthos and fish. These characteristics indicate that the bay would be a very suitable site for shallow water mine countermeasure exercises. As natural factors have resulted little coral reef development, there is little potential for further damage by training activities.

DADI BEACH

Personnel from EOD have selected a tentative site for underwater explosive training off of Dadi Beach, located south of Tipalao Beach. The selected site, at 13°24'32.34"N and 144°39'02.95"E, ranges from a water depth of 33 m to 35 m. Underwater reconnaissance surveys of the deep area consisted of an expanse of white sand intersected by low limestone reefs. The upper surfaces of the reefs extended approximately 0.5-1.0 m above the level of the sand flat. Edges of the reef were generally sharply angled forming a distinct boundary between the sand flat and the reef. Virtually no epibenthic biota was observed on the sand flats. Most of the surface of the limestone reef was covered with a short algal turf. Biotic composition of the reef surfaces consisted of low cover of small encrusting reef corals (primarily *Porites spp.*) that comprised less than 1% of cover of the solid bottom. Several sea urchins were also observed on the reef surface.

Reconnaissance of the area revealed that the sand flats are expansive, extending at least 150 m to the northwest and 200 m to the southeast, within the depth range of 30-33 m. Within this area the percentage of solid limestone reef was estimated at 10-15% compared to 85-90% sand plain. Based on the very limited biota of this area, it appears that EOD exercises would have minimal to no environmental impact, especially if the zone of effect from detonations could be limited to the sand flats.

Appendix D
Farallon de Medinilla Surveys, Reports, and Biological Opinions

D-1: September 1997 - Historical Overview of Farallon de Medinilla: 1543 to 1997
D-2: November 19, 1996 - Avifaunal Survey Report of Farallon de Medinilla
D-3: December 1996 - Botanical Survey of Farallon de Medinilla, Commonwealth of the Northern Mariana Islands
D-4: December 3, 1996 - Preliminary Report-Marianas EIS-Farallon de Medinilla Marine Assessment
D-5: December 10, 1996 - Trip to Farallon de Medinilla (FDM), Commonwealth of Northern Mariana Islands
D-6: January 8, 1997 - Endangered Species Survey of Farallon de Medinilla (FDM) 16-17 Dec 96
D-7: January 29, 1997 - Biological Opinion of the U.S. Fish and Wildlife Service for Aerial Bombardment and Gunnery Practice Associated with Tandem Thrust 1997 at Farallon de Medinilla, CNMI
D-8: March 24, 1997 - Farallon de Medinilla (FDM) Aerial Wildlife Surveys
D-9: May 16, 1997 - Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at Farallon de Medinilla, CNMI
D-10: June 11, 1997 - Wildlife Surveys of Farallon de Medinilla of May 17 and 27, 1997
D-11: July 15, 1997 - Farallon de Medinilla (FDM) Ordnance Survey
D-12: July 18, 1997 - FDM Marine Biological Survey and Associated Marine Surveys on Guam, 7 to 13 July 1997
D-13: August 21, 1997 - Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 19 July and 2 Aug 97
D-14: September 1997 - Assessment of the Marine Environment Farallon de Medinilla, CNMI, Military Training in the Marianas EIS
D-15: September 11, 1997 - Biological Opinion of the U.S. Fish and Wildlife Service for Ship to Shore Gunnery Practice at Farallon de Medinilla, CNMI
D-16: September 16, 1997 - Farallon de Medinilla Survey, July 8-10, 1997
D-17: October 31, 1997 - Farallon de Medinilla Nearshore Reef Survey, July 8-10, 1997
D-18: November 1997 - Preliminary Archaeological Reconnaissance and Assessment of Farallon de Medinilla, Mariana Islands
D-19: November 6, 1997 - Farallon de Medinilla Survey Report
D-20: December 1, 1997 - Forwarding Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 9 and 15 Sep 97
D-21: December 30, 1997 - Biological Opinion of the U.S. Fish and Wildlife Service for Aerial Bombardment and Small Arms Gunfire at Farallon de Medinilla, CNMI
D-22: March 2, 1998 - Forwarding Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 19 and 23 February 1998

Appendix D-1
Historical Overview of Farallon de Medinilla: 1543 to 1997

HISTORICAL OVERVIEW OF FARALLON DE MEDINILLA: 1543 TO 1997

Prepared by:

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September 1997

1.0 Introduction

The following summary is the product of research in the historical record to determine what changes in the natural features of FDM may have occurred cumulatively over time. Events are sequenced chronologically, between 1543 and August 1997, with a brief discussion of observations and conclusions at the end. The purpose of this overview is to assess cumulative changes over time in order to evaluate the specific effects wrought by use of the island for military training.

2.0 Earliest References to FDM: 1500s to 1800s

1543: The first reference to FDM may be in the accounts of the Villalobos expedition, which reached the Marianas in 1543. An island was discovered at 16 degrees N latitude, and the small island was named "Abriojos" (keep your eyes open), since it was almost at sea level. Andrew Sharp (1960) suggests that the description and location of this island may be Farallon de Medinilla.[1]

1671/1672: The next probable reference to the island is on the map of the Mariana Islands by Lopez drawn in 1671 or early 1672. An islet named "Rocher" (rock) is placed on the map in the approximate location where FDM is today. Thus the early Spaniards in the islands knew of its existence, although no references to it appear in the early Spanish writings. [2]

1819/1829: The first significant ornithological explorations of the Marianas were by the French naturalists Quoy and Gaimard during 1819 and 1829. They observed the megapode (*Megapodius laperouse laperouse*) on several other Marianas islands (Agrigan, Pagan, Almagan, Saipan, Tinian, Agiguan, Rota, Guam), but not FDM.

1836-1898: Other naturalists described birds collected in the Marianas during subsequent years (Kittliz 1836; Oustalet 1889, 1893, 1896; Marche 1891; Hartert 1898), but these studies weren't specific to FDM.

1863: In 1863, in the *Navigational Data for the Mariana Islands* published by the Spanish Hydrographic Office, FDM is referred to as a small, uninhabited island of "...truncated calcareous rock, gullied and sterile, and covered in places with red soil". Several deep caves on the south and west sides were noted, as was, at the southernmost tip of the island, a low spit that joined a small peak to the island.

1866: In June 1866, *Voyage of the Spanish Corvette "Narvaez" from Manila to the Marianas Islands*, FDM is referred to as dry rock, not very high above the ocean surface, abounding in deep hollow caverns formed "...by the wash of the sea". It was noted to be "completely bare of vegetation", with the explanation that the sea washed over it in heavy storms. It was noted that "...marks of the sea [were] everywhere on it".

1876: In 1876, Corte y Ruano Calderon says the island "...merits no attention at all," that on the south and west coasts of the islet there were some "holes," and that the island did not seem to be utilizable in any way, since "...not even the primitive inhabitants occupied it".

[1]International Archaeological Research Institute, Inc. (IARII) (December 1996) Draft Report. *Preliminary Archaeological Reconnaissance of Farallon de Medinilla, Mariana Islands.* Prepared for Belt Collins Hawaii.

[2]IARII (December 1996).

3.0 Explorations of FDM in the Early 1900s

1902: In 1902, a German colonial administrator by the name of Fritz explored the Marianas. He noted FDM as having a plateau covered with bush about four meters high and with a savanna of "low grass and lilies." He also specified that there were no coconut trees, but there were plants such as papayas, Talisai (tropical almond [*Terminalia catappa*]), Gulos (*Cynometra ramiflora*), Lada (Indian mulberry [*Morinda citrifolia*]), Ahgau (*Premna serratifolia*), and Nunok (Chinese lantern tree [*Hernandia nymphaeifolia*]). He noted that "marine birds in great numbers nest in the trees and bushes and on the bare earth,"and that there was a deep layer of guano on the ground of the woods. He also observed "woodcock", pigeons, thrushes, and numerous coconut crabs. During his approximately three hour long stay on the island, Fritz planted coconuts, casuarines, beans, and grasses.

1903: In 1903, *A list of the birds of Micronesia under Japanese mandatory rule* was published. The only birds listed from FDM were from the family Sulidae (specifically three species of boobies, the *Sula leucogaster plotus, Sula sula rubripes,* and *Sula dactylatra personata*). Abundance estimates were not given.

1901-1919: Other naturalists described birds collected in the Marianas during subsequent years (Seale 1901; Mearns 1909; Townsend and Wetmore 1919), but these studies weren't specific to FDM.

1914-1944: Japanese ornithologists published several editions of checklists of the birds of the Japanese-mandated islands, including the Marianas, during the Japanese era from 1914-1944 (Takatsukasa and Kuroda 1915a, 1915b; Kuroda 1922; Takatsukasa 1932-1938; Hachisuka et al. 1932, 1942). These lists mostly comprised accounts of birds collected during scientific expeditions, but not all provided lists of bird occurrence by island group.[3]

1934: During the summer of 1934, the Japanese had the opportunity to visit and collect plants for a few days on Rota, Tinian, Saipan, Anatahan, Sarigan, Alamagan, Pagan, and Agrigan. No samples were taken from FDM.[4]

1944: Black and white aerial photos around the entire circumference of the island were taken of FDM by the U.S. Military in August 1944. These photos (Figure 1) show substantial groves of small trees distributed throughout the northern portion of the

[3]Reichel, James D. and Philip O. Glass (January 1991) *Checklist of the Birds of the Mariana Islands.* 'Elepaio, Vol. 51(1).

[4]Biogeographical Society of Japan (1934-1935) *Bulletin of the Biogeographical Society of Japan.* Volume V. Tokyo, Japan.

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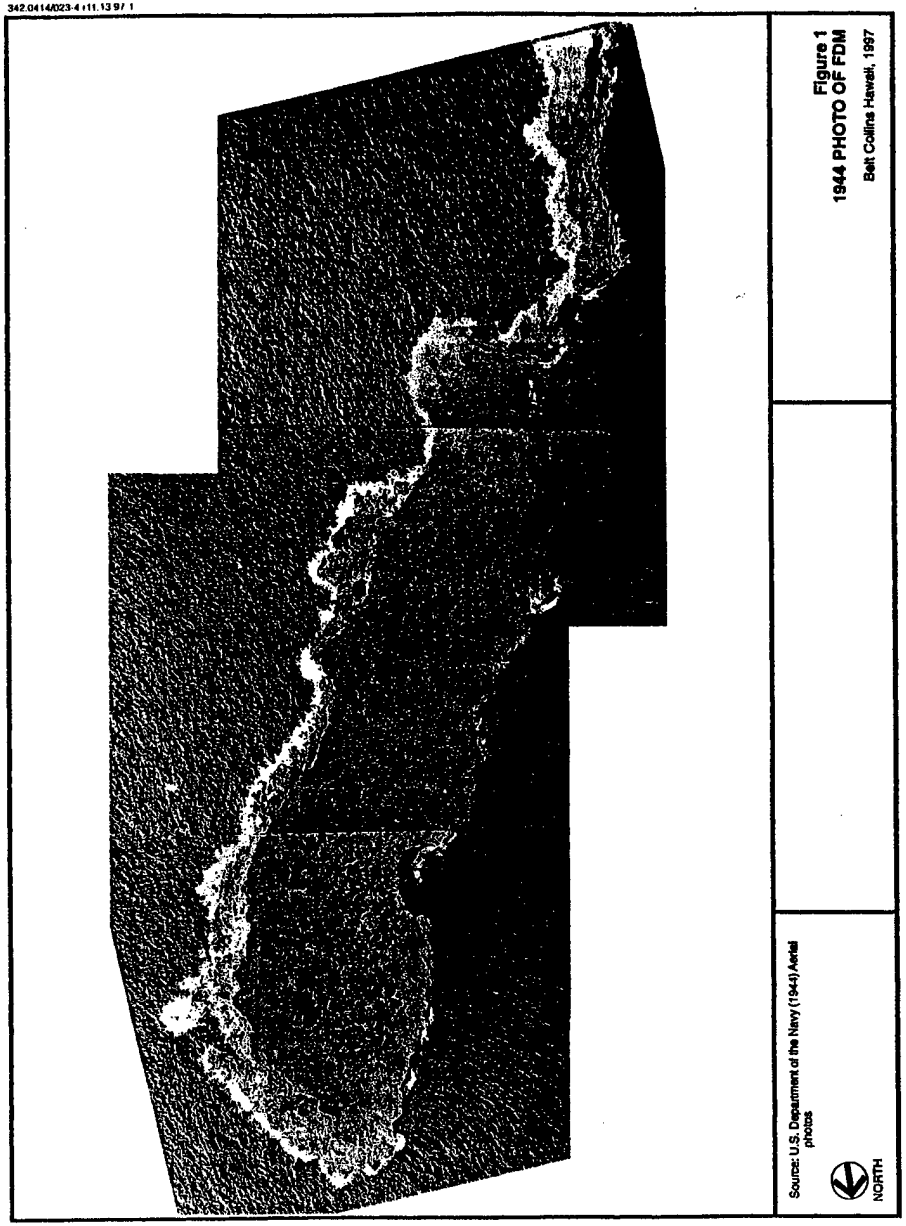


Figure 1
1944 PHOTO OF FDM
Belt Collins Hawaii, 1997

Source: U.S. Department of the Navy (1944) Aerial photos

NORTH

island.[5]

1945-1993: In the 48 year period between 1945 and 1993, the first years in which regular weather observations are found, 63 typhoons passed within 75 nm of FDM. Although the data average 1.2 typhoons per year, the number of storms per year varies from zero in some years up to six in 1968.[6]

1951: Baker's (1951) work, for many years the standard ornithological reference work for the region, gives detailed species accounts of the 206 forms of birds known from Micronesia before 1950, but did not compile a separate list for the Marianas.

Baker did note the geographic range of the birds, and three species of boobies were recorded as occurring on FDM: the brown booby (*Sula leucogaster plotus*), the red-footed booby (*Sula sula rubripes*), and the masked booby (*Sula dactylatra personata*). Baker also noted that, according to Yamashina, 12 masked booby eggs were taken from FDM on February 19, 1931.

Note that two species of frigate birds (*Fregata minor minor* and *Fregata ariel ariel*) were noted in the Marianas but were not listed as occurring on FDM.

1952: Black and white photos from 1952 show mass wasting and erosion on the island cliffs (at the northeastern beach) and large patches of vertical woody vegetation (Figure 2).

1957: FDM was mentioned briefly in the July 10, 1957 U.S. Naval Administration Unit, Saipan District survey report by Johnson. "Various types of sea birds" (unfortunately the text was not more specific) were noted to reside on the island, and it was mentioned that there was an unknown quantity and quality of bird guano. The report stated that the commercial prospects of the guano were unknown, and unless collection of it as fertilizer was feasible, the island had no place in the economy of the Saipan District.

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[5]U.S. Department of the Navy (1944) Black and white aerial photos of FDM. Bishop Museum Archives.

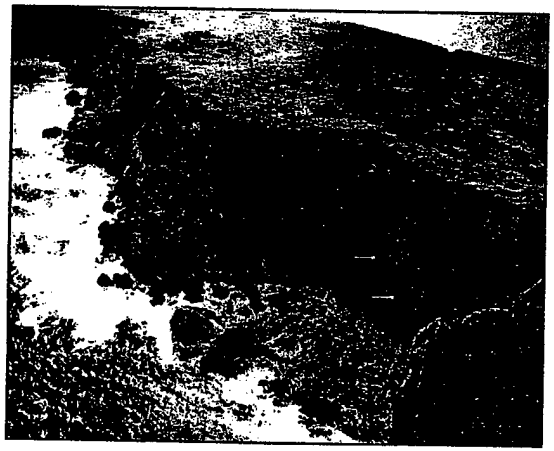
[6] Joint Typhoon Warning Center (1977) *Annual typhoon report*. Joint Typhoon Warning Center, Guam.

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NORTH

1952 Aerial photo



NORTH

1996 Aerial photo

Source: U.S. Department of the Navy (1952 & 1996) Aerial photos

Figure 2
COMPARISON OF FDM PHOTOS: 1952 AND 1996

Belt Collins Hawaii, 1997

4.0 Use of FDM as a Bombardment Range

1944: A "Use and Occupancy Agreement"dated August 1, 1944 provided for use of Naften Rock, near Saipan, as a bombing range.This agreement was written under the terms of the "Land Agreement, Trust Territory of the Pacific Islands", which states that the Government of the Trust Territory shall make available to the DoD lands required for military purposes.

1968: In a letter dated March 27, 1968, Manuel Muna, representative of the Second District, Congress of Micronesia, suggested that the High Commissioner relocate the bombing of Naftan Rock (which had been used for bombing since the August 1, 1944 "Use and Occupancy Agreement") to FDM.

1971: A revised agreement in October of 1971 provided for use of FDM as a U.S. Navy and U.S. Air Force bombing range; terminating use of Naftan Rock for those purposes.

During the peak of the Vietnam War, the quantity of ordnance delivered on FDM is estimated to be 22 tons per month, consisting primarily of air-dropped 500- and 750-pound bombs, and a monthly average of 60 rounds of 3-inch ammunition from ships' guns.

1975: In 1975 the CNMI covenant was created and included an allowance for the U.S. Navy to continue using portions of CNMI property through a long-term lease.

Lesser amounts of ammunition were expended on FDM starting in 1975, compared to the four previous years. Currently, an average of four tons per month are being used.[7] This activity level varies as security and training needs change.

1981: In 1981, a 100-year lease was negotiated for military use of several portions of the CNMI, including FDM.

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7 Personal communication with Lt. Cmdr Bryan Jagoe, code N45, COMNAVMARIANAS, July 31, 1997.

5.0 Surveys Conducted on FDM: 1975-1995

1974: A letter dated October 11, 1974 from the Environmental Protection Board, Department of Health Services, and Trust Territory of the Pacific Islands indicates no awareness of any ecological surveys conducted in the marine environment at FDM.

1975: A Final Environmental Impact Statement for the Department of the Navy was published in February 1975. The purpose of the EIS was to examine the impacts of military training on FDM. The text gives descriptions of the plants, animals, and marine resources at FDM.

Six species of seabirds were noted (red-footed booby, masked booby, brown booby, great frigatebird, white tern, and common noddy tern). These were noted as common species of seabirds found in many parts of the Pacific and Indian Oceans. Of these, the three species of boobies and the white terns were documented as breeding on the island. Boobies were documented to nest as a colony fairly evenly distributed over the vegetated top of the island at a rate of approximately 100 nests per acre (indicating a population of about 50,000 adult boobies on the island, if applied uniformly to the island's surface area). White terns did not breed in surface colonies, but nested primarily in the deep limestone caves at the base of the island. Their numbers were estimated at about 1,000. Other species of birds noted were the Pacific golden plover, whimbrel, Micronesian starling, white-throated ground dove, and Philippine turtle dove.

The entire top of the island was vegetated. The overstory was composed primarily of Indian mulberry (*Morinda citrifolia*), which was growing as a small shrub-like tree up to about 12 feet high. (This is consistent with earlier observations and photos.) In the gulches a few true kamini (*Calophyllum inophyllum*) trees occurred. Also noted were hau shrubs (*Hibiscus tiliaceus*) and *Bikkia marianensis* shrubs, large solid stands of spider lilies (*Pancratium littorale*), and several young papaya trees (*Carica papaya*). It was noted that all of these plants are common species of wide distribution throughout the Pacific and Indian Oceans.

The coastline was described as "...extremely precipitous, broken by numerous sea caves and occasional rock slides which form a talus slope of large blocks and boulders." FDM was described as having no fringing reef or shallow coastal zone. The shoal areas in the vicinity of the island were noted as providing suitable habitat for commercially important species of fishes, such as jacks, snappers, groupers, and wrasses, all of which are found elsewhere in the Marianas. It was also estimated that pelagic species such as tunas, wahoo, spanish mackerel, barracuda, and dolphin could be expected to occur in waters adjacent to the island at various times of the year.

1975: In 1975 there was a two-week field expedition aboard the schooner *New World* to the Northern Mariana Islands, including observers from Univ of Guam, Univ of Hawaii, and the Yap Institute of Natural Science. Originally the four islands they were going to explore were Uracas, Maug, Guguan, and FDM. However, due to the bombing of FDM, they dropped it from the list.

1983: A summary of environmental and fishing information on Guam and the CNMI by Eldredge, et al. notes that FDM is, in general, "the only island in the archipelago from which no, or very few, biological specimens have been collected."

1984: The only known botanical specimens from FDM up to this point were collected by two wildlife biologists in 1984. The thirteen specimens collected were: mallow (Abutilon indicum), dafao (*Boerhavia* sp), *Callicarpa candicans*, *Capparis spinosa*, crinum (*Crinum asiaticum*), blinding tree (*Excoecaria agallocha*), beach morning-glory (*Ipomoea pes-caprae*), Indian mulberry (*Morinda citrifolia*), *Operculina ventricosa*, pisonia (*Pisonia grandis*), sea purslane (*Portulaca lutea*), beach sunflower (*Wollastonia biflora*), and an unidentified sterile grass.[8] All of these were also observed by Art Whistler on his November 1996 survey (in the case of *Capparis spinosa*, the same genus but a different species was observed, the *Capparis cordifolia*).

1985: A seabird survey and inventory was conducted between October 1, 1984 to September 30, 1985 in an attempt to develop a strategy for preservation of significant habitat areas in the northern Marianas islands.[9] This report noted that the most important seabird rookeries are Naftan Rock, FDM, Guguan, Maug, and Uracas. It also noted that investigations during the period of 1979 through 1984 have revealed some of the largest colonies in the western Pacific for certain seabird species. As shown on Table 1, several species of birds were observed as nesting or were suspected to nest on FDM.

1987: The field guide by Pratt el al. (1987) provides for the first time a comprehensive guide and checklist for all the birds known from the tropical Pacific, including the Marianas. However, they only list the islands of Guam, Rota, Saipan, Tinian, and Aguijan.

1991: A bird survey study by Reichel, 1991, notes that the most important bird colony locations in the Marianas are on the islands of Naftan Rock, FDM, Gugan, Maug, and Uracus, and that the brown tree snake is the single greatest threat to birds in the Marianas and the Pacific.[10]

This study gives population figures for the largest number of breeding pairs known from any one island at a single time (which may underestimate total breeding populations since many species breed year-round). [Note: Table 1 gives numbers of individuals, not pairs.] Censuses from 1979-1988 were used. No census information is available prior to 1979. Estimated breeding population for all three species of boobies is 750 pairs.

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[8] Whistler, Art (December 1996) *Botanical Survey of Farallon de Medinilla, CNMI.* Prepared for Belt Collins Hawaii.

[9] U.S. Fish andWildlife Service (1985) *Job Progress Report Research Project Segment: Seabird Survey and Inventories for October 1, 1984 through September 30, 1985 in the CNMI.*

[10] Reichel, J.D. (1991) "Status of Conservation of Seabirds in the Mariana Islands" in *Seabird Status and Conservation: A Supplement, ICBP Technical Publication No. 11* edited by J.B. Croxall.

Table 1: Nesting Observations

	Breeding Status			
Bird (common name)	1985[1]	1991[2]	1995[3]	1996[4]
red-tailed tropicbird	suspected	suspected	----------	suspected
white-tailed tropicbird	suspected	suspected	possibly nests on other islands besides Guguan	----------
masked booby	confirmed	confirmed	confirmed	confirmed
red-footed booby	confirmed	confirmed	----------	confirmed
brown booby	confirmed	confirmed	confirmed	confirmed
great frigatebird	----------	----------	----------	confirmed
brown noddy	confirmed	----------	nest on cliffs and offshore rocks of most Marianas islands	confirmed
black noddy	confirmed	confirmed	----------	confirmed
white tern	confirmed	suspected	nest in small numbers on all islands	confirmed
sooty tern	----------	----------	----------	suspected
megapode	----------	----------	----------	suspected

Sources: 1. USFWS (1985)
2. J. D. Reichel (1991)
3. Stinson (1995)
4. Bruner (1996)

Nesting for the masked booby is restricted to only four islands. The apparently recent spread of these birds to Guguan may indicate an increasing population for the chain, since seasonal differences in surveys make conclusive statements about recent population changes difficult.

There is a single undocumented record for the great frigatebird breeding on Maug (this record is not considered valid without additional supporting evidence, according to Reichel). Moderate populations of these birds are known to roost on several islands. Population estimates on Maug range from 10 to 100, on Guguan are a minimum of 35, and much smaller numbers have been recorded from other islands, with roosting birds reported only from FDM and Rota.

January 1991: The January 1991 *Checklist of the Birds of the Mariana Islands* by Reichel and Glass is the first text to provide an island-by-island checklist of the avifauna of the Marianas. This report tallied 19 bird species total for FDM, six of which were labeled "hypothetical." This report gives relative abundance estimates (I.e. common, uncommon, rare, etc).

March 1994: Stinson's 1994 report of "Birds and Mammals Recorded from the Mariana Islands" noted that the masked booby is common on FDM, Maug, and Uracas. He recorded the great frigatebird at common on Rota, Maug, and Gugan and rare on most of the other islands, including FDM.

1994: The "1994 Civil Affairs Handbook Mandated Marianas Islands" briefly mentions FDM. This report notes that the island is composed of madreporic rock, presumably on a basalt nucleus, and that rock formations appear to be of coral limestone and augite andesite. It also notes the plateau is covered with bush and savanna grass, and that the shores have low cliffs with deep caves on the south and west sides.

March 1995: Stinson's 1995 report *Status and Conservation of Birds in the Mariana Islands, Micronesia*, notes that 13 species of seabirds are known to breed in the Mariana Islands. Masked boobies nest in significant numbers on Maug, Uracus, and FDM; brown boobies nest on most of the islands, with up to 500 pairs reported on FDM; and great frigatebirds roost on a few of the islands (with nesting documented on Maug).

Unfortunately, this report is not island specific, so it's difficult to determine from this report what species occur on FDM.

See Table 1 for other relevant observations of nesting birds.

6.0 Environmental Studies Conducted on FDM in 1996

January 1996: Many color photos of FDM were taken by the Navy, including some at close-range. These photos, taken from the air, show bird nesting areas, areas of mass wasting and erosion, unexploded ordnance, location of targets on the island, bomb impact areas, and vegetation type.

November 1996: On the 5th of November, a Belt Collins survey team supported by EOD Detachment Guam visited FDM to conduct botanical, avifaunal, archaeological, and marine surveys. The investigations were terminated after six hour's work due to an approaching typhoon, leaving the surveys incomplete. Although the entire northern part of the island was sampled for flora, fauna, and cultural artifacts, detailed follow up was not possible, and the southern portion was not visited. Marine investigations were not possible. The following summarizes information that was collected in those six hours. (The details of these reports can be found here in Appendix H.)

•Art Whistler (Isle Botanica) conducted a brief botanical survey of the northern half of the island.[11] Without having access to historical information, he surmised the current vegetation on the island as being heavily impacted by the activities of man, primarily the bombardment of the island. Currently the island is covered with herbaceous or shrubby vegetation dominated by littoral species. Because of the years of bombardment, and possibly other factors, the vegetation is not homogenous, but rather a mosaic of several types, lacking clear boundaries.

Both native and weedy species occur on the island, in four different zones or areas: littoral zone, limestone outcroppings, central area, and wetland-like areas. The dominant plant of the central area is the beach sunflower (*Wollastonia biflora*), although crinum thickets cover much of the central region, as do patches of disturbed vegetation, which are scattered throughout the central area, and probably represent places most recently impacted by explosives.

There are no threatened or endangered plant species on the island. Nearly all the species encountered are widespread plants, most of them littoral.

•Phil Bruner (Independent consultant) conducted an avifaunal survey of FDM and found that the island supports a diverse avifauna of 17 species. The island supports a dense cover of low vegetation where birds can shelter, nest, and, for some species, find food.

The most abundant bird on the island was the masked booby, but at other times of the year other species likely dominate. Most of the masked boobies were incubating eggs along the eastern (windward) side of the island. Brown boobies, which are also ground nesters, were also mostly concentrated along the eastern side of the island. Red-footed boobies and a small colony of great frigatebirds breed on the western (leeward) side of the island where there is higher brush to support their nests (Figure 3). No frigate chicks were seen, but

11 Art Whistler (December 1996).

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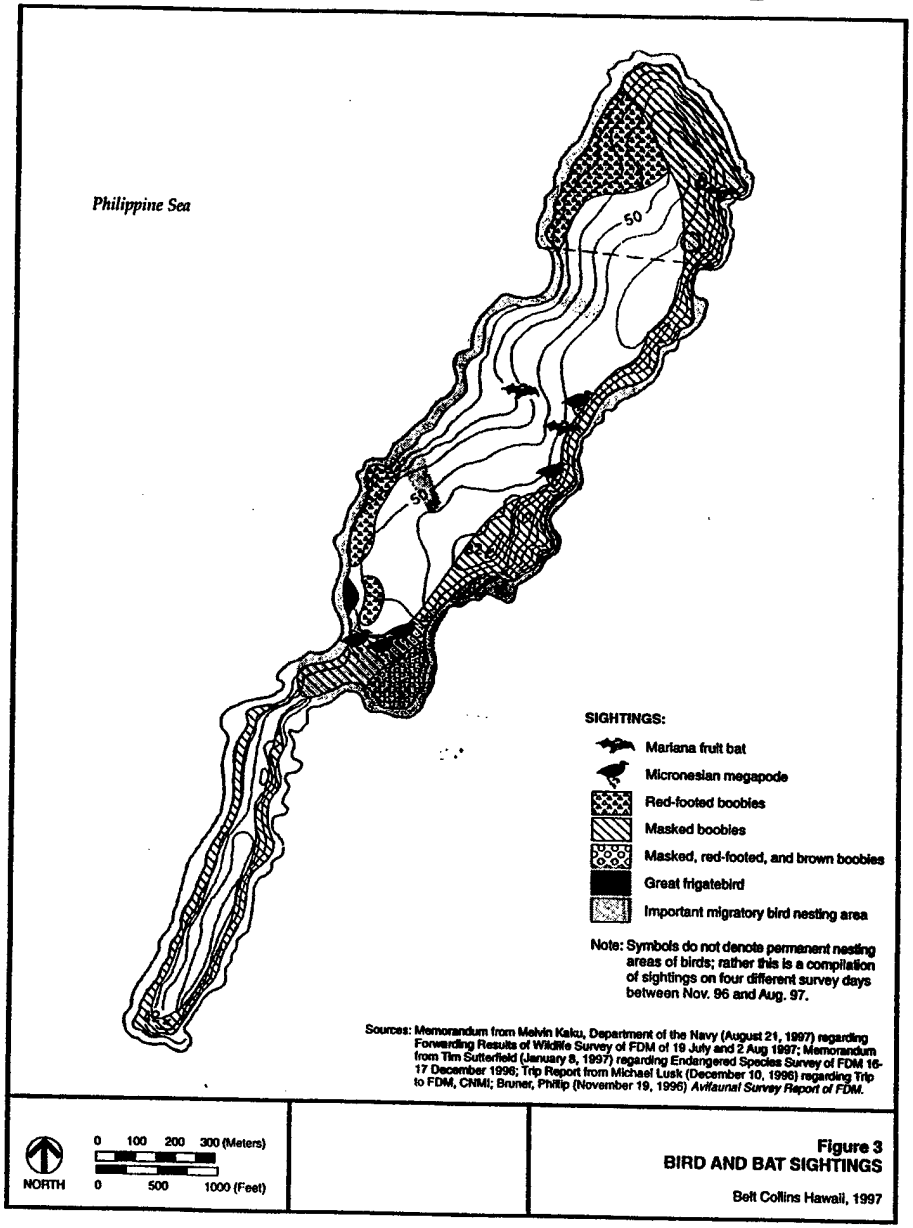


Figure 3
BIRD AND BAT SIGHTINGS
Belt Collins Hawaii, 1997

some adults observed were on eggs in the southern portion of the island.

The only endangered species recorded was the endemic Micronesian megapode. Four birds were flushed from dense vegetation, where cover and food are more available. More of these birds may occur on the island and could have been missed during the survey due to the low growing, dense vegetation.

•Michael Lusk (USFWS) and Curt Kessler (CNMI Wildlife Biologist) joined Phil Bruner to do a bird survey of FDM. Lusk's written observations were similar to those in Bruner's report. He added that black noddies, common noddies, and white terns were seen using the sea caves on the east central edge of the island, and that nesting and presence of eggs was noted for the common noddies and white terns inside the caves. He also noted that the red-footed boobies on the southeastern side of the island were nesting in low vegetation less than six feet tall and that the distribution and population of these boobies was probably limited by the lack of medium and tall trees on the island. The Micronesian megapodes were encountered in low, shrubby vegetation from two to six feet in height. The locations of the booby and frigatebird colonies was mapped, as was the location of the megapode sightings (see Figure 3). His population estimates for the various bird species varies slightly from Bruner's estimates.

He noted that bombs were observed close to nests, meaning that bombs do fall in active nesting areas. The ordnance impacts appeared to be the greatest near the edges of the island, which is where two of the megapodes were spotted. Also, the birds did respond to the helicopter approach by flying off the island. The impact of this noise disturbance was difficult to gauge, however, because some of the masked boobies began to resettle on their nests within 15 minutes.

•Dave Welch (IARII) conducted a preliminary archaeological reconnaissance of FDM and did not find any archaeological sites or isolated non-modern artifacts during the course of the survey. Therefore there is currently no evidence of prehistoric or early historic human activity on the island. The only cultural materials observed (ordnance, trucks, collapsed tower) all relate to the use of the island as a bombing target by the U.S. military since the last year of World War II. None of these remains constitute significant historic resources. Except for the first targets placed on the island (and what these may be and whether they are still extant is unknown), all are less than 50 years old and therefore not eligible for the National Register of Historic Places. Neither do any possess integrity of place nor are they of any value for research purposes. While a more intensive survey of the island would be needed to conclusively state that no prehistoric evidence of occupation exists on the island, such a study is no longer possible since access to the island is now prohibited for safety reasons.

•Steve Dollar (Marine Research Consultants) was unable to do an in-water survey due to a developing typhoon and dangerous seas. Therefore, his observations are based on a land survey.

He noted that the island consists of steep vertical walls with numerous wave-cut caves and notches, and that the shoreline consists primarily of large boulders and rock outcrops with

little beach formation. There appeared to be little shoal formation around most of the island, and the submarine slope appeared to be very steep.

During the survey strong tradewinds resulted in fully developed seas, causing large surf to break on the windward shorelines. It was estimated that marine resources and benthic biota would not be concentrated on the windward side due to the combination of steep vertical profiles of the submarine shoreline and the massive physical forces from breaking waves, but that the leeward side would have improved prospects for a more fully developed biotic community.

Several coconut crabs were observed, one green sea turtle was observed on the surface off the leeward side of the island, and no marine mammals were observed. Interviews with EOD staff and Patrick Bryan, a Fisheries Official for the CNMI, revealed that coral growth reportedly was good, with coverage of about 50% of the available stratum, and that fish were abundant.

December 1996: A follow up survey was undertaken by Tim Sutterfield, PACNAVFACENGCOM Fish and Wildlife Biologist, on December 16 and 17, 1996. An overflight of the entire island was conducted and photos were taken. No sea turtles were observed in the nearshore waters or on the two beaches during these helicopter flyovers. In addition, a total of ten hours was spent on the island over the two days. A foot survey of the entire perimeter of the northern portion of the island was performed on the first day. The southern end of the island was not surveyed because the EOD personnel determined that numerous components of MK-80 cluster bombs on that portion of the island made ground surveys unsafe. On the second day six variable circular plot count stations were established along the eastern cliffline of the northern end of the island to survey Micronesian megapodes.

During the first day, no megapodes were seen, but two Mariana fruit bats were detected; one in a ravine and one on the northern end of the island (see Figure 3). Both bats were roosting on shrubs that were approximately three feet tall. The fruit bat is not a federally protected species, but is listed on the CNMI Endangered Species List and is protected from hunting throughout the CNMI. Six snake traps that were set during the November 5 trip were recovered, with no sign of snakes.

On the second day of the survey, recordings of megapode calls were played at each of the six count stations, with no response received from any megapodes. However, while hiking, the surveyors flushed two megapodes from the heavily vegetated ravine that bisects the northern end of the island. In addition, a Mariana fruit bat was seen in this ravine. Seabirds were not censused due to time constraints, but it was noted that all three species of boobies were nesting and on eggs. Frigatebirds were also nesting.

7.0 Environmental Studies Conducted on FDM in 1997

January 1997: The USFWS Biological Opinion issued on January 29, 1997 for Tandem Thrust 97 Aerial Bombardment and Gunnery Practice on FDM provided some important background information on the Micronesian megapode and green sea turtle. The following is a summary of this information.

Populations of the Micronesian megapode exist on northern Mariana islands, except for Uracus (USFWS 1995b). Islands such as Anatahan, Sarigan, and Gugan may each have as many as 200 to 500 birds. There are estimated to be 10 to 25 birds on Saipan, less than 10 on Tinian, and extirpated from Guam and Rota. Their total population is estimated to be 1,000 to 1,500 birds. It is estimated that on FDM there are likely not more than ten megapodes, a number that represents 0.7 to 1.0% of the total estimated population within the Marianas archipelago. No critical habitat has been designated for the Micronesian megapode.

There are no population estimates for the CNMI population of green and hawksbill sea turtles. The nesting population does not appear to be very large in the CNMI, but at one time may have been much larger. No monitoring of sea turtle nesting on FDM or sea turtle abundance monitoring in the waters off FDM have ever been conducted. No critical habitat has been designated for the green sea turtle or hawksbill turtle.

There are two small beaches (both approximately 50 m long and 10 m wide) on FDM, one on the southwestern corner and one on the northeastern corner of the main body of the island, that could be used for nesting. Each turtle could average three to four clutches of eggs for the season. It is not possible to estimate the percentage of breeding turtles or nests this represents in the Marianas archipelago.

February and March, 1997: Aerial helicopter faunal surveys were conducted by Tim Sutterfield, PACNAVFACENGCOM Fish and Wildlife Biologist, at FDM on February 21, March 4, and March 20 in accordance with the USFWS Biological Opinion issued on January 29, 1997. The February 21 survey was conducted prior to use of the island by the Independence Battle Group, and on March 4 a post-survey of these activities was conducted. The March 20 study was a post-impact survey after B52 aerial bombardment training by the Air Force between March 13 and 18. For the use of these three surveys, survey points were established around the island for bird counts. An additional around the island survey was done approximately 300 m offshore to look for sea turtles and marine mammals.

It didn't appear that bombing had any significant impact on the seabird population, and aerial observations on the megapode are not expected to be productive. Little new damage to soil or vegetation was observed in the more heavily used flat nesting areas of the northern portion of the island. The southern portion, which contains less vegetation and lower bird populations, seemed to have sustained the most damage.

Between 1500 and 2500 nesting pairs of red-footed boobies and 200 to 300 pairs of masked boobies were using the island. Only a few brown boobies and a couple of great frigatebirds were seen. Only one dead masked booby was seen during the three surveys. It was next to a

new bomb crater and was obviously killed by the bomb blast. No Micronesian megapodes were seen during the surveys, and no Mariana fruit bats, sea turtles, or marine mammals were seen during the surveys or while in transit between Saipan and FDM.

May 1997: On May 16, 1997 the USFWS issued a Biological Opinion for Gunnery and Aerial Bombardment Practice on FDM to occur during May 1997 and from July 21- August 1, 1997. This document required the Navy to conduct both pre- and post-exercise helicopter overflights to monitor training impacts and assess take of threatened or endangered species for both the May and July/August exercises.

This document noted that the USFWS was unable to determine the amount of take from the training exercise covered under the previous (January 29, 1997) biological opinion because megapodes are likely to remain underneath brushy cover. Therefore, deaths or injury resulting from either blast or shrapnel would be difficult to detect from aerial surveys. And, on-the-ground surveys are not possible due to the high incidence of UXO distributed over the island.

This document also noted that while it is possible that several sea turtles could be using the beaches for nesting, the beaches appear to be heavily wave-washed and are probably not prime nesting habitat.

Particular concern was expressed over the great frigatebird since FDM represents one of only two small breeding colonies known to exist in the Mariana island chain.[12] And, based on the November 1996 avifaunal surveys of FDM, when compared to bird populations given in the Reichel 1991 report, FDM appears to represent the largest known nesting site for masked boobies in the Mariana and Caroline islands. Although neither of these birds are listed as threatened or endangered, they are protected under the Migratory Bird Treaty Act of 1918, as amended.[13]

May 1997: The pre- and post-bombing surveys of FDM, required by the May 16, 1997 biological opinion, were conducted on May 17 and 27, 1997. The marine surveys were performed by following the coastline 300 meters offshore at an altitude of 300 feet or less and the seabird surveys were accomplished by flying just seaward of pre-established stations at an altitude of 300 feet or less.

On May 17, prior to the bombing exercises, 497 ground nesting seabirds were counted. Noddies were beginning to arrive by the thousands to begin nesting. A few sooties, three great frigate birds, and six brown noddies were also observed. No turtles or marine mammals were seen in the waters around the island or while in transit to or from FDM. No turtle tracks were seen on either of FDM's two small beaches.

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[12] Stinson, B.W., R.E. Johnson, M.R. Lusk, C.G. Rice, and D.T. Alban (1995) *New Bird Records in the Mariana Islands.* Micronesica 28 (1): 109-117.

[13] 16 U.S.C. 703-712; 40 Stat. 755

On May 27, after the bombing, 503 ground nesting seabirds were counted. Therefore, there was no significant change in the number of seabirds on the island after the bombing. Noddies were still swarming by the thousands and a flock of 40-50 brown boobies flew out of a cave on the southern end of the island. No dead birds were detected on land, and only a few new bomb craters were seen on the northern end of the island. No live or dead marine mammals or sea turtles were seen while transiting to FDM from Saipan or in the vicinity of FDM.

July 1997: Belt Collins marine conducted a three-day marine survey between July 8 and 10, 1997 as a follow-up survey to the original November 1996 field expedition which was cut short by the approaching typhoon. The marine survey team included Detachment 5 from the Explosive Ordnance Disposal Mobile Unit Five (EODMU-5), and representatives of the CNMI, the U.S. National Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service. Field surveys were conducted using the "Manta tow" method to gather rapid ecological assessments of the entire perimeter of FDM, and then by SCUBA for more detailed assessments in areas of primary interest. The following are observations taken from Steve Dollar's, John Goody's, EODMU-5, and NMFS reports.

General Description: The perimeter of FDM consists of steep vertical walls with numerous wave-cut caves and notches. Substantial erosion in many regions has led to rockslides, distinguishable underwater to depths of 20 meters. The submerged shoreline consists of an essentially vertical wall that extends to a depth of approximately 10-12 meters. At the base of this cliff, the bottom topography flattens to a gentler slope in the reef terrace zone.

Ordnance impacts: Unexploded ordnance was observed around the entire island. This UXO was concentrated around the middle section of the island and thins out towards the extreme north and south ends of the island. The reef terrace and upper portions of the sandy slope in the central portion of the island contained numerous UXO, primarily Mark 80 series bombs. Many of the older bombs were colonized by living coral and algae. Few metal fragments of exploded ordnance were noted on the reef surface. Most of the intact bombs on the reef were not armed with high explosives, but rather were equipped with practice fuzes and smoke marking charges.

Clear evidence was seen on certain portions of the island of ordnance impacts on the cliff faces and tops. At the southern end of the island an apparently recent indentation in the shoreline cliff appeared to be an impact crater from an explosive caused by target exercises.

Coral development: Certain bottom areas were scoured and devoid of significant coral development. The reef terrace near cliff edge had coral cover of less than 1% of bottom cover. Further from shore, coral cover increased to 10-20%. Coral cover on the tops of some boulders that appeared to have originated from mass wasting of the cliff face was 25-30%. Coral growth on the sand flats was less than 1%. In addition to corals, the predominant benthic organism was the green calcareous alga *Halimeda* spp, which covered substantial areas (50-60%) of the boulder and reef platform surfaces.

A major difference between the windward and leeward sides of the island was the substantially and consistently higher coral cover on the leeward reef terrace. On the leeward

side, coral cover on the elevated sections of the reef platform and on the tops of large boulders was as high as 50-70%. This finding is consistent with conditions observed during the November 1996 survey, during which strong tradewinds resulted in fully developed seas and large surf breaking on the windward shorelines and offshore terrace. These conditions create hydrolic stress and mechanical scouring inhospitable to coral formation.

Erosion: Substantial erosion, owing to the friable nature of the limestone, was observed. Certain areas, primarily the cliffflines along the narrow middle of the island, are regions of mass-wasting where large sections of deteriorated rock have slid into the ocean. Underwater observations revealed several areas, primarily on the windward side of the island, where the product of these slides are distinguishable to water depths of up to 20 m.

Photographs of FDM over a period of years consistently reveal substantial sediment plumes carried off both the north and south ends of the island. During this survey, such plumes were not generally evident and water clarity was high, with estimated underwater visibility at 25-30 m in many areas. The only areas with noticeably turbid water were off the two beaches in the center section of the island.

Turtle nesting: Neither the windward nor leeward beach appeared to serve as a nesting site for turtles. Water clarity off both beaches was limited owing to turbidity of apparently terragenous origin, and the emergent portion of the beaches consisted of rubble/cobbles with some sand and no vegetation. Both beaches appeared to be subject to the wash of waves during some tidal and weather conditions.

General observations: During the survey, two green sea turtles (*Chelonia mydas*) were observed, one on the surface on the windward side of the island, and one underwater near the shoreline cliff on the leeward side. No marine mammals were observed. The overall fish community contained numerous species and diversity. However, low numbers of commercially desirable reef fish and evidence of lost bottom fishing gear indicate there is a degree of fishing pressure being exerted on the nearshore fishery resources surrounding FDM. The greatest abundance and diversity of reef fishes were associated with the complex and rugged substrate mainly on the leeward side, particularly in the areas offshore the central and northern portion of FDM. Sea urchins were, curiously, absent. At the extreme southern end of the island, an assemblage of 80-100 small gray reef sharks was observed, but they were not present the following day, suggesting that the site is not a permanent point of aggregation.

In addition, numerous seabirds (in the thousands) were observed, primarily noddy terns and brown boobies. Approximately 100 red-footed boobies were observed roosting on the top portions of the island.

July and August 1997: Tim Sutterfield, PACNAVFACENGCOM Fish and Wildlife Biologist, conducted pre- and post-bombing helicopter surveys of FDM in accordance with the May 16, 1997 Biological Opinion issued by the USFWS. Bombing occurred between July 21 and August 1, 1997; the surveys were conducted on July 19 and August 2, 1997. The marine mammal and reptile surveys were performed by following the coastline 300 meters offshore at an altitude of 300 feet or less, and the seabird surveys were accomplished by

flying just seaward of pre-established stations at an altitude of 300 feet or less. These surveys were not intended to count total numbers of birds using the island; rather, they were to determine what impact the use of the range is having on the larger nesting or roosting birds (such as masked and red-footed boobies) that are using the flat upper portion of the island.

During the pre-bombing survey on July 19, a large flock of mixed seabirds was observed departing to the north as helicopter approached. Also, a flock of 40 or more brown boobies flew out of a cave on the southern end of the island. A total of 330 larger nesting birds were tallied at pre-determined stations during the survey. No turtles or marine mammals were seen in the vicinity of the island or in transit to or from the island. No turtle tracks were seen on either of the two beaches.

During the post-bombing survey on August 2, it was noted that bombardment of the island during the July 21 to August 1 training exercises appeared to have been intensive and on target; 25 to 50 new bomb craters were observed. The valley in the middle of the northern portion of the island had burned to bare earth. There were also several other smaller circular burn areas.

As during the pre-bombing survey, a large flock of mixed seabird species departed to the north at the helicopter's approach. A flock of 50 to 100 brown boobies flew out of a cave on the northern end of the island and a flock of 50 or more flew out of a cave on the southern end of the island. This increase in the numbers seen roosting in the caves over the pre-bombing survey indicates the likely beginning of the nesting season. A total of 336 larger nesting birds were tallied at the sampling stations, and one or possibly two dead seabirds were seen near a new bomb crater on the southern end of the island.

Fewer noddies were evident than during the pre-bombing survey. Only one brown booby was seen nesting on the island and no frigatebirds were observed. Figure 3 shows areas that are significant seabird nesting areas.

No turtles or marine mammals were seen in the vicinity of the island or in transit to or from the island.

8.0 Synthesis and Conclusions

8.1 Erosion

Historical background: Mass wasting and erosion have been occurring on FDM over time as a result of natural processes, as reported by the earliest observers. References to the island as being gullied, eroded down to the soil layer, and containing deep caves and caverns were made by the Spanish explorers. Tectonically, FDM is more closely associated in structure to Saipan than the emergent volcanic islands to the north. A volcanic core is overlain by limestone with variable amounts of volcanic sediment mixed in. The limestone is faulted and subject to caves and sinkholes. Mass wasting is typical of these types of islands; limestone is weakened by a combination of rainwater solution along faults, wave action undercuts the cliffs, and benthic organisms bore into the limestone near the waterline. Frequent earthquakes, ranging between 5 and 8 on the Richter scale, accelerate the erosion process.

Conditions in the last fifty years: Photos of the island taken before the commencement of military use reveal that the island was experiencing erosion and mass wasting, with large boulders breaking off from the steep island cliffs into the sea. These conditions are also well documented after the commencement of military bombing. Four years after the bombing began the 1975 EIS described the coastline as "...extremely precipitous, broken by numerous sea caves and occasional rock slides which form a talus slope of large blocks and boulders." More recently, in the last two years, detailed color photos and in-depth surveys have documented that substantial erosion continues on FDM. Certain areas, primarily in the narrow middle of the island, are regions of mass-wasting where large sections of deteriorated rock have slid into the ocean.

Causes of erosion: While the erosion on FDM appears to be a natural process that has been occurring continuously, it is unclear to what degree military bombardment has aggravated the rate of mass wasting. Photos taken during recent surveys of FDM show that ordnance impacts areas of the cliff faces as well as the central, interior portions of the island. These impacts range from those of inert projectiles to large bomb craters. It is likely that impacts from ordnance on the margins of the island contribute in some degree to the natural process of fracturing and erosion.

8.2 Vegetation:

Species represented: Vegetation surveys of FDM over time (the years of 1902, 1975, 1984, and 1996) demonstrate that the species present on the island have not been significantly altered over the last hundred years. While it is difficult to compare these surveys, since they are of dissimilar methodology, it is interesting to note that a number of species, including lilies, low grasses, and papaya, are consistently mentioned in all the surveys. A third of the species mentioned in the 1975 report were also identified in the 1984 survey, and nearly all (92%) of the species collected in the 1984 survey were also identified in 1996. The most thorough botanical inventory was completed in 1996. It includes almost all the species identified in all the other surveys, and lists several additional species which, rather

than representing new species, were most likely just overlooked by the previous studies.

Structure: The structure of the plant community on FDM has apparently undergone changes over the period of record. The 1902 report states that the plateau was covered with bush about 4 m high; the 1975 report also records shrub-like trees approximately 3.5 m high. These reports are consistent with the 1944 aerial photos showing extensive groves of small trees on the island. While today vegetation covers the entire top of the island, with the exception of areas of bare ground around the perimeter, nothing over 1.8 m high has been reported, and extensive vertical development of woody plants is not present. Comparisons of aerial photos taken both before and after FDM was used as a bombardment range demonstrate these changes in vegetation structure (see Figure 2).

Species composition: Species composition has also changed over time. The 3.5 m shrub-like trees mentioned in the 1975 report were identified as Indian mulberry, and were classified as the dominant overstory tree. The 1996 survey found the dominant plant in the central region of the island to be beach sunflower, with crinum thickets also covering much of the central region. The current vegetation on the island appeared heavily impacted by surface disturbance; the vegetation was not homogenous, but rather a mosaic of several types, lacking clear boundaries. Patches of disturbed vegetation scattered throughout the central area were thought to represent places most recently impacted by explosives. Hypothetically, the continuous disturbance caused by periodic bombardment creates a condition more favorable to pioneer plants and faster growing species, at the expense of plants that require a more stable ecosystem.

Possible causation: The changes in vegetation structure and composition are likely due to a combination of factors, both natural and anthropogenic. Lightning-induced fires and typhoon-related storm damage to plants (through wind pruning and scouring and salt damage by wind-blown sea spray) are examples of natural conditions which may have caused periodic changes in vegetation. Ground disturbance is solely attributable to military activities, and may have contributed to a change in natural equilibrium. During a post-bombing survey in March of 1997, little new damage to soil or vegetation was observed in the more heavily used flat nesting areas on the northern portion of the island. However, during the August 1997 post-bombing survey, 25 to 50 new bomb craters were observed, and the valley in the middle of the northern portion of the island had burned to bare earth.

Vegetation used for bird nesting: Throughout the last hundred years (during the 1902, 1975, and 1996 surveys) birds have been noted to use the vegetation on FDM for nesting. The 1902 report vaguely describes marine birds in "great numbers" nesting in the trees and bushes. The 1975 report estimated that boobies nested in a colony distributed fairly evenly over the vegetated top of the island. The 1996 surveys documented nests of red-footed boobies and great frigatebirds on the high brush on the western side of the island, and megapodes were seen in the dense, low shrubby vegetation in the central, interior portion of the island.

Vegetation changes and bird distribution: The 1996 report noted that the distribution and population of red-footed boobies was probably limited by the lack of medium and tall trees on the island. However, there are several species of birds utilizing FDM that require bare

ground or sea caves as nesting sites. These include the masked and brown boobies, observed nesting on the ground on the eastern side of the island, and the black noddies, common noddies, and white tern that use the sea caves on the east central edge of the island for nesting. It is possible that the change in vegetation structure has had an effect on the proportion of habitat suitable for roosting and nesting of various bird species using the island, thereby changing the relative abundance of bird species using the island. It is not possible with existing information to confirm or quantify this possibility.

8.3 Birds:

Species distribution: The majority of bird studies completed in the Marianas are geographically aggregated and do not specify which species occurred on the island of FDM. Baker's 1951 work, for example, for many years the standard ornithological reference work for the region, gives detailed accounts of over 200 bird species, but only lists their general distribution.

Despite this lack of detail, several species have been noted rather consistently during 17 different studies over a 95-year time period (Table 2). The three species of booby have been documented consistently since 1903; the whimbrel, plover, great frigatebird and Micronesian starling have been consistently found on the island since 1975, along with several types of doves, terns, and noddies; and the Micronesian megapode has been consistently observed on the island since 1991, and may have been observed as early as 1902 by Fritz, referred to as a "woodcock."[14]

Abundance estimates: While extensive collecting was done in the Marianas in the late 1800s and early 1900s by Europeans and Americans, in the 1920s through World War II by the Japanese, and in the mid-late 1940s by the Americans, no seabird population estimates are available from these times.[15] Estimates from recent times may not be representative of actual bird use of the island. The 1975 EIS lacks an explanation of methodology used for counts, the recent November 1996 survey was based on only a few hours on the island and only during one season of the year. The various helicopter surveys conducted in 1997 did not note total numbers of birds on the island, but rather only the birds most likely to be impacted by military bombardment at certain counting stations (i.e. ground nesters that did not fly away during the approach of the helicopter).

The first abundance estimates available are from the 1975 EIS. The estimate for nesting boobies exceeds by more than 60X any other estimate given for boobies on FDM (Table 3). Boobies in the hundreds, though, have been recorded consistently over the past 12 years. The USFWS estimates that approximately ten endangered megapodes occur on the island. In 1997, between two and four Mariana fruit bats were observed (although mammals, bats

[14] Barring further information, it is difficult to say whether Fritz saw one of the several types of Asiatic woodcocks known from the area, or possibly a snipe, or maybe even a megapode.

[15] J.D. Reichel (1991).

Table 2: FDM Bird Species List

	Reference made to these species during these years:									
Common Name	1902	1903	1932	1951	1975	1985	1991	1995	1996*	1997•
red-tailed tropicbird						√	√		√	
white-tailed tropicbird						√	√			
wedge-tailed shearwater							√			
masked booby		√	√	√	√	√	√	√	√	√
red-footed booby		√		√	√	√	√		√	√
brown booby		√		√	√	√	√	√	√	√
great frigatebird					√		√		√	√
Pacific reef heron							√			
Micronesian megapode							√	√	√	√
Pacific golden plover									√	
lesser golden plover					√		√			
wandering tattler							√			
whimbrel					√		√		√	
black noddy						√	√		√	√
brown noddy					√	√	√		√	√
sooty tern							√		√	√
white tern/common fairy tern					√	√	√	√	√	
gray-backed tern										
little tern										
Philippine turtle dove					√		√			
white-throated ground dove					√		√	?	√	
Micronesian starling					√		√	√		
"woodcock"	√									
"pigeon"	√									
"thrush"	√									
cattle egret									√	
bristle-thighed curlew									√	
ruddy turnstone									√	
Eurasian tree sparrow									√	
Mariana fruit bats									√	√
Notes:										
*Represents findings from two studies in 1996.										
•Represents findings from seven studies in 1997.										

TABLE 3: FDM Bird Abundance Estimates

	Abundance estimates in # of individuals during these time periods:						
Common Name	1975	1985	1991	1994	1995	1996	1997
red-tailed tropicbird		20	20/u			4	
white-tailed tropicbird		10	10/u				
wedge-tailed shearwater			u				
masked booby	50,000 total boobies	200	100/c	c		750	
red-footed booby		1000	400/a			500	
brown booby		1000?	1000/a		≤1000	200	
great frigatebird			u			25	
Pacific reef heron			u				
Micronesian megapode			h			4+	10
Pacific golden plover						10	
lesser golden plover			h			5	
wandering tattler			u				
whimbrel			h			2	
black noddy		100s	100s/c			20	
brown noddy		1000-3000	a			50	
sooty tern			u			1	
white tern/common fairy tern	1,000	100	60/c			200	
gray-backed tern							
little tern							
Philippine turtle dove			h				
white-throated ground dove			h			30 to 50	
Micronesian starling			h				
"woodcock"							
"pigeon"							
"thrush"							
cattle egret						1	
bristle-thighed curlew						3	
ruddy turnstone						6	
Eurasian tree sparrow						4	
Mariana fruit bats							2 to 4
Key:							
u= uncommon							
c= common							
a= abundant							
h=hypothetical (species not unequivocally known from the island)							
Source of definitions in key: Reichel and Glass (Jan. 1991)							

are listed herein as the only other terrestrial animal of concern).

Nesting: Accounts of nesting on FDM begin with Fritz's 1902 survey. Reports of observed nests have been made of all three species of booby, the brown noddy, black noddy, and white tern (see Table 1). Birds for which nesting has not been observed, but which are thought likely to nest on FDM include the Micronesian megapode, white-tailed tropicbird, and red-tailed tropicbird. Masked booby nesting is restricted to only four Mariana islands, and FDM appears to have the largest nesting population of these (based on the November 1996 avifaunal surveys of FDM, when compared to bird populations given in the Reichel 1991 report). The frigatebird is thought to have only two small breeding colonies in the Marianas, one of which is on FDM.

Effects of military use: Some individual mortalities have been observed as a direct result of range use, and noise disturbance has been observed to cause some species of birds to fly off the island. A post-bombing survey in August 1997 recorded 25 to 50 new bomb craters and several burn areas. Over time, the change in vegetation from such occurrences may have resulted in fewer tree nesters and more ground nesters. However, there remains a diverse avifauna utilizing the island, and no significant changes in the number of ground nesting birds was found to occur during two pre- and post-bombardment surveys conducted in 1997.

It is not possible to say whether or not the cumulative effects of military use on FDM have resulted in a net long-term relative change in species abundance, or absolute abundance of birds using the island. Present day counts may represent a condition different from that which existed earlier, but no studies have yet been conducted to conclusively determine the cause(s) of such changes. Natural factors, such as weather and oceanic conditions, may have as profound effects on bird distribution and abundance as any manmade causes.

8.4 Marine Resources:

No systematic marine survey had been conducted on FDM prior to 1996. There is no baseline by which to compare current conditions. However, the following observations can be offered in evaluating possible cumulative effects:

Coral Development: Coral development appears relatively undisturbed by military use of the island. Because corals are relatively slow to regenerate, direct effects of bombing over time should be discernible if they were occurring. The only direct effect observed was the presence of unexploded ordnance in the water, which appear to be functioning as firm substrate similar to mass wasted rocks from the island. The dominant force affecting coral development appears to be wave energy and scouring.

Sediment Plumes: Underwater observations of FDM have revealed several areas, primarily on the windward side of the island, where rockslides are distinguishable to water depths of

approximately 20 m.[16] These slides have, at times, resulted in substantial sediment plumes which have been observed off both the north and south ends of the island. These plumes, which are quickly carried away from FDM by strong currents, are thought to have a limited effect on water quality.[17] Coral growth can also be impacted by sediment plumes from surface runoff. It is unclear to what degree military bombardment has aggravated the rate of mass wasting that has led to sediment plumes, and to what extent this type of erosion may be impacting coral growth.

Ordnance Impacts: Numerous intact unexploded bombs were observed on the reef surrounding the island. Most of these were not filled with explosives, but rather had inert fillers and were armed with smoke tracers. In some areas these UXO served as substratum for successful coral settlement and growth. Few bomb fragments were found on the reef, likely due to the complete destruction of ordnance on impact with the sea surface and the transport of these fragments away from the impact site by currents and wave surge.

With one exception on the submerged cliff shoreline, there was no evidence of damage to the reef surface and associated biota from explosives. Therefore, ordnance appeared to have a negligible effect on biotic community structure at FDM.

Marine Species: The shoal areas in the vicinity of the island provide suitable habitat for commercially important species of fishes, but fish communities appear to lack many of the larger fish. The reduced abundance of food fish may be the result of fishing pressure rather than military exercises, since the overall fish communities contained numerous species and diversity. Very few sightings of green sea turtles and no sightings of hawksbill turtles, dolphins, whales, or other marine mammals occurred during any of the five to ten recent surveys. The two small, wave-swept beaches on FDM are not suitable for turtle nesting. It is unlikely that marine mammals or reptiles are being negatively impacted by military activities on the island.

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Appendix D-2
Avifaunal Survey Report of Farallon de Medinilla
(November 19, 1996)

AVIFAUNAL SURVEY REPORT OF FARALLON DE MEDINILLA

Prep. for

Belt Collins & Associates

Honolulu, Hi

by

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Faunal Surveys

19 November 1996

INTRODUCTION

This report provides the findings of a brief one day (15 November 1996) avifaunal survey of Farallon De Medinilla. The purposes of the investigation were:

1- Determine what birds presently occur on the island.

2- Where possible, and within the constraints of available time, obtain data on the relative abundance of each species.

3- Record breeding phenology.

4- Identify the general types of habitats available to birds.

METHODS

The field survey was limited to a walking tour of the northern 2/3 of the island. Fig. One indicates the route walked. Brief stops were made at locations where birds were nesting. Notes were kept on the numbers of each species and their breeding activity. At a few locations the near shore waters were scanned with binoculars. Night observations were not conducted.

Weather during the survey was warm with light clouds and strong easterly winds. The sea was rough and onshore waves were high. Occasionally sea foam was blown up on the top of the island. The vegetation was low in stature but lush. Apparently the island had

received sufficient rain during the past few months. No signs of fire or high wind damage were noted.

The common and scientific names of birds used in this report follow those given in Pratt et al. 1987. The taxonomic sequence of species presentation also follow the order given in this resource.

RESULTS AND DISCUSSION

Table I summarizes the field survey findings. Below are expanded notes obtained for each species.

Family: Phaethontidae: Tropicbirds

Red-tailed Tropicbird (Phaethon rubricauda)

Four Red-tailed Tropicbirds were seen flying over and around the island. This species nests on the ground under vegetation and on coastal cliffs. Pratt et al. 1987 report this species from Maug and Pagan. They probably nest on Farallon De Medinilla but our brief visit did not permit sufficient time to search for nests.

Family: Sulidae: Boobies and Gannets

Masked Booby (Sula dactylatra)

This species is the largest of the boobies (Genus Sula). They nest on the ground. Males can be distinguished from females by their

brighter yellow bills and thin high whistle-like calls. A rough estimate of 750 birds was obtained by a combination of over flight of the island and a walking survey. We found most were incubating eggs but a small percentage had downy chicks. Many pairs had two eggs but this species typically raises only one chick. At the time of our visit Masked Boobies were clearly the most abundant bird on the island. At other times of the year other species likely dominate. Boobies typically nest in areas where they are not frequently disturbed. They show little fear of man and only leave their nest if approached too closely.

Brown Booby (Sula leucogaster)

Brown Boobies were the least common booby recorded on the survey. We estimated around 200 were either nesting or just resting on the island. Those that were nesting had large, almost fledged chicks. Apparently they were at the end of their breeding season. We found several dead chicks that were nearly fledged when they died. We also saw some chicks that appeared thin and may have been abandoned. Perhaps recent storms reported to have passed through this region affected the adults ability to forage and feed their chicks. Brown Boobies nest on the ground like Masked Boobies. They were most concentrated along the eastern side of the island (Fig. 1).

Red-footed Booby (Sula sula)

An estimated 500 Red-footed Boobies were scattered on nests or seen flying over the island and offshore. This species builds its nest of sticks and places it up in trees or on the tops of bushes. The absence of trees on the island meant that low bushes were the preferred nesting sites. A few had eggs but most were just beginning to build their nests. One dark phase bird was seen attending a nest. In the north Pacific the white color phase predominates with typically better than 90% of the adults colored white with black wing tips. In the south-eastern Pacific the dark color phase of brown to gray bodies with golden heads and white tails comprises the vast majority of these populations. This apparent anomaly is usually explained by the suggestion that north and south Pacific gene pools are not mixing due to the isolating effects of the equatorial doldrums. The continued predominance of one color phase over the other may be due to initial founding events and genetic drift rather than particular selection pressures.

Family: Fregatidae: Frigatebirds

Great Frigatebird (Fregata minor)

This species occurs in the tropical waters of Pacific, Indian and Atlantic Oceans. They nest in trees and bushes and construct loosely arranged flat platforms of small sticks similar to Red-footed Booby nests. A small colony of frigates were nesting on the west of the island (Fig. 1). No chicks were seen but some adults were on eggs.

Perhaps 25 frigates were on or near the island during our visit. We saw juveniles with white heads roosting near the colony and flying near shore. This species chases other seabirds and steals their catch. Boobies are often a favorite target of these aerial pirates.

The Lesser Frigatebird (Fregata ariel) also occurs pantropical but nests more often on the ground. They are less common than the Great Frigatebird and none were seen on this survey.

Family: Ardeidae: Herons, Egrets and Bitterns

Cattle Egret (Bubulcus ibis)

Pratt et al. (1987) report this species as a common migrant to western Micronesia. One Cattle Egret was seen flying across the island near the Brown Booby colony. This land bird forages on a wide variety of prey including small rodents, insects, prawns, eggs and chicks. We saw only the one bird but our brief visit might have missed others on the island.

Family: Megapodiidae: Megapodes

Micronesian Megapode (Megapodius laperouse)

Four Micronesian Megapodes were seen on the walking portion of the survey. All were flushed from the cover of dense vegetation. They called and flew a short distance before dropping into the vegetation. Time did not permit a search for nest mounds. This dark brownish chicken-like bird is often called an Incubator Bird because of their unusual habit of burying their eggs in mounds of

dirt and leaf liter where the heat of the sun and the decomposing plants provide the warmth necessary to promote development of the embryo. The young are independent and very precocial at hatching. The nest mounds are used communally by several females and are often large and distinct. This species is endangered. They are restricted (endemic) to Micronesia. On uninhabited islands they are less shy. How many actually occur on Farallon De Medinilla was not determined. The four birds we observed probably do not represent the entire population. A more thorough systematic search would provide a more accurate picture of the species abundance.

Family: Charadriidae: Plovers and Dotterels

Pacific Golden-Plover (Pluvialis fulva)

Approximately ten plover were seen and heard during the survey. The southern end of the island was not visited but appeared from the air to be more barren and thus more useable by shorebirds like plover. This migrating species requires open habitat to forage. They are the most common and abundant shorebird wintering in the north Pacific. They nest on the tundra in western Alaska and the Russian far east. Long term studies in Hawaii and Alaska suggest that plover wintering in Hawaii and the central and southeastern Pacific nest in Alaska while those which migrate to the western Pacific, Coastal Asia and the Indian Ocean breed on the Russian tundra. All of the plover seen on the survey were in their non-breeding (winter) plumage. We did not have close enough looks at the birds to see if any were juveniles (birds of the year). Pacific Golden-

Plover are usually territorial on the wintering grounds and return each year to the same foraging territory. This behavior makes it possible to obtain quite accurate population counts if there is sufficient time to observe a site over a few days. Our studies in Hawaii have found that better than 70% of the plover marked in one season will survive to return the subsequent winter (Johnson et al. 1989). We have birds marked in the early 1980's still returning to our study sites on Oahu. These birds may be 16+ years old!

Family: Scolopacidae: Sandpipers, Phalaropes, and Related Birds

Whimbrel (Numenius phaeopus)

Two Whimbrel were seen during the walking survey. This migratory shorebird is a common winter visitor in Micronesia (Pratt et al. 1987). Whimbrel's breed in the arctic tundra of north America and Russia. They are similar in size to Bristle-thighed Curlew (Numenius tahitiensis) but have a different call, are lighter in color and lack the cinnamon rump of the Bristle-thighed Curlew. Although only two were tallied on the survey others may occur on the island, particularly in the more open southern sector.

Bristle-thighed Curlew (Numenius tahitiensis)

Pratt et al. (1987) report this species from eastern Micronesia. They typically winter in the central and southeastern Pacific. The three birds seen on Farallon De Medinilla indicate a more westerly distribution than previously believed. Bristle-thighed Curlew are

the only shorebirds whose entire winter range is confined to oceanic islands. They breed in a very restricted area of western Alaska. Presently the United States Fish and Wildlife Service (USFWS) list the Bristle-thighed Curlew as a "species of concern".

Ruddy Turnstone (Arenaria interpres)

Six Ruddy Turnstones were counted on the walking survey. This is a common migratory shorebird in the Pacific. They forage in open habitats covered in low vegetation as well as along shorelines and wetlands. Typically they winter in small flocks and are not territorial. A longer survey of the island might find more turnstones. The ones we recorded were in the central sector of the island.

Family: Laridae: Jaegers, Gulls and Terns

Sooty Tern (Sterna fuscata)

One Sooty Tern was seen flying offshore by T. Sutterfield (PACDIV) but none were recorded by those involved on the walking bird survey. This species is very common in the tropics and usually nests in large numbers on uninhabitated islands. They probably nest on Farallon De Medinilla but were not doing so during the period covered by this survey. Outside of the breeding season Sooty Terns are pelagic.

Brown Noody (Anous stolidus)

A rough estimate of 30 Brown Noddies were seen flying about the island and nesting on the eastward facing cliff faces. This species

occurs in all the tropical oceans. They are flexible in their nest sites. Some will construct nests in trees while others will nest on the ground. Brown Noddies are more pelagic and forage less in flocks than the similar Black Noddy (Anous minutus) (Pratt et al. 1987). Relatively few birds were present during the survey which might indicate that the breeding season was just beginning.

Black Noddy (Anous minutus)

This species is smaller and darker than the Brown Noddy with a more contrasting gray cap. They forage closer to land but also will nest on the ground or in trees. About 20 Black Noddy were seen on the survey, some on nests on narrow ledges in the sea caves. Pratt et al. (1987) report Black Noddies forage in flocks.

Common Fairy-Tern (Gygis alba)

This species was the most abundant tern seen on and around the island. About 200 were observed, many on nests in the same sea caves as the noddies. Fairy-terns are pan-tropical and nest on inhabited as well as uninhabited islands. They are not shy and will readily approach people.

Family: Columbidae: Pigeons and Doves

White-throated Ground-Dove (Gallicolumba xanthonura)

Around 30 White-throated Ground-Doves were seen on the walking survey. No nests were discovered. The birds were fairly tame and only flushed when approached closely. This species is endemic to the Mariana Islands and Yap. Despite their name they frequently forage

in trees on forested islands. The population appeared robust for such a small island.

Family: Passeridae: Old World Sparrows

Eurasian Tree Sparrow (Passer montanus)

This was the only introduced (non-native) species recorded on the survey. Four Eurasian Tree Sparrows were seen in the central region of the island. Pratt et al. (1987) reports this species is native to Eurasia and may have been introduced in the 1940's to the Mariana Islands. They occur on Saipan and many have gotten to Ferallon De Medinilla on their own or may have been introduced from Guam during military operations on the island.

HABITATS

The island supports a dense cover of low vegetation where birds can shelter, nest and for some species find food. The shoreline cliffs and sea caves provide nesting sites for terns. Masked Boobies and Brown Boobies were nesting along the eastern (windward) side where they could more easily become airborne when departing their ground nests. Red-footed Boobies and Great Fregatebirds breed on the western side of the island where there is less wind but higher brush to support their nests. Shorebirds like plover, curlew and turnstone require open habitat and were found in areas that were barren or had patchy vegetation. Megapodes and doves were in the dense vegetation where cover and food were more available. Rats (species unindentified) were also observed on the field survey.

OTHER STUDIES

The only previous data available for Farallon De Medinilla are contained in the 1975 Department of the Navy Final Environmental Impact Statement, Farallon De Medinilla Bombardment Range, Mariana Islands. Section 8 of this document concerns wildlife. Six species of seabirds are reported: Red-footed Booby; Masked Booby; Brown Booby; Great Frigatebird; Fairy Tern; and Common Brown Noddy Tern. These same species were also observed on the 1996 field survey. The 1975 report further indicates that Pacific Golden-Plover, Whimbrel, Micronesian Starling (Aplonis opacus guani), White-fronted Ground Dove and Philippine Turtle Dove (Streptopelia bitorquata dusumieri) are "found on the island". The 1975 EIS also notes "a large population of Polynesian Rats (Rattus exulans)".

Population estimates for each species are not given in the 1975 EIS. The report does, however, state that "boobies nest as a colony which is fairly evenly distributed over the vegetated top of the island at a rate of about 100 nests to the acre". They extrapolate this approximate nesting density to estimate a population of 50,000± adult boobies on the island. This estimate apparently refers collectively to all three booby species. No methods are presented in the wildlife section so one cannot know how these numbers were obtained, what time of year the survey was conducted and how many days were involved in the survey. Furthermore, the comment that the boobies were "evenly

distributed" over the island does not conform to the present nesting patterns. The wide discrepancies between the 1975 observations and the present survey results suggest either (i) that very large changes have occurred in the local bird populations in the time interval between these surveys, or (ii) that the earlier reported results are inaccurate. Due to the lack of description of methods in the 1975 EIS, full credence cannot be given to the numerical estimates reported therein.

CONCLUSIONS

A total of seventeen avian species were recorded on this brief survey. Estimates of their abundance are necessarily imprecise. Seabirds, migrants and resident landbirds share the island. Several species were nesting. No night observations were conducted. Birds like petrels and shearwaters which forage away from the island during the day and return after dark may have been missed by this diurnal survey. Other species might use the island for nesting at different times of the year.

The only endangered species recorded was the Micronesian Megapode. Only four birds were tallied. A more thorough search of the island, especially the areas covered in dense vegetation, would likely reveal more megapodes.

Despite potentially detrimental military activity, the island supports a diverse avifauna. Birds were nesting in target areas

which must result in some mortality during training exercises, although no direct evidence of this mortality was observed.

RECOMMENDATIONS

1- More data are needed on the abundance, distribution, and breeding status of the endangered Micronesian Megapode. While only two or three additional field days would likely be sufficient to obtain this information, at present access to the island is prohibited because of the recent discovery by EOD teams of unexploded cluster bombs on the island. This UXO needs to be cleared before any biological ground surveys can be resumed. At present there are no plans to undertake UXO clearing on FDM.

2- Night observations need to be made in order to learn whether or not petrels and shearwaters may be using the island.

3- The White-throated Ground Dove appears to be common. Any future visit ought to attempt a more complete census of the dove population.

4- More data on seabird activity on the island should be collected from future site visits or flyovers. The accuracy of the booby population estimate in the 1975 report is questionable because there is no explanation of methodology.

TABLE 1

Birds recorded on a one day field survey (5 November 1996) of Farallon De Medinilla. Abundance estimates are based on either the total number recorded or a broad estimate of birds seen on or near the island.

Family Name	Scientific Name	Common Name	Abundance
Seabirds:			
Phaethontidae	Phaethon rubricauda	Red-tailed Tropicbird	4
Sulidae	Sula dactylatra	Masked Booby	750
	Sula leucogaster	Brown Booby	200
	Sula sula	Red-footed Booby	500
Fregatidae	Fregata minor	Great Frigatebird	25
Laridae	Sterna fuscata	Sooty Tern	1
	Anous stolidus	Brown Noddy	50
	Anous minutus	Black Noddy	20
	Gygis alba	Common Fairy-tern	200
Migrants:			
Ardeidae	Bubulcus ibis	Cattle Egret	1

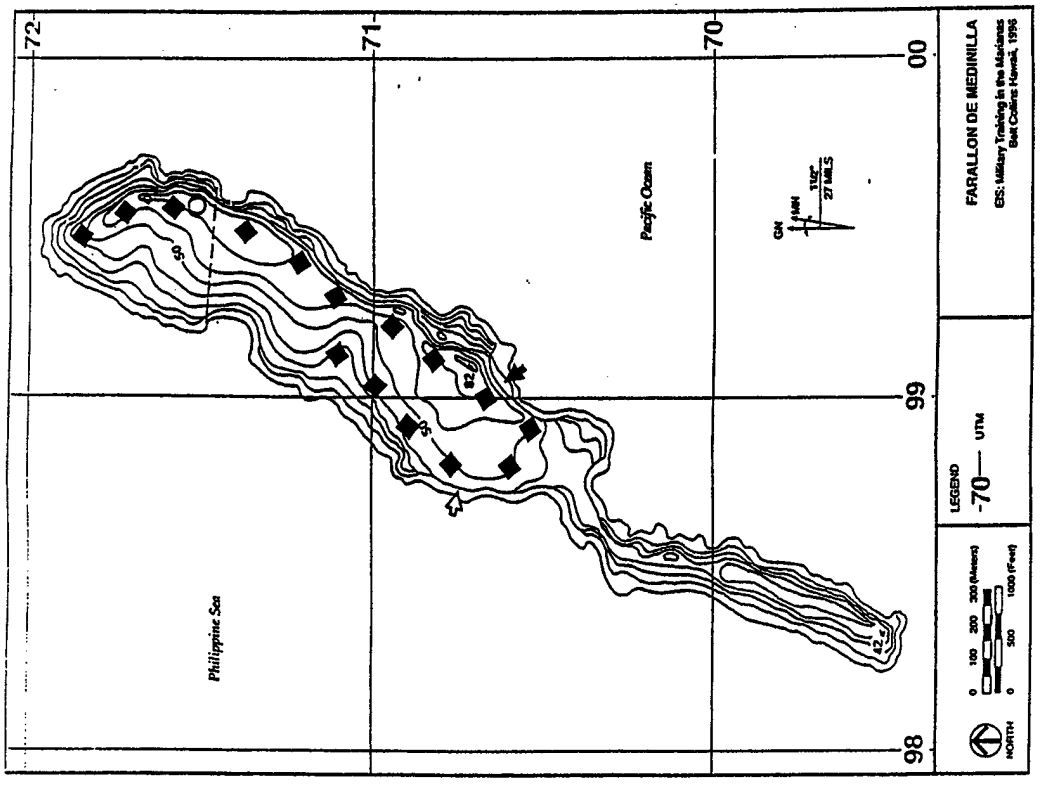


Fig. 1. Location of avifaunal survey. Solid diamonds indicate path of walking survey. Open arrow points to Great Frigatebird colony. Solid arrow indicates the area where Brown Boobies were nesting.

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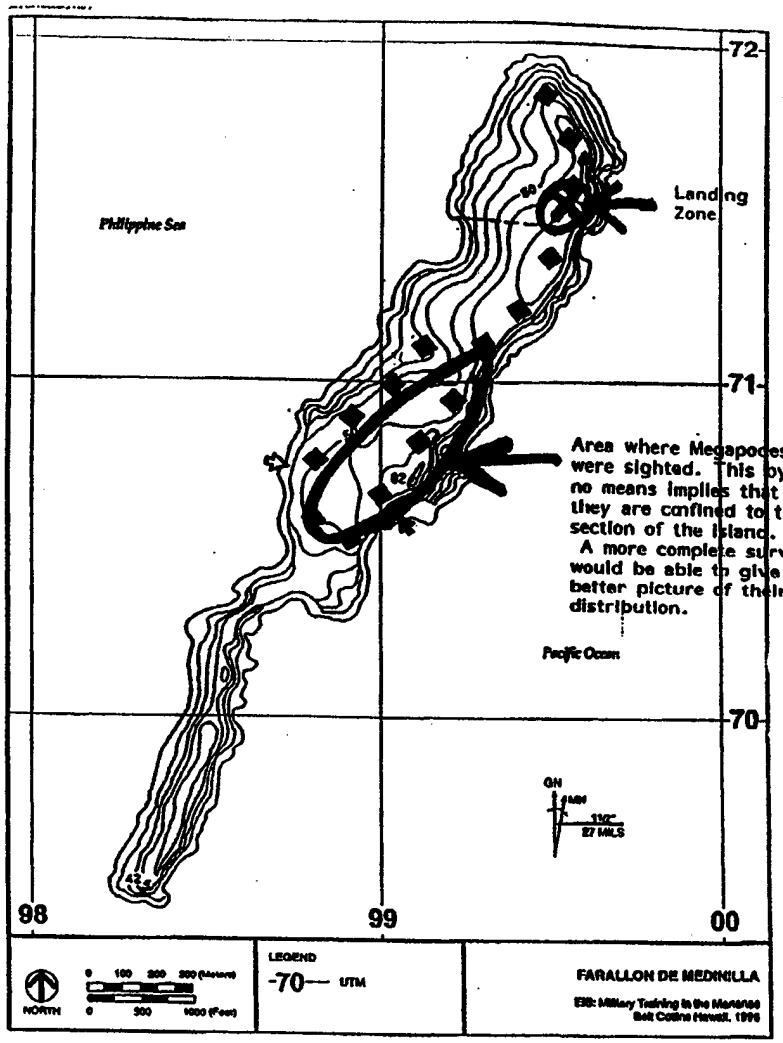
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TABLE 1 (cont.)

Family Name	Scientific Name	Common Name	Abundance
Migrants:			
Charadriidae	Pluvialis fulva	Pacific Golden-Plover	10
Scolopacidae	Numenius phaeopus	Whimbrel	2
	Numenius tahitiensis	Bristle-thighed Curlew	3
	Arenaria interpres	Ruddy Turnstone	6
Resident Land Birds:			
Megapodiidae	Megapodius laperouse	Micronesian Megapode	4
Columbidae	Gallicolumba zanthonura	White-throated Ground-Dove	30
Passeridae	Passer montanus	Eurasian Tree Sparrow	4


72
71
70
98
99
00
Philippine Sea
Landing Zone
Area where Megapodes were sighted. This by no means implies that th they are confined to this section of the island.
A more complete survey would be able to give a better picture of their distribution.
Pacific Ocean
GN
6MM
110°
27 MILS
LEGEND
-70- UTM
NORTH
FARALLON DE MEDINILLA

Appendix D-3
Botanical Survey of Farallon de Medinilla, Commonwealth of the Northern Mariana Islands (December 1996)

BOTANICAL SURVEY OF FARALLON DE MEDINILLA,

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Prepared by
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Isle Botanica

for
Belt Collins and Associates
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INTRODUCTION

Farallon de Medinilla is situated in the Commonwealth of the Northern Mariana Islands (CNMI) at 16° N and 146° E, about 45 miles north-northwest of Saipan. The CNMI can be divided into a northern portion comprising eight volcanic islands (some of them recently active) and six relatively low, limestone-covered islands. Farallon de Medinilla is the northern-most of the latter type, and is covered mostly with eroded limestone soil, with scattered limestone outcroppings.

The straight, narrow island is little more than a limestone ridge arising out of the sea. It is aligned in a northeast to southwest direction and surrounded on all sides by cliffs, which are highest on the eastern edge. It is approximately 2 miles long and 1600 ft across at its widest point, and has an area of approximately 224 acres. Its highest elevation, approximately 82 ft, occurs in the central portion. The topography inland from the cliffs is for the most part flat to gently sloping. The island has apparently never been inhabited, nor have feral animals been established there (although the Polynesian rat, Rattus exulans, is present).

PREVIOUS BOTANICAL STUDIES

Apparently no botanist has ever visited Farallon de Medinilla, although one made reconnaissance overflights by helicopter in 1984. Apparently the only specimens, 13 in number, known from the island were collected by two wildlife biologists in the same year. These are Capparis spinosa, Abutilon indicum,

Portulaca lutea, Pisonia grandis, Morinda citrifolia, Excoecaria agallocha, Callicarpa candicans, Ipomoea pes-caprae, Boerhavia sp., Operculina ventricosa, Wollastonia biflora, Crinum asiaticum, and an unidentified sterile grass (D. Herbst. pers. comm.).

Three main publications have been published on, or which include, the flora of the CMNI. One is a checklist of the flora of Micronesia (Fosberg et al. 1979, 1982, 1987), the second is a checklist (with two additions) of the flora of the CNMI (Fosberg et al. 1975, 1977, 1980), and the third a checklist of the CMNI prepared during a Japanese expedition to the northern volcanic islands in 1992 (Ohba 1994). At least seven species, Mariscus javanicus, Heteropogon contortus, Sesuvium portulacastrum, Wollastonia biflora, Ipomoea pes-caprae, Morinda citrifolia, and Premna serratifolia, are recorded by Fosberg et al. (1979, 1987) from Farallon de Medinilla, but it is not certain if these records are based on specimens or observations.

The Japanese expedition did not visit, nor did Ohba's publication mention, other than in passing, Farallon de Medinilla. The publication includes a checklist of species recorded during their visit (but excludes species recorded only by previous botanists). Only 29 of the 40 species recorded on Farallon de Medinilla during the present survey were noted (see Table 1) by Ohba for the volcanic CMNI islands.

The only other botanical record turned up in the literature search from the island is found in an environmental impact statement produced by the Navy (anon. 1975). It lists the following species: Morinda citrifolia, Calophyllum inophyllum,

Hibiscus tiliaceus, Bikkia tetrandra, Crinum asiaticum (misidentified as Pancratium littorale), Carica papaya, Cyperus spp. (Mariscus javanicus), Ipomoea pes-caprae, Cynodon dactylon, Heteropogon contortus, Euphorbia spp. (it is not clear what this is), Boerhavia spp., Sesuvium portulacastrum (misidentified as Batis spp.), and Portulaca spp. There is no indication of how these were identified, and no mention of voucher specimens.

METHODOLOGY

Two aspects of the botany of Farallon de Medinilla were studied during the site visit--the flora and the vegetation. The island was visited by the Principal Investigator on the 5th of November 1996, accompanied by other members of the survey team and several EOD (Explosive Ordnance Disposal) team members. The trip was to include four days of daily visits via helicopter from the U.S.S. Kilauea. However, because of an approaching hurricane, the visit was cut short just after noon of the first day, and the survey team was evacuated to Saipan.

While on the island, the Principal Investigator made a reconnaissance along with other members of the survey team and recorded notes on the vegetation and flora. This reconnaissance covered only the northern half of the island in the half day available.

Most plant identifications were done in the field, since nearly all species present were well known and were familiar to the Principal Investigator. To insure accuracy, voucher specimens of most species encountered (37 of the 40) were

collected. Insufficient time prevented the collection of the remaining three. The voucher specimens were divided into sets, one sent to the University of Guam, another to the Bishop Museum Herbarium, a third to the Smithsonian Institution, and a fourth retained at the University of Hawai'i Botany Department. Also because of the insufficient time, only a preliminary checklist of the flora, augmented by the Navy E.I.S. (anon. 1975), and an abbreviated description of the vegetation, is possible from the notes made during the visit.

THE FLORA

The flora of Farallon de Medinilla comprises all the plants found on the island. These plants are either native (species arriving by natural means, usually before human occupation) or alien (species arriving by accidental or intentional transport). Native species can be further divided into "endemic" species that are restricted to that area (i.e., are found only in the Mariana or Northern Mariana Islands) and "indigenous" species that are widespread and found in other areas. Alien species can be further divided into cultivated plants, which are usually intentionally introduced, and weeds, which in most cases are accidentally introduced. Since the island shows no signs of previous occupation, cultivated plants, other than two species that escape from cultivation (papaya and crinum lily), are not found on the island. Consequently, the vascular plants on the island are put into the two categories below: native species and weedy species.

The number of native and naturalized species recorded on the island 43 (Table 1), although additional time on the island would have no doubt increased this number.

Native Species

There are about 32 native vascular plant species recorded from Farallon de Medinilla (Table 1). The low number of native species is not unusual, since small islands with inhospitable conditions often have a small flora. This is due mainly to the small size, low elevation (which precludes multiple habitats), and harsh environmental conditions that are detrimental to most species. Only one species, Digitaria gaudichaudii, is endemic to the Mariana Islands (and Wake Island). This low rate of endemism is also to be expected on an island such as Farallon de Medinilla, where the majority of species are widespread littoral plants.

Strangely, the most common littoral shrub in the Pacific, Scaevola taccada (beach naupaka) was not seen on the island. Another plant that would be expected there, the coconut (Cocos nucifera), was likewise missing from the flora.

Weedy Species

About 11 of the 43 recorded species could be classified as weedy or naturalized alien species. This includes one grass that could not be identified beyond genus (Brachiaria), but which is probably an alien species not previously recorded from the CNMI. Some of the weedy species are uncommon, such as Blechum brownei, Amaranthus viridis, Leucaena leucocephala, Physalis angulata, and

Stachytarpheta jamaicensis. Only one alien species, Operculina ventricosa, was common, but this plant, which is native to tropical America, probably arrived naturally by seawater flotation of its seeds from neighboring islands.

THE VEGETATION

The climate at Farallon de Medinilla is wet tropical, and the vegetation in this area would be expected to be a limestone forest. However, because of the effects of the salt-laden sea breezes and occasional hurricanes, the island was probably originally covered with littoral scrubland. This vegetation probably prevailed up to 1971, when the island was first utilized as a bombardment range for the Navy and Air Force.

The current vegetation of the island has been heavily impacted by the activities of man, almost entirely due to the bombardment of the island. The earlier E.I.S. (anon. 1975) noted that "the overstory is composed primarily of Morinda citrifolia ... which at this location grows as a small shrub-like tree up to about 12 feet high." At the time of the visit, no woody plants found on the island even approached this height, and Morinda was rather uncommon. It is likely that this was a misidentification for Pisonia grandis, which at the time of the present survey was common, but not large.

Currently the island is covered with herbaceous or shrubby vegetation dominated by littoral species, but to distinguish plant communities would be nearly impossible because of the short duration of the visit and the mosaic nature of the vegetation.

Most of the plants on the island are to some degree tolerant of salty conditions, and each is distributed on the basis of its own tolerances. Since there is an environmental (probably salinity) gradient from the shore of the island up to the highest elevation (82 ft), there is also a gradient in vegetation, with each species growing where it can. Consequently, there is few clear boundaries between any vegetation units that could be created.

However, several aspects of the vegetation can be discussed, bearing in mind that these aspects generally lack definable boundaries. These aspects are divided here into a littoral zone, limestone outcroppings, central area, and wetland.

The Littoral Zone

The littoral zone (Fig. 1) occurs just above the high tide mark. It is present on the west side of the island where the cliffs are low, but on the east side the cliffs are so high that the right environmental conditions are lacking. The vegetation here is usually dominated by littoral species, such as Ipomoea pes-caprae (beach morning-glory) (Fig. 2), Portulaca lutea (sea purslane) (Fig. 3), and Sesuvium portulacastrum (seaside purslane, a misnomer since it does not actually belong to the purslane family) (Fig. 4), and Fimbristylis cymosa (Fig. 5), along with lesser amounts of other littoral plants, such as Portulaca oleracea (purslane), Wollastonia biflora (beach sunflower) (Fig. 6), and Boerhavia repens (Fig. 7). These species are able to survive occasional sea spray, which does not extend very far away from the shore.

Limestone Outcroppings

The eastern side of the island is bounded by limestone cliffs (Fig. 8), and at the the north end, at least (the southern end was not visited), there are some outcroppings inland. The vegetation on the cliffs and outcroppings is dominated by plants that can live rooted in rock cracks rather than soil, but which may not be able to withstand any direct sea spray. The dominant species in this habitat is Excoecaria agallocha (Fig. 9), with lesser amounts of Digitaria gaudichaudii, Bikkia tetandra, Hedyotis strigulosa, and Portulaca oleracea.

Some of these species, such as the beautiful Bikkia tetrandra (Fig. 10), are more or less restricted to this habitat because in soil they would soon be overgrown and shaded out by more vigorous species.

The Central Area

This comprises the central area of the island away from the low, exposed edges of the west coast (Fig. 11). It is covered with soil that appears to be a combination of highly eroded, red volcanic material and eroded limestone. The dominant plant here is probably Wollastonia biflora (beach sunflower). Also common are Mariscus javanicus, Capparis spinosa (spiny caper) (Fig. 12), and Ipomoea pes-caprae (beach morning-glory), with lesser amounts of Boerhavia spp., Portulaca lutea (sea purslane), Operculina ventricosa (Fig. 13), and Pisonia grandis (Fig. 14). In some places, the grass Digitaria gaudichaudii dominates (Fig. 15).

Because of the years of bombardment, and possibly other

factors, the vegetation here is not homogeneous, but rather a mosaic of several types, but which generally lack boundaries. Two additional subtypes can be distinguished, crinum thickets and disturbed vegetation.

Crinum Thickets

Crinum thickets, dominated by Crinum asiaticum (crinum lily), cover much of the central region (Figs. 16 & 17). The large crinum lily, which is widely cultivated in the tropics, appears to be native to Farallon de Medinilla. Probably 90% of the biomass in these thickets is composed of crinum lily, since it can crowd out or shade out most of the other species.

Disturbed Vegetation

Patches of disturbed vegetation are scattered throughout the central area, and probably represent places most recently impacted by explosives. In some places above the cliffs on the eastern side of the island, baren areas, inhabited by Masked Boobies, are present (Fig. 18). Since the "natural" vegetation in disturbed areas has been removed, the regrowth is usually dominated by herbaceous, light-loving species, many of which are called "weeds." These species, such as Portulaca oleracea (purslane), Phyllanthus amarus, Chamaesyce hirta, and Boerhavia repens are often present throughout the central area, but are either obscure under the other larger species, or are shaded out there but remain in the soil as seeds awaiting disturbed conditions when they can again propagate. After a few years, other taller or viney species, such as Wollastonia biflora and Capparis spinosa overgrow these places, concealing the past disturbance.

Wetland

There are no true wetlands on the island, since it lacks the right soil conditions and the indicator species. However, there are areas where the soil appears to be relatively impermeable and where water collects after rains, or perhaps drains down from up the slope. Only one of these areas (Fig. 19) was seen during the short reconnaissance (on the west-central slope), and it was entirely dominated by Mariscus javanicus, a littoral species classified as a "fac-wet" plant (Reed 1988). Since the soil did not appear to be wetland soil, the area was so small, and no obligate wetland species were present, this would probably not qualify as a significant wetland. However, other wetland areas not located because of insufficient time may be present on the island.

DISCUSSION

There are major two aspects of the botany of Farallon de Medinilla that must be addressed, sensitive types of vegetation and threatened or endangered plant species. Also to be discussed is the impact of introduced plant species on the island.

Sensitive Vegetation

There are apparently no sensitive types of vegetation on the island. The one wetland seen was too small and lacked the prerequisites of a wetland. However, these areas may be vital to the presence of land birds on the island, such as the megapode. Sea birds do not need fresh water, but land birds generally do.

Threatened and Endangered Plant Species

There are no threatened or endangered plant species on the island. This is mostly because there is only one listed threatened or endangered species in the CNMI (Serianthes nelsonii) and only three that are being considered for candidacy (M. Lusk, pers. comm.). Such species are usually inland plants, which tend to have a higher rate of endemism than littoral species. Nearly all the species encountered on the island are widespread plants, most of them littoral.

Only two species recorded from the island can be considered rare or uncommon. One is the seaside cotton Gossypium hirsutum var. taitense (Fig. 20), which has a spotty distribution across the Pacific, and has been previously recorded only a couple of times in the CNMI. The other is the bunch grass Digitaria gaudichaudii, which is endemic to the Marianas and Wake Island, and was the only endemic species recorded from the island.

The Introduction of Alien Species

The introduction of alien plant species to island ecosystems can be a major problem. This problem is somewhat mitigated on Farallon de Medinilla because most introduced plants are unable to germinate and/or survive in the harsh maritime conditions, and native plants, which are adapted island conditions, can usually compete successfully against introduced plants.

Despite the relative resistance of small islands to invasive species, the problem of alien species on is obvious. As noted earlier, during the present survey and in the literature, only 11

species appear to be non-native. With the exception of two, these appear to be plants restricted mostly to disturbed habitats, and which do not pose a threat to the environment.

The two possible exceptions are Leucaena leucocephala (tangantangan) and Operculina ventricosa. Tangantangan dominates most of the disturbed areas of Guam and the other Mariana Islands. Only one small patch was observed on Farallon de Medinilla, in the east-central area. Its seeds do not disperse very well, but once the plant becomes established in an area, it competes with native vegetation and is hard to eradicate. The other species is a morning-glory vine from the Caribbean and was introduced sometime ago to the Marianas, but which is probably a natural introduction to Farallon de Medinilla, to which it spread by seawater-dispersed seeds.

RECOMMENDATIONS

The flora on the island is in good shape, and no species seem to be adversely affected by the bombardment, at least those species recorded during the abbreviated visit. However, the vegetation is damaged by the bombardment, which could lead to problems for native birds who use it. Some sea birds, such as the Red-footed Booby, nest in trees, which are the most likely plants to be damaged by bombardment. To address the possible problems for the flora and vegetation, the following recommendations are made:

1. Finish the botanical survey to see if there are any other significant plant species on the island, and to see if any critical vegetation types can be recognized.

2. Map and study the marginal wetlands, and correlate this with information from ornithologists to see if these areas are critical to the land birds.

3. Control the introduction of new weedy species, and eradicate the patch or patches of tangantangan before they become a problem.

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19. Wet area dominated by Mariscus javanicus.
20. Gossypium hirsutum var. taitense, a native cotton.

TABLE 1. CHECKLIST OF THE FLORA OF FARALLON DE MEDINILLA

The species are arranged in two groups, monocots and dicots. Within these two groups they are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
MONOCOTS			
AMARYLLIDACEAE (Amaryllis Family)			
Crinum asiaticum L.	I	crinum, piga-palayi	10288
CYPERACEAE (Sedge Family)			
Fimbristylis cymosa R. Br.	I	-----	10289
Mariscus javanicus (Houtt.) Merr. & Metcalfe	I	-----	10290
POACEAE (Grass Family)			
Brachiaria aff. reptans (L.) Gardner & Hubb. ex Hook.	X?	-----	10291
Cynodon dactylon (L.) Pers.	X	Bermuda grass	10296
Digitaria gaudichaudii (Kunth) Henrard	E	-----	10292
Digitaria radicosa (Presl) Miq.	I	-----	10293
Heteropogon contortus (L.) Beauv.	I	tangle-head	10295
Lepturus repens (L.) R. Br.	I	lesaga	10294
DICOTS			
ACANTHACEAE (Acanthus Family)			
Blechum brownei Juss.	X	yerbas babui	10297
AIZOACEAE (Fig-marigold Family)			
Sesuvium portulacastrum (L.) L.	I	chara, seaside purslane	10298
AMARANTHACEAE (Amaranth Family)			
Achyranthes canescens R. Br.	I	-----	10299
Amaranthus viridis L.	X	kuletes apaka	10300
ASTERACEAE (Sunflower Family)			
Wollastonia biflora (L.) DC.	I	masigsig, beach sunflower	10301

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
CAPPARIDACEAE (Caper Family)			
Capparis cordifolia Lam.	I	spiny caper, atkaparas	10302
CARICACEAE (Papaya Family)			
Carica papaya L.	X	papaya	n.s.
CLUSIACEAE (Mangosteen Family)			
Calophyllum inophyllum L.	I	Alexandrian laurel, da'og	n.s.
CONVOLVULACEAE (Morning-glory Family)			
Ipomoea pes-caprae (L.) R. Br.	I	beach morning-glory alalag-tasi	10303
Operculina ventricosa (Bert.) Peter	X	-----	10304
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	X	garden spurge, golandrina	10305
Excoecaria agallocha L.	I	blinding tree	-----
Phyllanthus amarus Sch. & Th.	X	maigo-lalo	10306
FABACEAE (Pea Family)			
Pongamia pinnata L.	I	gulos	10307
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan	10308
MALVACEAE (Mallow Family)			
Abutilon indicum (L.) Sweet	I	mallow, matbas	10309
Gossypium hirsutum L. var. taitense (Parl.) Roberty	I	cotton, algodon	10310
Hibiscus tiliaceus L.	I	beach hibiscus, pago	n.s.
MORACEAE (Mulberry Family)			
Ficus prolixa Forst. f. var. carolinensis (Warb.) Fosb.	I	banyan, nunu	10311
MYRTACEAE (Myrtle Family)			
Eugenia reinwardtiana (Bl.) DC.	I	a'abang	10312

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia albiflora Fosb.	I	dafao	-----
Boerhavia repens R. Br.	I	dafao	10313
Pisonia grandis R. Br.	I	pisonia, umumu	-----
PORTULACACEAE (Purslane Family)			
Portulaca australis Endl.	I	-----	10314
Portulaca lutea Sol. ex Forst. f.	I	sea purslane	10315
Portulaca oleracea L. var. granulato-stellulata V. Poel.	I	purslane, botdolagas	10316
RUBIACEAE (Coffee Family)			
Bikkia tetrandra (L. f.) A. Rich.	I	gausali	10317
Hedyotis strigulosa (Bartl. ex DC.) Fosb.	I	-----	10318
Morinda citrifolia L.	I	lada, Indian mulberry	10319
SOLANACEAE (Nightshade Family)			
Physalis angulata L.	X	wild cape-gooseberry, tomate chaca	10320
STERCULIACEAE (Cacao Family)			
Melochia villosissima (Presl) Merr.	I	sayafe	10321
VERBENACEAE (Verbena Family)			
Callicarpa candicans (Burm. f.) Hochr.	I	qualitay	10322
Premna serratifolia L.	I	ahgao	10323
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena	10324

[2] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

N.s. indicates species recorded in the 1975 E.I.S. but not seen during the present survey.



Figure 1: Littoral strand



Figure 2: Ipomoea pes-caprae



Figure 3: Portulaca lutea



Figure 4: Sesuvium portulacastrum



Figure 5: Fimbristylis cymosa



Figure 6: Wollastonia biflora



Figure 7: Boerhavia repens

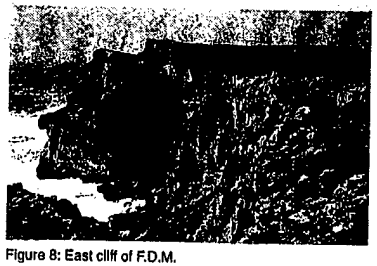


Figure 8: East cliff of F.D.M.



Figure 9: Excoecaria agallocha



Figure 10: Bikkia tentrandra

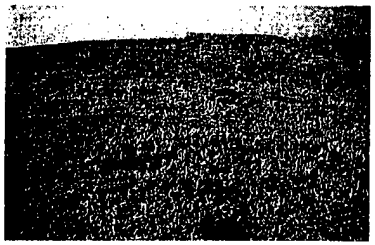


Figure 11: Looking south from north end, F.D.M.



Figure 12: Capparis spinosa



Figure 13: Operculina ventricosa



Figure 14: Pisonia grandis

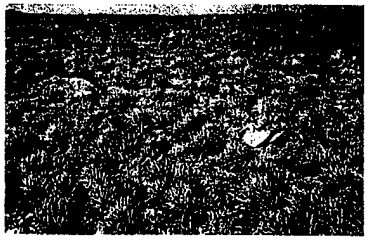


Figure 15: F.D.M. central, east coast

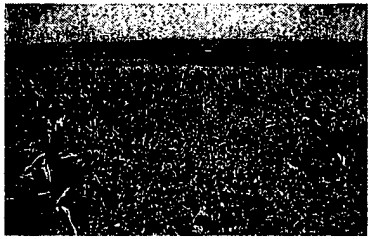


Figure 16: Crinum patch, F.D.M.



Figure 17: Crinum asiaticum



Figure 18: East cliffs of F.D.M.

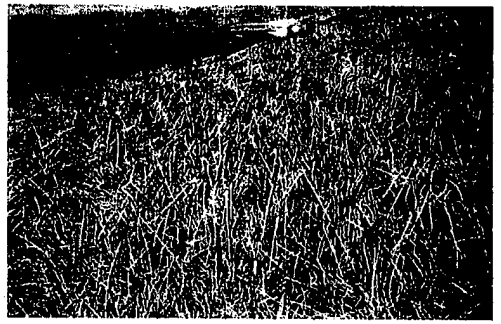


Figure 19: Central F.D.M. – looking north

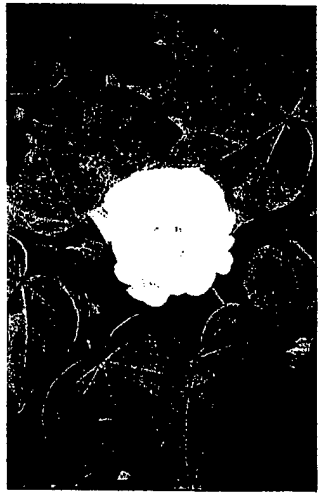


Figure 20: Gossypium hirsutum var. taitense

Appendix D-4
Preliminary Report—Marianas EIS—Farallon de Medinilla Marine Assessment (December 3, 1996)

4467 SIERRA DRIVE
HONOLULU, HI 96816
PHONE: 808-734-4009
FAX: 808-732-1813

December 3, 1996

Mr. John Goody
Belt Collins Hawaii
680 Ala Moana Blvd.
Honolulu, HI 96813

RE: Preliminary Report - Marinas EIS - Farallon de Medinilla Marine Assessment

Dear John:

Following the field expedition of November 1- 6, 1996 to the Island of Farallon de Medinilla CNMI, I would like to provide you with a preliminary summary of findings. The fieldwork on which the report is predicated consisted of a land survey of the island conducted on November 5, 1996. No in-water work was conducted as a result of ship evacuation of the area in response to a developing Typhoon.

The island consists primarily of uplifted lithified limestone substrata with the margins consisting primarily of steep vertical walls with numerous wave-cut caves and notches. The shoreline consist primarily of large boulders and rock outcrops with little beach formation. While there is little detailed bathymetry of the waters surrounding the island, it was visually apparent that there is little shoal area around most of the island, and the submarine slope of the island appears to be very steep. Weather conditions during the field visit consisted of strong tradewinds (20-30 kts) that resulted in fully developed seas. Wind-generated seas caused large surf to break on the shorelines of the windward side of the island (northwest); there was considerable lee on the southeast side with relatively calm water and small surf. The combination of steep vertical profiles of the submarine shoreline, and the massive physical forces from breaking waves on the windward side of the island likely results in a limited assemblage of benthic biota, at least to the depth of wave base.

Because the shortened mission prevented reconnaissance dives, I have interviewed all parties that to my knowledge have dived at FDM. These include members of the EOD team based in Guam, and Patrick Bryan, a Fisheries Official for CNMI. The consensus of these interviews was that deep water surrounds much of the island, with the exception of shoal areas at the northern and southern ends. Bryan reports that at the northern end and central parts of the leeward side of the island substrate drops gradually seaward. In these areas coral growth was good with *Pocillopora, Acropora, Porites, Montipora* and *Millepora* providing coverage of about 50% of available substratum. Fish were reported to be abundant by all observers. Bryan reports that Kyphosids were abundant near the shoreline, and Acanthurids (surgeonfish) and Chaetodonts (butterflyfish) were abundant in deeper water. In the central part of the island, Bryan reports two large unexploded projectiles and other related materials at a depth of

approximately 20 m. Bryan also reported that while the emergent sides of the island showed signs of explosive blasts, there was no evidence of similar damage underwater.

Our land-based survey also revealed the presence of at least several coconut crabs (*Birgus latro*) inhabiting cracks in the rocks near the shoreline. One green sea turtle (*Chelonia mydas*) was observed from the shoreline on the surface off the leeward side of the island. No marine mammals were observed.

In sum, with the very limited information available, it appears that the marine resources are primarily concentrated on the leeward side of the island. Steep underwater topography probably limits the area where explosive materials would remain at shallow depths; in most areas ordnance would likely roll down the steep embankment to abyssal depths. Without doubt, future field surveys that include underwater reconnaissance will add significantly to the ability to assess the potential impacts of the proposed uses of Farallon de Medinilla.

Sincerely,

Steven Dollar, PhD.

Appendix D-5
Trip to Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (December 10, 1996)

TRIP REPORT

TO: Robert Smith, Ecoregion Manager
Brooks Harper, Field Supervisor
Karen Rosa, Recovery Program Leader
Margo Stahl, Interagency Program Leader
Mariana Island Team
Beth Flint, Refuges

DATE: 10 December 1996

FROM: Michael Lusk (in association with Curt Kessler, CNMI Wildlife Biologist)

RE: Trip to Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands

The purpose of this memo is to provide a "quick and dirty" overview of my trip to the island. It is not intended to fully evaluate the impacts of potential training on the species encountered, nor to fully chronicle all important island resources (e.g., vegetation). In addition to this report, there is a video on file in our office that chronicles our findings. I hope to make slides available to our library in the near future.

Brief Itinerary

3 Nov. -6:00 A.M.: Pick-up at hotel by Navy.

1:00 P.M.: Board USNS Kilauea, Guam.

4:00 P.M.: USNS Kilauea underway.

4 Nov.-7:30 A.M.: Transported by helicopter from USNS Kilauea to FDM.

1:00 P.M: Transported by helicopter from FDM to USNS Kilauea.

3:00 P.M.: Transported by helicopter from USNS Kilauea to Saipan.

8:15 P.M.: Depart Saipan (Airline).

9:00 P.M.: Arrive Guam

Overview

We were transported by the USNS Kilauea from Guam to offshore Farallon de Medinilla (FDM). On the morning of 4 November we were transported by helicopter from the Kilauea to FDM.

We surveyed FDM for approximately five hours from 7:30 AM to 1:00 PM. During this time we were able to walk the perimeter of the large northern portion of the island (Figure 1). The interior portion of the island was inaccessible due to heavy groundcover which hides unexploded ordnance. The small southern part of the island is not accessible by foot from the north. Estimations of seabirds for this area were done from the helicopter during fly-over. Original plans were to spend the rest of the day and all of the next day on the ground, but an approaching storm required our early withdrawal. Despite the small amount of time spent on the island, we were able to gain a great deal of valuable information. I took both slide and video film of the trip.

Several different "teams" were deployed to the island with Navy EOD escort. I accompanied Curt Kessler, CNMI wildlife biologist, and Phillip Bruner, Belt Collins ornithologist. Other teams included Art Whistler, Belt Collins botanist, Scott Vogt, CNMI herpetologist, and a Belt Collins archaeologist. Representatives from the National Marine Fisheries Service and CNMI fisheries were also present, but due to rough seas were not able to survey the marine resources of the island.

Wildlife Resources

During the trip we recorded sixteen bird species, estimated their population sizes, and noted any obvious breeding activities (Table 1). Typhoon Yates hit the island two to three weeks prior to our visit and may have had an effect on the breeding bird population. This may account for some of the dead immature birds mentioned later in the account.

Masked Boobies: Masked boobies were concentrated primarily on the eastern rim of the island, although some were found in the more interior portions of the southern tip of the main island (Figure 2). Several boobies were seen attending one or two eggs, one downy chick was seen, and several family groups contained immatures. Nests were located mostly on bare hardpan soil along the cliff edges on the windward (eastern) side of the island.

Red-footed Boobies: Small colonies of red-footed boobies were observed on the western edge and southeastern corner of the island (Figure 2). This species was roosting and nesting in the low shrub vegetation (< six feet). Their distribution and population on the island is probably limited by the lack of medium and tall trees. Nests were seen containing eggs, but no chicks or fledglings were observed.

Brown Boobies: Brown boobies were limited in their distribution, being restricted to the southeastern corner of the island (Figure 2). Although no nests were observed, several dead immatures were found in the southeastern portion of the island and some living immatures appeared emaciated. More brown boobies were probably utilizing the steep cliffs of the island for roosting and nesting, but were not visible from our vantage point.

Great Frigatebirds: A breeding colony of great frigatebirds was discovered on the west central edge of the island (Figure 2). The colony was distinct, but was surrounded by nesting red-footed

boobies. Several nests, one egg, and one immature were observed. The frigatebirds were nesting in low shrubs (four to six feet high), similar to those being used by the red-footed boobies, adjacent to the cliff line.

Black Noddies, Common Noddies, and White Terns: All three species were seen using the sea caves on the east central edge of the island (Figure 1). Nesting was noted for common noddies and white terns inside the caves. Eggs were seen for both of these species.

Micronesian Megapodes: Four megapodes were flushed on the southern end of the main island (Figure 3). Within approximately 100 feet of the northern most megapode sighting was an area of exposed soil containing scratching and burrows. It is unclear if this was the result of megapode activity however. Megapodes were encountered in low, shrubby vegetation from 2 to six feet in height. Megapodes were encountered in fairly open areas, but this may be a result of our search pattern. Heavy vegetation and the threat of concealed ordinance in the interior of the island prevented us from throughly searching this area. We should not assume that megapodes are restricted to areas of shrubby vegetation on the southern end of the island.

Other Species: At least two rats were seen, but none were captured. They were most probably Polynesian rats (*Rattus exulans*) but positive identification was not possible. Three small (<6 inches across carapace) coconut crabs (*Bigus latrus*) were observed (Figure 3). Two species of lizards were observed, the snake-eyed skink (*Cryptoblepharis poecilopleurus*) and the blue tailed skink (*Emoia caeruleocauda*).

Some Impact Concerns

There is no question that bombing of this island will result in the death of seabirds, migratory shorebirds, and possibly the endangered Micronesian megapode. On several occasions we observed boobies nesting very close to unexploded ordinance. While the unexploded ordinance may not provide an immediate threat to the birds, it does indicate that bombs do fall in active nesting areas. Although there may be peaks in the seabird breeding season, our observations indicate that breeding probably occurs year-round. Two megapode sightings, the northern and southern most (Figure 3), were near the edges of the island where ordinance impacts appear to be the greatest.

Another major concern is the transport of junk cars from Guam onto FDM as targets. Currently there are about twelve of these vehicles on the island. Even though these cars may be searched for brown tree snakes (*Boiga irregularis*) before transport, there is still a good chance snakes may stow away in the cars and later invade the island. Snake traps were brought to the island by the CNMI herpetologist, but the short time we had on the island prevented their distribution.

It is very difficult to gauge the impact that naval activity has had on the seabird and megapode population. As the helicopter approached and landed, several hundred seabirds were airborne, but some of the masked boobies began to resettle on nests within fifteen minutes. It was not possible to tell how long other species, such as red-footed boobies, were off their nests.

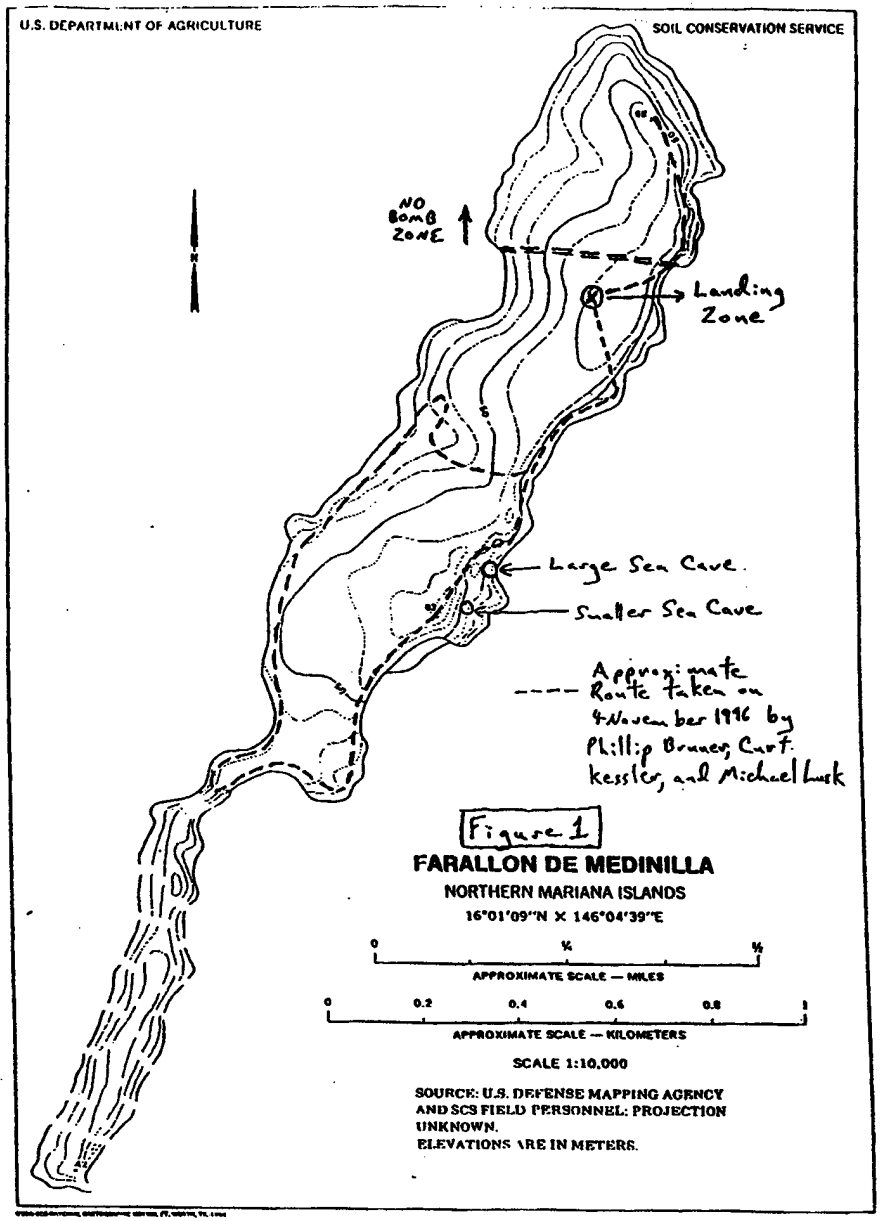
Historically, it is very difficult to determine how many birds were using the island. An Environmental Impact Statement prepared by the Navy in 1975 states that boobies are evenly distributed over the island and estimates a population of 50,000 boobies and 1,000 white terns. If this estimate is accurate, then bombing on the island since 1975 has had a tremendous effect on the birds. However, the report does not state how they arrived at their estimate. The only pictures included in the report are from offshore, which leads me to believe they may have never been on the island. A 1991 paper by Jim Reichel in an ICBP technical publication lists the population of masked boobies on FDM to be 50 pairs, red-footed boobies 200 pairs, and brown boobies as 500 pairs. These estimates in turn are based primarily on observations made in 1984 by biologists who approached the island by boat but never actually got onto the island (Thane Pratt, personal communication). These numbers are much lower than our estimates, but are close enough that seasonal variation may account for most of the difference. To gauge the impacts of bombing it will be important to determine the accuracy of the 1975 EIS estimates. It is possible that bombing changed the predominate vegetation cover of the island to such a degree that nesting habitat was significantly reduced. The University of Guam Marianas Archipelago Resource Center has aerial photos of FDM from 1944 that may give additional information on past seabird use and vegetation changes. In addition, there is a reference to FDM in a 1902 report by the German G. Fritz that may indicate past seabird use and that needs further examination.

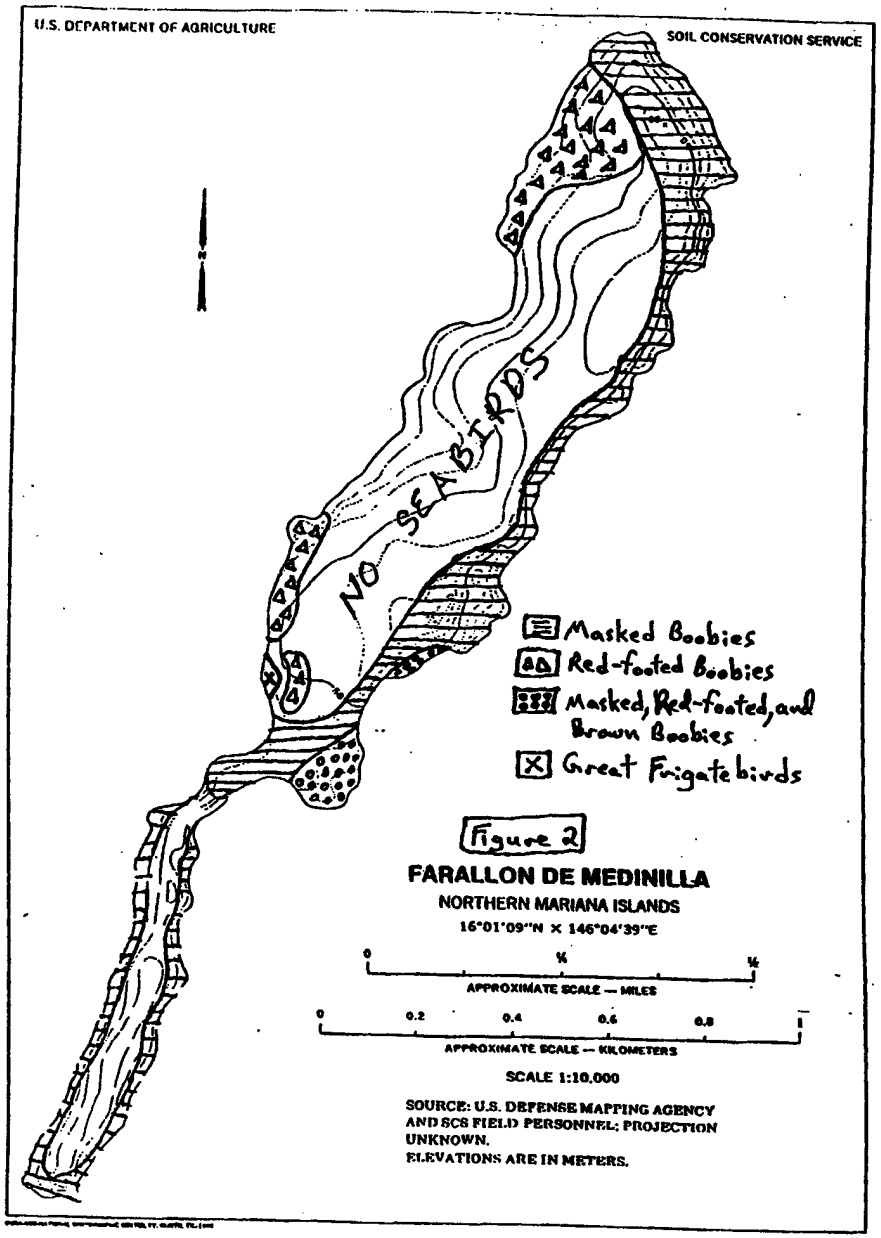
Possible Mitigation Measures

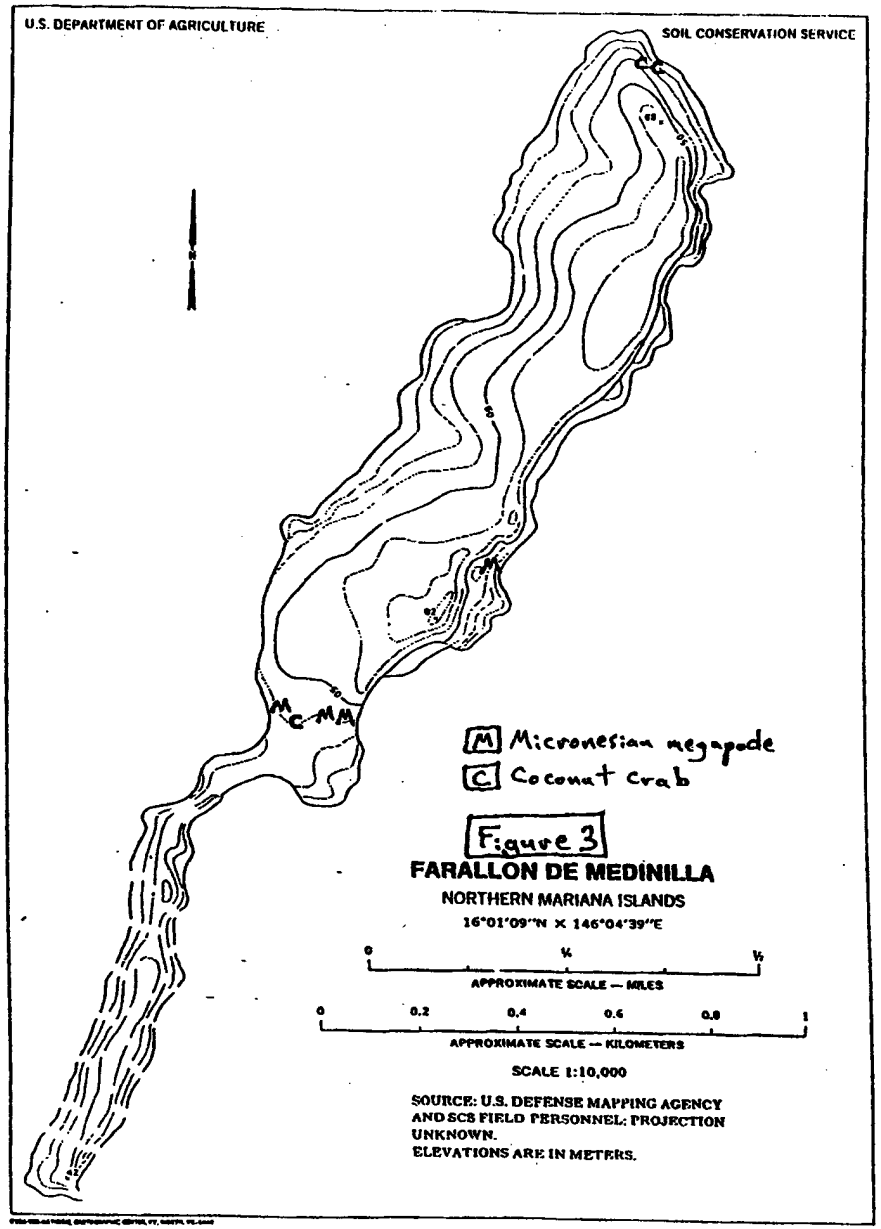
Should the Navy be allowed to continue to use the island for bombing, there are several mitigation steps to consider. The most obvious recommendation is that bombing be restricted to nonpeak breeding seasons for seabirds and that the impact area be restricted to the interior portion of the island where there are very few, if any, seabirds. Edge impacts in particular should be avoided. It is unknown what effect this would have on the megapodes however. The Navy could also arrange for aerial photos of before and after bombing sorties to gauge nesting disturbance and coordinate annual visits by its own, and possibly Service and CNMI, biologists. Other more long term mitigation measures might be considered such as the aerial broadcast of rodenticide over FDM, or the Navy's assistance in eradicating feral ungulates and non-native predators from another island such as Sarigan.

Table 1. Bird species recorded on 4 November 1996 from Farallon de Medinilla, their approximate populations, and indication if breeding was observed.

Common Name	Scientific Name	Population Estimate	Breeding Status
Brown Booby	*Sula leucogaster*	200	Immatures
Masked Booby	*Sula dactylatra*	750	Nests w/eggs, chicks, immatures
Red-footed Booby	*Sula sula*	500	Nests w/eggs
Great Frigatebird	*Fregata minor*	25	Nests w/eggs, immatures
Red-tailed Tropicbird	*Phaethon rubricauda*	4	
Common Noddy	*Anous stolidus*	50	Nests w/ eggs
Black Noddy	*Anous minutus*	20	
Sooty Tern	*Sterna fuscata*	1	
Bristle-thighed Curlew	*Numenius tahitiensis*	2	
Whimbrel	*Numenius phaeopus*	2	
Ruddy Turnstone	*Arenaria interpres*	2	
Lesser Golden-plover	*Pluvialis dominica*	5	
White Tern	*Gygis alba*	200	Nests w/eggs
Eurasian Tree Sparrow	*Passer montanus*	4	
White-throated Ground-dove	*Gallicollumba xanthonura*	50	
Cattle Egret	*Bubulcus ibis*	1	
Micronesian Megapode	*Megapodius laperouse*	4+ (four observed)	




U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NO SEABIRDS
Masked Boobies
Red-footed Boobies
Masked, Red-footed, and Brown Boobies
Great Frigatebirds
Figure 2
FARALLON DE MEDINILLA
NORTHERN MARIANA ISLANDS
16°01'09"N × 146°04'39"E
0 ½ ½
APPROXIMATE SCALE — MILES
0 0.2 0.4 0.6 0.8 1
APPROXIMATE SCALE — KILOMETERS
SCALE 1:10,000
SOURCE: U.S. DEFENSE MAPPING AGENCY AND SCS FIELD PERSONNEL; PROJECTION UNKNOWN.
ELEVATIONS ARE IN METERS.
JUNE 1986 BASE 4-R-


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
M
C
Micronesian megapode
Coconut crab
Figure 3
FARALLON DE MEDINILLA
NORTHERN MARIANA ISLANDS
16°01'09"N × 146°04'39"E
0 ½ ½
APPROXIMATE SCALE — MILES
0 0.2 0.4 0.6 0.8 1
APPROXIMATE SCALE — KILOMETERS
SCALE 1:10,000
SOURCE: U.S. DEFENSE MAPPING AGENCY AND SCS FIELD PERSONNEL; PROJECTION UNKNOWN.
ELEVATIONS ARE IN METERS.
JUNE 1986 BASE 4-R-

Appendix D-6
Endangered Species Survey of Farallon de Medinilla (FDM) 16-17 Dec 96 (January 8, 1997)

11015.4G23
236/FDMES
8 Jan 97

MEMORANDUM

From: PACNAVFACENGCOM CODE 23 Tim Sutterfield
To: File
Via: 23

Subj: ENDANGERED SPECIES SURVEY OF FARALLON DE MEDINILLA (FDM) 16-17 Dec 96

Encl: (1) Map of 16 Dec survey route and findings.
(2) Map of established census stations.
(3) Map of 17 Dec survey route and findings.

1. The Subject survey was conducted by PACNAVFACENGCOM Fish and Wildlife Biologist Tim Sutterfield and COMNAVMARIANAS Lieutenant Commander Jaego while accompanied by an EOD technician. A total of ten hours was spent on the Island. six hours on 16 December and four hours on 17 December. Transportation to FDM was provided by HC-5 helicopter squadron.

2. On the morning of 16 December an overflight of the entire island was done and photos were taken. EOD technicians were lowered to the previously unsurveyed southern end of the island to determine the degree of unexploded ordnance hazard prior to allowing the biological team access to that portion of the island. EOD determined that numerous components of MK-80 cluster bombs discovered on that portion of the island made ground surveys unsafe. However additional overflights and photos were taken and it appears that there is very little vegetation that might support endangered species on that end of the island.

3. In the late morning and afternoon of 16 December we performed a foot survey of the entire perimeter of the northern portion of the island (see enclosure 1 map). No megapodes were seen but a Mariana fruit bat was detected in the ravine west of the hole that looks into the large sea cave and a second bat was seen on the northern end of the island near the red footed booby colony (see enclosure 1 map). Both bats were roosting on shrubs that were approximately three feet tall. The fruit bat is neither a federally or Commonwealth listed species on FDM. Six snake traps that were set during the 5 November trip were recovered. there were no sign of snakes having been in the traps but coconut crabs had eaten holes through two of the traps.

4. On 17 December six variable circular plot count stations were established along the eastern cliffline. the stations were 150 meters apart and marked with pink marker flags 12 inches tall (see enclosure 2 map). At each station Micronesian megapode recordings were played for two minutes followed by three minutes of monitoring. There were no responses to the recordings and no megapodes were heard calling. We then descended into the heavily vegetated ravine that bisects the northern end of the island searching the area where megapodes were seen during the November survey. We flushed two megapodes from this area one from the southeastern end of the ravine and one from the northeastern end of the ravine and a Mariana fruit bat was also seen in this ravine (see enclosure 3 map). Both megapodes were flushed from dense vegetation and flew short distances before diving into lily (Crinum asiaticum) patches.

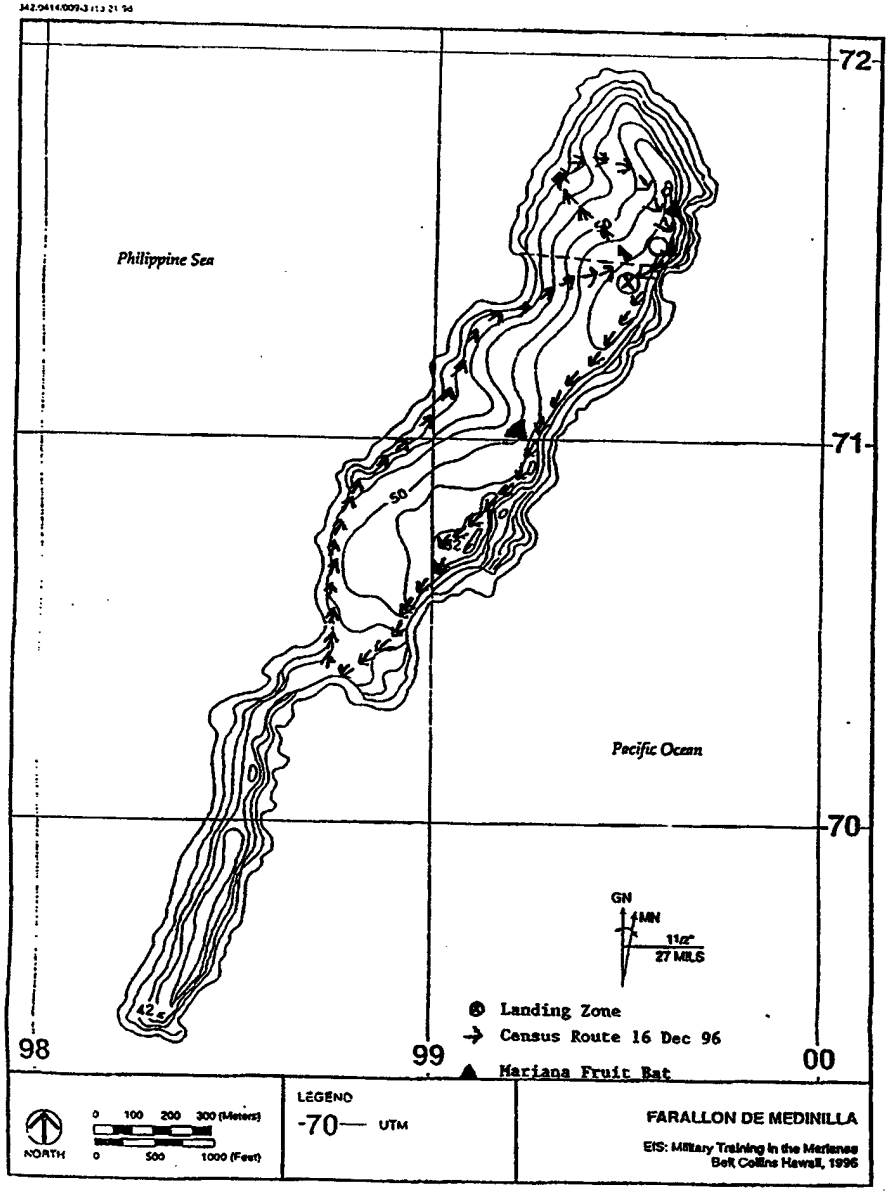
5. Because of time constraints seabirds were not censused. It was noted that the masked boobies were on eggs or on very young hatchlings. red-footed boobies were on eggs. a few brown boobies were nesting. and frigatebirds were nesting but did not determine if they were on eggs.

6. During the flyovers and while following the shoreline no sea turtles were observed in the near shore waters or on the two beaches where nesting might be possible.

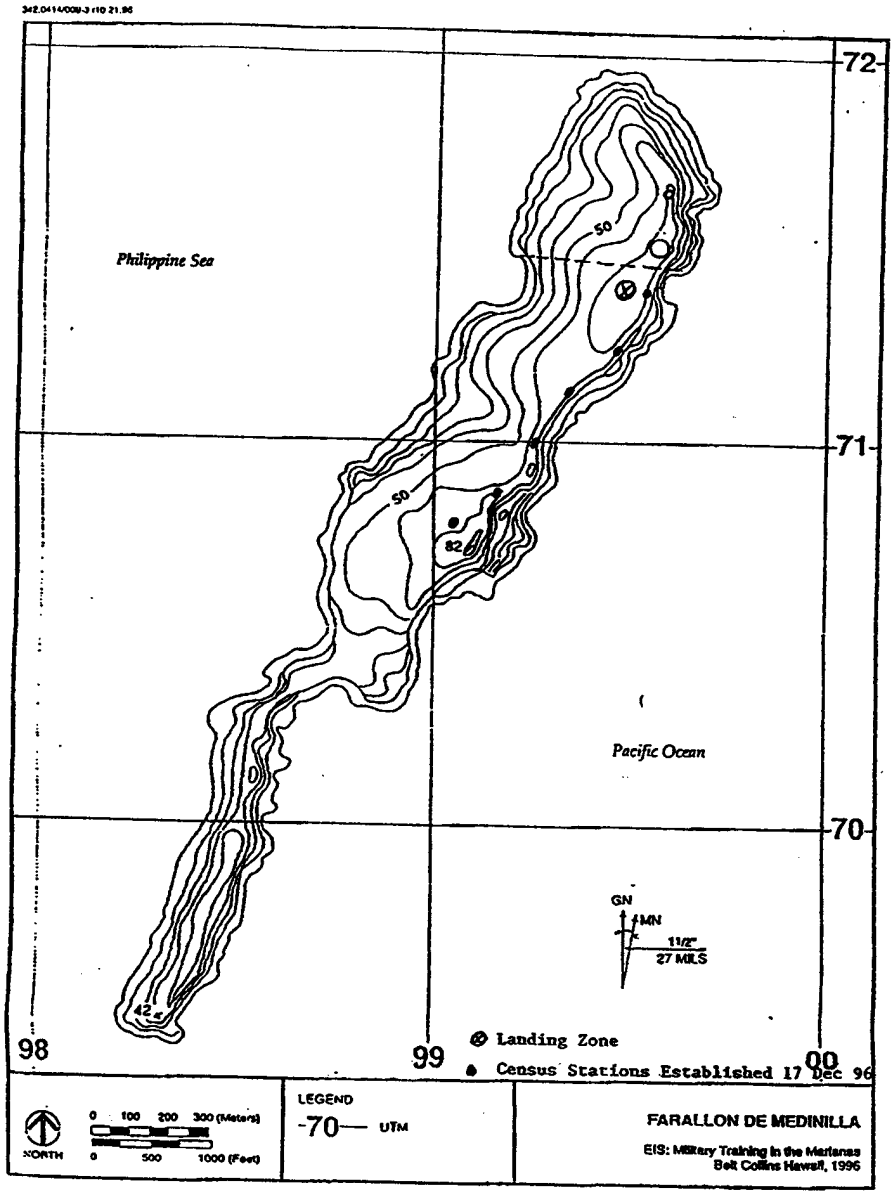
7. For future surveys a minimum of two full eight hour days or three six hour days should be allotted to survey the northern portion of the island. The ten hours that were spent during this survey did not allow for sufficient coverage of the interior portions of the island.

Tim Sutterfield
Fish and wildlife Biologist

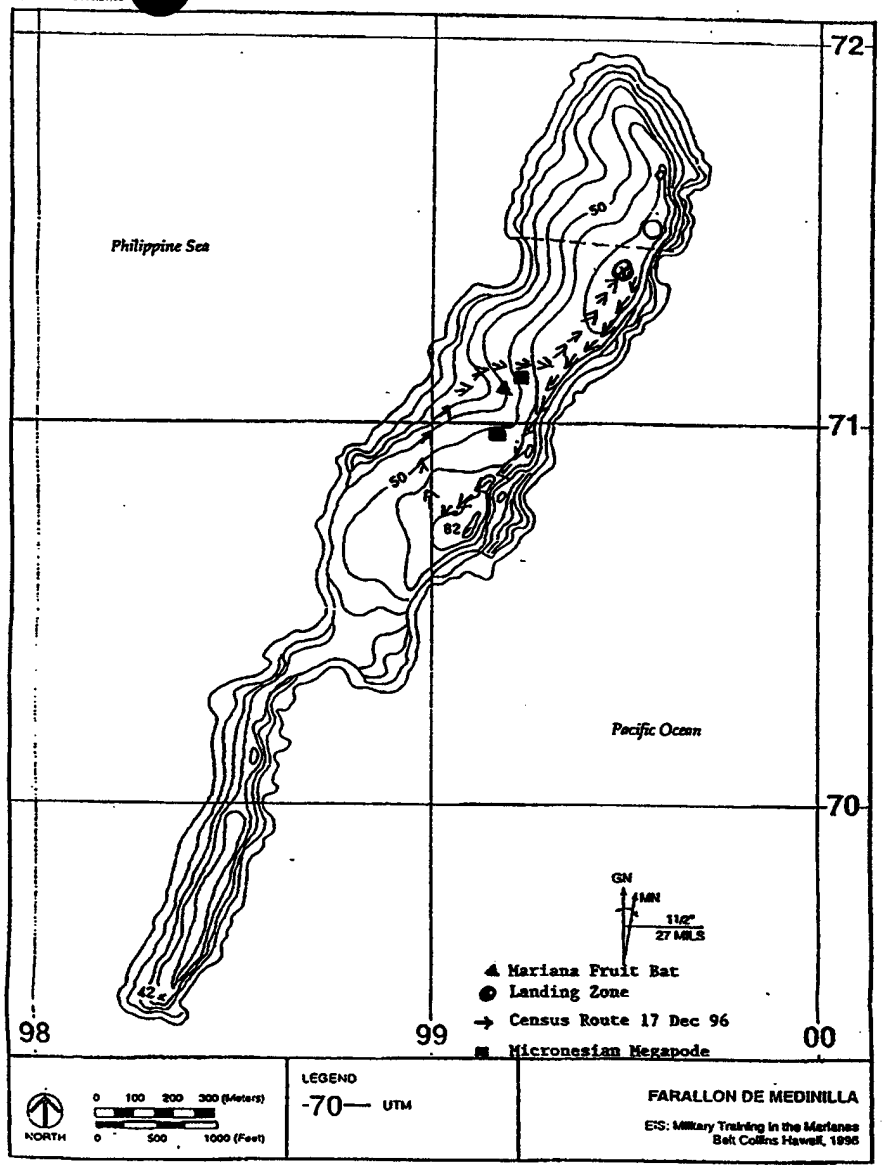
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EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

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EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

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FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

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Appendix D-7
Biological Opinion of the U.S. Fish and Wildlife Service for Aerial Bombardment and Gunnery Practice Associated with Tandem Thrust 1997 at Farallon de Medinilla, CNMI (January 29, 1997)

BIOLOGICAL OPINION
of the
U.S. FISH AND WILDLIFE SERVICE
for
AERIAL BOMBARDMENT AND GUNNERY PRACTICE
ASSOCIATED WITH TANDEM THRUST 1997
AT FARALLON DE MEDINILLA,
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

29 January 1997

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- Effect of the Take 7
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS ECOREGION
300 ALA MOANA BOULEVARD, ROOM 3108
BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

In Reply Refer To: MRL

Stanley Y. Uehara
Director, Environmental Planning Division
Department of the Navy
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

RE: Biological Opinion (Log Number 1-2-97-F-01), Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI).

Dear Mr. Uehara:

This report represents the biological opinion of the U.S. Fish and Wildlife Service (Service) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544; Stat. 884), as amended, (Act) regarding potential impacts to the federally listed endangered Micronesian megapode, *Megapodius laperouse laperouse*, threatened green sea turtle (*Chelonia mydas*), and endangered hawksbill sea turtle (*Eretmochelys imbricata*) from proposed aerial bombardment and gunnery practice. The Department of the Navy, as range managers, proposes to use FDM for aerial bombardment and gunnery practice during a four week period in February and/or March 1997 as part of Tandem Thrust 1997 (Figure 1).

This biological opinion addresses potential impacts to the Micronesian megapode which is known to occur on FDM, and green and hawksbill sea turtles which are also known to occur in the CNMI and may nest on FDM. The opinion is based upon 1) review of the information presented in your letter December 6, 1996, letter requesting formal consultation, 2) information provided by Tim Sutterfield and Dan Moriarty in telephone conversations and by fax, 3) information provided in the Service's *Preliminary Draft Recovery Plan for the Micronesian Megapode*, 4) information provided in the *Draft Recovery Plan for U.S. Pacific Populations of the Green Turtle* and in the *Draft Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, 5) information provided in the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*, 6) literature published on megapodes, green turtles, and hawksbill turtles and 7) a site visit to FDM on 4 November 1996.

The Navy requested initiation of section 7 consultation for the proposed action in a letter dated December 6, 1996 and received by the Service on December 12, 1996. The log number for this consultation is 1-2-97-F-01. A complete administrative record of this consultation is on file in the Service's Pacific Islands Office in Honolulu, Hawaii.

BIOLOGICAL OPINION

It is the biological opinion of the Service that aerial bombardment and gunnery practice on Farallon de Medinilla, as described below, is not likely to jeopardize the continued existence of the Micronesian megapode, green sea turtle, or hawksbill turtle. Incidental take for these species is anticipated, and the Service has specified reasonable/prudent measures and terms/conditions to minimize the impact of these takings.

Description of the Proposed Action

The Department of the Navy proposes to engage in aerial bombardment and gunnery practice on FDM, CNMI, over a four week period in February and/or March 1997. The purpose of this project is to allow Navy carrier aircraft, ships, and Air Force B-52 bombers participating in Tandem Thrust 97 to practice bombing and surface gunnery. Air Force B-52 bombers and Navy Fighter/attack aircraft assigned to the Carrier Air Group aboard the aircraft carrier INDEPENDENCE will practice delivery of live ordnance, consisting primarily of MK-80 series iron bombs which are designed to explode on impact. However, a variety of other ordnance will also be used. An estimated total of 10,000 20 MM PGU-27B rounds, one AGM-65F live air to ground missile, four WALLEYE I live glide bomb, two WALLEYE I ERDL live glide bomb, 20 LGTR inert bombs, 140 MK-82 live 500 pound (#) bombs, 300 MK-117 live 750# bombs, 60 MK-83 live 1000# bombs, 17 MK-84 live 2000# bombs, 200 BDU-45 inert bombs, 100 MK-83 inert bombs, 6 MK-84 inert bombs, 70 MK-20 CBU 59 live anti-personnel bombs, and 1000 MK-76 inert bombs will be delivered by aircraft. Ships assigned to the Carrier Task Group will conduct gunnery practice by firing an estimated 100 5/54 live rounds. The most likely ammunition type for the 5/54 will be high explosive with controlled variable time fuzed rounds that produce fragmentation air burst as well as high explosive point detonations. It is possible that bombing or naval gunfire will occur at night.

Biology and Population of the Species

Unless otherwise referenced, the following information on the status and habitat requirements of the Micronesian megapode is taken from the Service's *Preliminary Draft Recovery Plan for the Micronesian megapode*, unpublished field notes, published literature, and field surveys. Information on the status and habitat requirements of the green and hawksbill sea turtles is taken from the U.S. Pacific Sea Turtle Recovery Team's (USPSTRT) *Recovery Plan for U.S. Pacific Populations of the Green Turtle* and their *Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, respectively, and the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*,

unpublished field notes, published literature, and field surveys.

a) Micronesian Megapode

The Megapodiidae are a family within the order Galliformes (chicken-like birds) that occur only within the Australasian region (USFWS 1995b). The Micronesian megapode was first described by Quoy and Gaimard from a specimen collected on Tinian in 1820 (Quay and Gaimard, 1824). The Micronesian megapode historically occurred on all the islands in the Marianas archipelago, but is now extirpated from Guam and Rota and is currently found only in low numbers on Tinian and Saipan (USFWS 1995b). The subspecies *M. l. senex* occurs in the Palau islands (Baker 1951).

Megapodes are omnivorous and have been observed to feed on seeds, beetles, ants, other insects, and plant matter (Glass and Aldan 1988, Stinson 1993). Megapodes are believed to be monogamous and may defend a territory of approximately 1 hectare (ha) on a year-round basis (Glass and Aldan 1988). Megapodes are known as "incubator birds" because of their reliance on external heat sources, such as solar energy, volcanic activity, or microbial decay, to incubate their eggs (Clark 1964). Micronesian megapodes apparently use both burrow nesting and mound building in egg incubation (USFWS 1995b). Exact nesting seasons for this subspecies are not known. Nesting probably occurs year-round on some of the Mariana islands, but may occur seasonally on some islands depending on heat source for incubation (USFWS 1995b).

The Micronesian megapode was listed as an endangered species on 2 June 1970 (USFWS 1995a). Hunting pressure on adults and eggs, introduced predators, and loss of habitat due to feral ungulates, development, and vulcanism have all been cited as reasons for local extirpations on some islands and a general population decline on the remaining islands (USFWS 1995b).

Megapodes are extirpated from Guam and Rota, and remanent populations are estimated to be 10 to 25 birds on Saipan and less than 10 on Tinian (USFWS 1995b). Larger populations persist on all the remaining northern Mariana islands, except for Uracus (USFWS 1995b). Islands such as Anatahan, Sarigan, and Gugan may each have as many as 200 to 500 birds. The total population for *M. l. lapernuse* is estimated to be 1,000 to 1,500 birds.

b) Green and Hawksbill Sea Turtles

Both green sea turtles (*Chelonia mydas*) and hawksbill sea turtles (*Eretmochelys imbricata*) are known to occur in the waters of the CNMI (USFWS 1996). Green sea turtles are distributed globally throughout tropical and subtropical seas with temperatures above 20° Centigrade (USPSTRT 1995a). Hawksbill sea turtles also occur globally, generally occurring between 30°N and 30°S latitudes in the Atlantic, Pacific, and Indian oceans and associated bodies of water (USPSTRT 1995b).

Green sea turtles greater than 30 - 35 cm feed exclusively on macroalgae and seagrasses, while

post-hatchlings and juveniles feed carnivorously (e.g., invertebrates and fish eggs) (USPSTRT 1995a). Hawksbill sea turtles appear to feed exclusively on sponges (USPSTRT 1995b). Both green and hawksbill sea turtles have been documented to migrate long distances, over 1,000 kilometers, between foraging grounds and nesting beaches (USPSTRT 1995a, 1995b). After completing migration to nesting beaches, both green and hawksbill turtles lay several successive clutches of eggs, each about two weeks apart, during the nesting season before returning to the foraging grounds (Susan Pultz, pers. comm.). A turtle tagged on Tinian was recently sighted in the Philippines (George Balazs, pers. comm.). Green sea turtles are known to nest in the CNMI from January through August, which means hatching may continue into October (USFWS 1996). Hawksbill sea turtles have been known to nest in the CNMI (USFWS 1996), but the exact months are not known. In other areas of the world, hawksbill sea turtles have been recorded nesting year-round (Witzell 1983; Richardson 1990). Clutches for both species may contain 100 or more eggs (USPSTRT 1995a, Maragos 1991).

The green sea turtle was listed as a threatened species on 28 July 1978, while the hawksbill turtle was listed as an endangered species on 2 June 1970 (USFWS 1995a). Both species were listed because of declining numbers associated with overexploitation for commercial and other purposes (hunting, poaching, tortoiseshell trade, etc.), gill net captures, habitat loss, and lack of effective regulations and enforcement (USPSTRT 1995a, 1995b). Spread of fibropapilloma has also slowed the recovery of green sea turtle populations (Balazs et al. 1992; Balazs and Pooley 1991).

There are no population estimates for the CNMI population of green and hawksbill sea turtles. In 1995, six to ten turtles were recorded nesting on the island of Tinian and a similar number probably nested there in 1994 (USFWS 1996). This implies that the nesting population in the CNMI is not very large presently, but at one time may have been much larger (USFWS 1996). Although no hawksbill turtles were observed nesting on Tinian in 1995, there has been an incidental report of a hawksbill nesting on Guam (USFWS 1996). The demolition of unexploded ordnance in waters off Rota in May 1996 killed one green sea turtle and another demolition in June 1996 resulted in the death of a juvenile hawksbill (D. Worthington, pers. comm.). No monitoring of sea turtle nesting on FDM or sea turtle abundance monitoring in the waters off FDM have ever been conducted.

Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. The baseline includes State, local, and private actions that affect a species at the time the consultation begins. Unrelated Federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

a) Micronesian Megapodes

The project area is the entire island of FDM. A total of four megapodes were discovered on the island during a site visit on 4 November 1996 (Lusk and Kessler 1996). Two megapodes were found on the island during a Navy site visit on 17 December 1996 (Figure 2). The size of the island, 0.7 km^2, leads the Service to estimate that there are likely not more than ten megapodes on the island. This number represents 0.7 to 1.0% of the total estimated population within the Marianas archipelago.

b) Green and Hawksbill Sea Turtles

The project area is the entire island of FDM, which includes two small beaches (both approximately 50 m long X 10 m wide), one on the southwestern corner and one on the northeastern corner of the main body of the island (Figure 2), that may provide nesting habitat for sea turtles. It is possible that several sea turtles could be using the beaches for nesting and that each turtle could average three to four clutches of eggs for the season. It is not possible to estimate the percentage of breeding sea turtles or nests this represents in the Marianas archipelago.

Effects of the Action on Listed Species

a) Micronesian megapodes

The primary concerns of the Service with regard to the effects of aerial bombardment and gunnery practice on the Micronesian megapode are (1) direct death of megapodes and (2) the destruction or abandonment of active megapode nests.

The impact areas for aerial bombardment and gunnery practice cover the entire area of FDM and megapodes have been documented to occur on this island (Lusk and Kessler 1996, Tim Sutterfield, pers. comm.). Therefore, the Service anticipates the possible direct death of all megapodes and destruction of all nests occurring on the island at the time of Naval training.

b) Green and Hawksbill Sea Turtles

The primary concerns of the Service with regard to the effects of aerial bombardment and gunnery practice on green and hawksbill sea turtles are (1) direct death of sea turtles on nesting beaches, (2) the destruction of active turtle nests, and (3) the creation of craters on beaches that can trap hatchlings moving from the nest to the ocean.

The impact areas for aerial bombardment and gunnery practice cover the entire area of FDM, including its two beaches. Although it is not certain that sea turtles use the beaches at FDM for nesting, it is highly likely that nesting does occur. Therefore, the Service anticipates the possible direct death of green sea turtles and hawksbill sea turtles and the destruction of all sea turtle nests

from ordnance exploding on FDM's beaches.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service has not identified any cumulative effects in the project area that may impact Micronesian megapodes, green sea turtles, or hawksbill sea turtles.

Biological Opinion of the Service

After reviewing current status of the Micronesian megapode, the green sea turtle, and the hawksbill sea turtle, the environmental baseline of the species in the action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that aerial bombardment and gunnery practice by the Department of the Navy in association with Tandem Thrust 1997 is not likely to jeopardize the continued existence of the Micronesian megapode, green sea turtle, or hawksbill sea turtle. No critical habitat has been designated for these species; therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the Act, as amended, prohibit the taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of a listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are non-discretionary and must be implemented by the Navy in order for the exemption in section 7(o)(2) to apply.

The Navy has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Navy fails to adhere to the terms and conditions of the incidental take statement the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service anticipates the loss of ten adult or juvenile megapodes, two active megapode nests,

one adult green sea turtle, one adult hawksbill sea turtle, and four active turtle nests as a result of the proposed training activities. Death of individual birds and turtles represents harm as defined under the Act. Destruction of an active megapode or sea turtle nest or disturbance that results in abandonment of an active nest represents harm as defined under the Act.

Effect of the Take

The Service has determined that this level of impact is not likely to result in jeopardy to the Micronesian megapode, green sea turtle, or hawksbill sea turtle because even though adult and/or juvenile mortality is likely, and active nests may be destroyed, such losses do not represent a threat to the stability of the overall population.

Reasonable and Prudent Measures

This reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of this measure, the Service believes that take of Micronesian megapodes and sea turtles will be minimized.

The Department of the Navy will minimize take of adult and juvenile megapodes, green sea turtles, and hawksbill sea turtles and minimize disruption to breeding activities (including destruction of any active nests) for all three species during project implementation.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, it is mandatory that the Navy comply with the following terms and conditions, which implement the reasonable and prudent measure described above:

(1) The Navy shall restrict their impact zone to the central interior portion and/or southern tip of the island and cliff faces, to the extent possible.

(2) The Navy shall prohibit the use of cluster bombs in training on FDM.

(3) The Navy shall monitor the extent of take by conducting a helicopter overflight survey of FDM with a qualified biologist prior to bombardment and after the exercise is completed.

(4) If a sea turtle is seen on a beach by participating aircraft, training will be altered until the turtle has left the beach and the nearby waters.

If, during the course of action, the amount or extent of the above-stated incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measure provided. The Navy must immediately provide an explanation

of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In addition to the loss of green or hawksbill sea turtles on nesting beaches, the Service is also concerned that bombs exploding in the waters surrounding FDM may result in take. The Service strongly advises the Navy to consult with the National Marine Fisheries Service on this issue. The Service also suggests that if an active sea turtle nest is discovered, and the possibility exists to recover the nest, eggs be recovered by a trained biologist and transported to a safe location for hatching.

Loss of even small numbers of megapodes, green sea turtles, hawksbill sea turtles, or their nests slow the recovery of these species and represents an adverse effect. Further, destruction of beach nesting habitat for turtles and nesting and foraging habitat for megapodes by bombing may not represent a permanent loss, but it does slow the recovery process of these species by requiring time for the habitat to recover suitably and therefore represents an adverse effect. In order to minimize the effect of this loss of individuals and habitat on the Micronesian megapode, green sea turtle, and hawksbill sea turtle, the Service recommends that the Navy fund conservation and recovery projects for these species in the Marianas at a cost of $100,000 per year for three consecutive years. Examples of such projects include: (1) eradication of feral ungulates on uninhabited northern islands, (2) conduct surveys to assess status, distribution, and identify nesting areas of these species, (3) conduct basic research into the life history and demography of these species, and (4) eradication of rats (*Rattus* spp.) on FDM and/or other uninhabited northern islands.

In addition to providing habitat for and/or supporting populations of endangered and threatened species, FDM also supports colonies of breeding seabirds, including masked boobies (*Sula dactylatra*), brown boobies (*Sula leucogaster*), red-footed boobies (*Sula sula*), great frigatebirds (*Fregata minor*), common noddies (*Anous stolidus*), black noddies (*Anous minutus*), and white terns (*Gygis alba*). FDM is particularly important for great frigatebirds as this is the only known breeding colony in the Mariana island chain. Although none of these birds are listed, they are protected under the Migratory Bird Treaty Act of 1918 [16 U.S.C. 703-712; 40 Stat. 755], as amended. The Service recommends that the Navy concentrate impacts within the interior portion of the island to lessen harm to nesting and roosting seabirds and that the Navy establish a long-term monitoring program to evaluate the effects of aerial bombing and naval gunnery on seabird populations.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

CONCLUSION

This concludes formal section 7 consultation on this action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning any of the information contained in this biological opinion, please contact Interagency Program Leader Margo Stahl or Wildlife Biologist Michael Lusk at (phone: 808/541-3441, fax: 808/541-3470, e-mail: Michael_Lusk@mail.fws.gov).

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: CNMI, DFW, Saipan

CC: MAIL LIST - DO NOT INCLUDE WITH CORRESPONDENCE

GDAWR

Guam Department of Aquatic and Wildlife Resources
Guam Department of Agriculture
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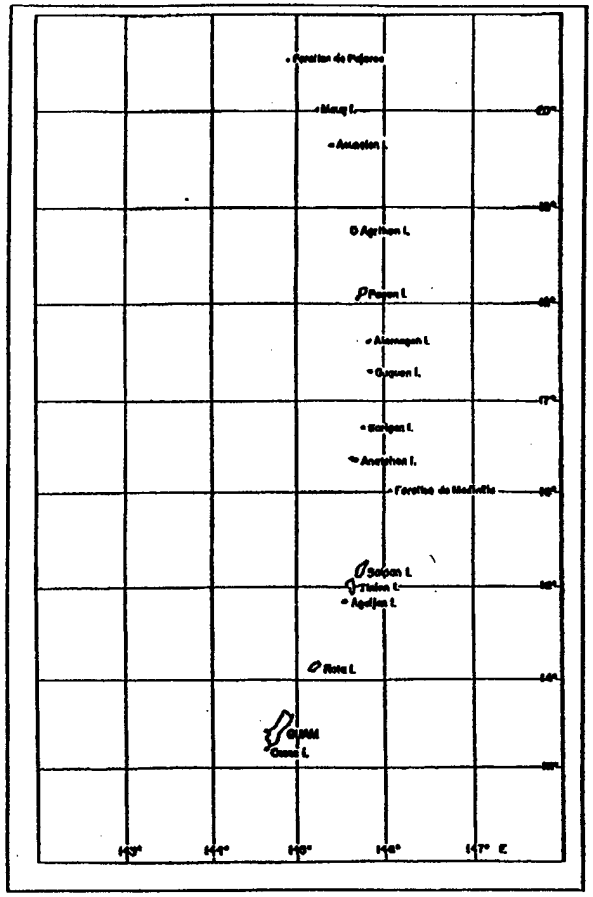


Figure 1. The Commonwealth of the Northern Mariana Islands and Guam.

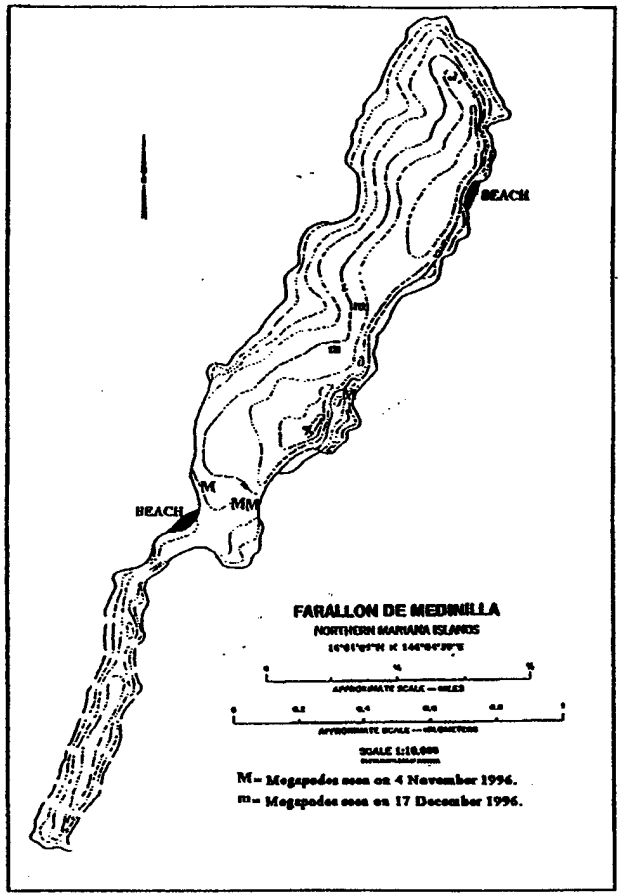


Figure 2. Locations of megapode sightings and beaches on Farallon de Medinilla.

Appendix D-8
Farallon de Medinilla (FDM) Aerial Wildlife Surveys (March 24, 1997)

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MEMORANDUM

From: PACNAVFACENGCOM Code 23, Tim Sutterfield
To: File
Via: Code 23

Subj: FARALLON DE MEDINILLA (FDM) AERIAL WILDLIFE SURVEYS

Ref: (a) Biological Opinion of the U.S. Fish and Wildlife Service for Aerial Bombardment and Gunnery Practice Associated with Tandem Thrust 1997 at Farallon de Medinilla, Commonwealth of the Northern Mariana Islands

Encl: (1) Helicopter Aerial Survey Methodology For Farallon De Medinilla

1. In accordance with the terms and conditions of the reference (a) biological opinion aerial helicopter faunal surveys were conducted at FDM on 21 February, 4 March, and 20 March 1997. The 21 February survey was done prior to the Independence battle group use of the island, from 21 February to 2 March, for aerial bombardment and ship to shore gunnery practice. The 4 March survey was a post Independence use of the island survey. The Air Force used the island for B52 aerial bombardment from 13-18 March and the 20 March survey was a post bombing impact survey.

2. Survey points were established around the perimeter of the island (enclosure (1)) and birds on the ground were counted at approximately the same spot during the three surveys. Since the points were not marked on the ground the number of survey points varied between 34 and 41 points over the three surveys. Photos were taken at each survey point and photos were also taken on the east and west side of a transect that bisected the northern part of the island. An additional around the island survey was done approximately 300 meters off shore to look for sea turtles and marine mammals. Each of the surveys lasted for about 1 hour of on station time at FDM.

3. During the 21 February pre-bombardment survey 495 red-footed and masked boobies were counted at 34 survey points for an average of 14.56 birds per survey point. During the 4 March, post Independence survey 713 birds were counted at 37 survey points for an average of 19.27 birds per survey point, and during the 20 March post B52 survey 838 birds were counted at 41 survey points for an average of 20.44 birds per survey point. Between the February and March surveys the number of nesting red-footed boobies seemed to increase considerably. It was not always easy to differentiate between red-footed and masked boobies sitting on the ground from a helicopter hovering at 500 feet.

4. Only one dead masked booby was seen during the three surveys, this bird was next to a new bomb crater and was obviously killed by the bomb blast. There were likely more bird casualties than just the one bird seen, but there was no evidence of mass seabird mortality as a result of the use of the island. No Micronesian megapodes were seen during the surveys, but this is not unexpected since this bird tends to stay under cover whenever possible. No Mariana fruit bats, sea turtles, or marine mammals were seen during the survey or while in transit between Saipan and FDM.

5. It does not appear that the bombing had any significant impact on the seabird population or on the endangered megapode. There was very little new damage to the soil or vegetation in the more heavily used flat nesting areas of the northern portion of the island. The southern portion of the island containing less vegetation and lower bird populations seemed to have sustained the most damage.

6. I would estimate that during the surveys between 1500 and 2500 nesting pairs of red-footed boobies and 200 to 300 pairs of masked boobies were using the island. Only a few brown boobies and a couple of great frigatebirds were seen.

7. Should you require further information on this matter please contact me at (808) 471-9338 or, by facsimile transmission at (808) 474-5909.

Tim Sutterfield
Fish and Wildlife Biologist

HELICOPTER AERIAL SURVEY METHODOLOGY FOR FARALLON DE MEDINILLA

1. Survey will be performed by PACNAVFACENGCOM fish and wildlife biologist Mr Timothy Sutterfield in coordination with COMNAVMAR N4

2. Transportation will be provided by HC-5 helicopter squadron.

3. Departure from Saipan outbound for Ferallon De Medinilla (FDM) will be no later than 0730.

4. Tentative survey dates will be 20 Feb. 3 March. and 20 March. Alternate days for the surveys will be the day after the scheduled survey date or as soon thereafter as weather or conditions permit.

5. Assistance will be requested from COMNAVMAR for a photographer who will have access to better camera equipment than the biologist. If available a large format camera will be used to document conditions at each station. If the photographer is not available pictures will be taken by the biologist using a single reflex lens 35 mm camera.

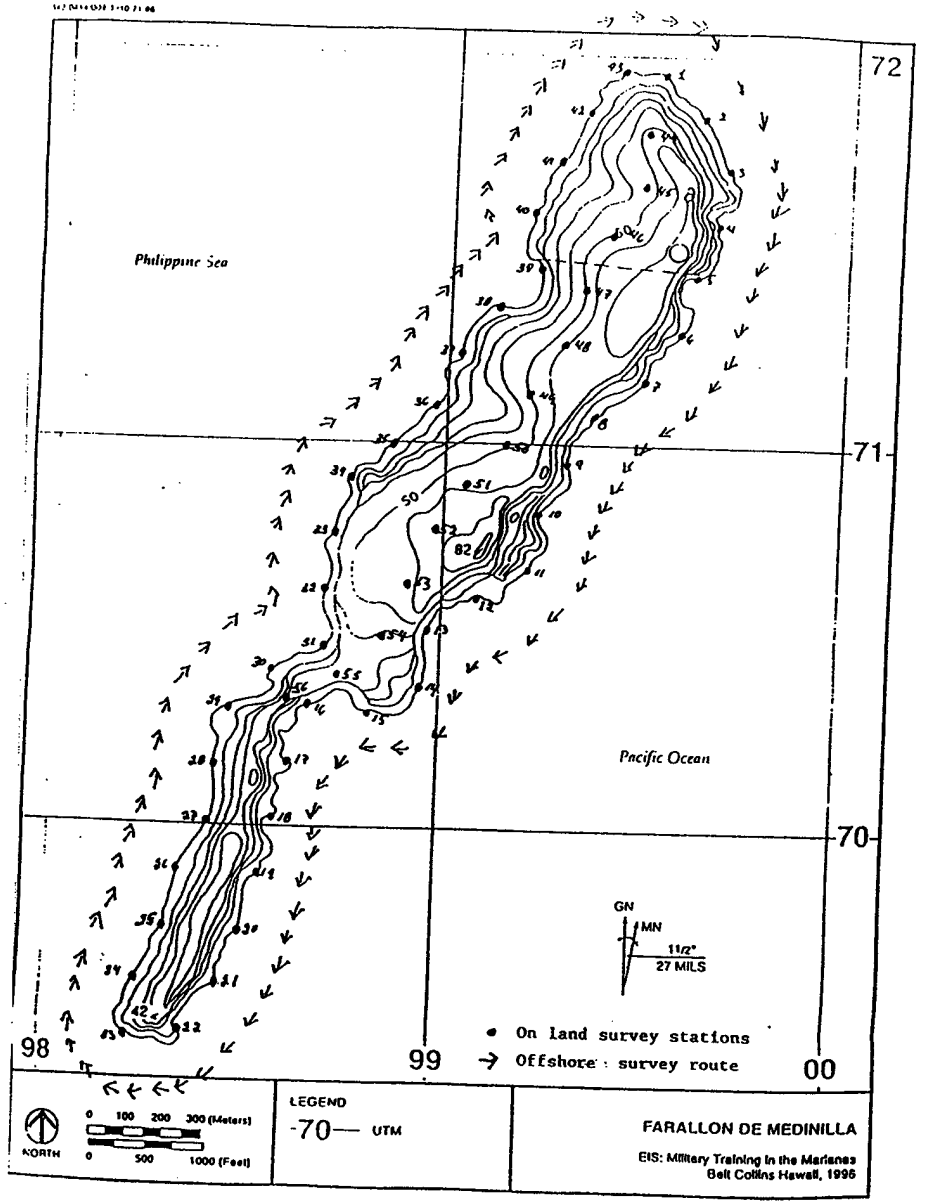
6. The survey methodology will consist of establishing two transect. the first with forty three stations (Enclosure (1) map) 150 meters apart will circle the island and a second transect with 13 additional stations will bisects the island in a north south direction. The helicopter will follow the transacts at an altitude of between 500 and 1000 feet. Beginning at the northern end of the island at station 1. the helicopter will pause for counts and photos at each station until the entire perimeter of the island has been flown ending at station 43. The second north south transect will be flown in a southerly direction starting at station 44 and ending at station 56. this transect will be surveyed again going in a northerly direction from station 56 to 44. Seabirds that are nesting on the island as well as any endangered species seen will be recorded by the biologist. Recent bomb damage to the soil or vegetation and birdlife will also be assessed.

7. Once the land survey is completed a survey of the nearshore waters for sea turtles and other marine mammals will be done by circling the island 150 meters off shore.

8. Estimated helo time at FDM will be a maximum of two hours. When the survey is completed the helo will return to Saipan for refueling and to drop of the biologist.

Encl:
(1) Map of FDM Survey Routes

ENCLOSURE(1)



ENCLOSURE(1)

Appendix D-9
Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at Farallon de Medinilla, CNMI (May 16, 1997)

BIOLOGICAL OPINION
of the
U.S. FISH AND WILDLIFE SERVICE
for
GUNNERY AND AERIAL BOMBARDMENT PRACTICE
AT FARALLON DE MEDINILLA,
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

May 16, 1997

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United States Department of the Interior

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In Reply Refer To: MRL

MAY 16 1997

Stanley Y. Uehara
Director, Environmental Planning Division
Department of the Navy
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

RE: Biological Opinion (Log Number 1-2-97-F-05), Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI).

Dear Mr. Uehara:

This report represents the biological opinion of the U.S. Fish and Wildlife Service (Service) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544; Stat. 884), as amended, (Act) regarding potential impacts to the federally listed endangered Micronesian megapode, *Megapodius laperouse laperouse*, threatened green sea turtle (*Chelonia mydas*), and endangered hawksbill sea turtle (*Eretmochelys imbricata*) from proposed gunnery and aerial bombardment practice. The Department of the Navy (Navy), as range managers, proposes to use FDM for ship to shore gunnery practice during May, 1997, and aerial bombardment practice from July 21 to August 1, 1997 in support of aircraft carrier training.

This biological opinion addresses potential impacts to the Micronesian megapode which is known to occur on FDM, and green and hawksbill sea turtles which are also known to occur in the CNMI and may nest on FDM. The opinion is based upon 1) review of the information presented in your April 4, 1997, letter requesting formal consultation, 2) information provided in a May 14, 1997, fax from Roy Tsutsui, 3) information provided in a May 13, 1997, phone call to Commander Ed Lynch, 4) information provided in the Service's *Preliminary Draft Recovery Plan for the Micronesian Megapode*, 5) information provided in the *Draft Recovery Plan for U.S. Pacific Populations of the Green Turtle* and in the *Draft Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, 6) information provided in the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*, 7) literature published on megapodes, green turtles, and hawksbill turtles, 8) a site visit to FDM on 4 November 1996, and 9) a March 24, 1997 memorandum from Tim

Sutterfield assessing impacts to the fauna of FDM as a result of the training activities covered in the Service's January 29, 1997, biological opinion.

The Navy requested initiation of section 7 consultation for the proposed action in a letter dated April 4, 1997 and received by the Service on April 7, 1997. The log number for this consultation is 1-2-97-F-05. A complete administrative record of this consultation is on file in the Service's Pacific Islands Office in Honolulu, Hawaii.

BIOLOGICAL OPINION

Description of the Proposed Action

The Navy proposes to engage in gunnery practice during May, 1997, and aerial bombardment from July 21 to August 1, 1997, on FDM, CNMI. The purpose of this project is to allow Navy carrier aircraft and ships to participate in aircraft carrier support training including surface gunnery and bombing practice. Ships assigned to the Seventh Fleet will conduct gunnery practice by firing an estimated 200 5/54 live rounds. The most likely ammunition type for the 5/54 will be high explosive with controlled variable time fuzed rounds that produce fragmentation air burst as well as high explosive point detonations. Navy fighter/attack aircraft assigned to the Carrier Air Group will practice delivery of live ordnance, consisting primarily of MK-80 series iron bombs which are designed to explode on impact. A variety of other ordnance may also be used. An estimated total of 135 MK-82 live 500 pound (#) bombs, 50 MK-83 live 1000# bombs, 36 MK-84 live 2000# bombs, 180 BDU-45 inert bombs, and 984 MK-76 inert bombs will be delivered by aircraft. It is possible that naval gunfire or bombing will occur at night. The Navy will conduct both pre- and post-exercise helicopter overflights to monitor training impacts and assess take of threatened and endangered species for both the May and July/August exercises.

Biology and Population of the Species

Unless otherwise referenced, the following information on the status and habitat requirements of the Micronesian megapode is taken from the Service's *Preliminary Draft Recovery Plan for the Micronesian megapode*, unpublished field notes, published literature, and field surveys. Information on the status and habitat requirements of the green and hawksbill sea turtles is taken from the U.S. Pacific Sea Turtle Recovery Team's (USPSTRT) *Recovery Plan for U.S. Pacific Populations of the Green Turtle* and their *Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, respectively, and the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*, unpublished field notes, published literature, and field surveys.

a) Micronesian Megapode

The Megapodiidae are a family within the order Galliformes (chicken-like birds) that occur only

within the Australasian region (USFWS 1995b). The Micronesian megapode was first described by Quoy and Gaimard from a specimen collected on Tinian in 1820 (Quay and Gaimard, 1824). The Micronesian megapode historically occurred on all the islands in the Marianas archipelago, but is now extirpated from Guam and Rota and is currently found only in low numbers on Tinian and Saipan (USFWS 1995b). The subspecies *M. l. senex* occurs in the Palau islands (Baker 1951).

Megapodes are omnivorous and have been observed to feed on seeds, beetles, ants, other insects, and plant matter (Glass and Aldan 1988, Stinson 1993). Megapodes are believed to be monogamous and may defend a territory of approximately 1 hectare (ha) on a year-round basis (Glass and Aldan 1988). Megapodes are known as "incubator birds" because of their reliance on external heat sources, such as solar energy, volcanic activity, or microbial decay, to incubate their eggs (Clark 1964). Micronesian megapodes apparently use both burrow nesting and mound building in egg incubation (USFWS 1995b). Exact nesting seasons for this subspecies are not known. Nesting probably occurs year-round on some of the Mariana islands, but may occur seasonally on some islands depending on heat source for incubation (USFWS 1995b).

The Micronesian megapode was listed as an endangered species on June 2, 1970 (USFWS 1995a). Hunting pressure on adults and eggs, introduced predators, and loss of habitat due to feral ungulates, development, and vulcanism have all been cited as reasons for local extirpations on some islands and a general population decline on the remaining islands (USFWS 1995b).

Megapodes are extirpated from Guam and Rota, and remanent populations are estimated to be 10 to 25 birds on Saipan and less than 10 on Tinian (USFWS 1995b). Larger populations persist on all the remaining northern Mariana islands, except for Uracus (USFWS 1995b). Islands such as Anatahan, and Gugan may each have as many as 200 to 500 birds. The island of Sarigan is estimated to have 1,000 megapodes (Steven Fancy, pers. comm). The total population for *M. l. laperouse* is estimated to be 1,500 to 2,000 birds.

b) Green and Hawksbill Sea Turtles

Both green sea turtles (*Chelonia mydas*) and hawksbill sea turtles (*Eretmochelys imbricata*) are known to occur in the waters of the CNMI (USFWS 1996). Green sea turtles are distributed globally throughout tropical and subtropical seas with temperatures above 20° Centigrade (USPSTRT 1995a). Hawksbill sea turtles also occur globally, generally occurring between 30°N and 30°S latitudes in the Atlantic, Pacific, and Indian oceans and associated bodies of water (USPSTRT 1995b).

Green sea turtles greater than 30 - 35 cm feed exclusively on macroalgae and seagrasses, while post-hatchlings and juveniles feed carnivorously (e.g., invertebrates and fish eggs) (USPSTRT 1995a). Hawksbill sea turtles appear to feed exclusively on sponges (USPSTRT 1995b). Both green and hawksbill sea turtles have been documented to migrate long distances, over 1,000 kilometers, between foraging grounds and nesting beaches (USPSTRT 1995a, 1995b). After

completing migration to nesting beaches, both green and hawksbill turtles lay several successive clutches of eggs, each about two weeks apart, during the nesting season before returning to the foraging grounds (Susan Pultz, pers. comm.). A turtle tagged on Tinian was recently sighted in the Philippines (George Balazs, pers. comm.). Green sea turtles are known to nest in the CNMI from January through August, which means hatching may continue into October (USFWS 1996). Hawksbill sea turtles have been known to nest in the CNMI (USFWS 1996), but the exact months are not known. In other areas of the world, hawksbill sea turtles have been recorded nesting year-round (Witzell 1983; Richardson 1990). Clutches for both species may contain 100 or more eggs (USPSTRT 1995a, Maragos 1991).

The green sea turtle was listed as a threatened species on July 28, 1978, while the hawksbill turtle was listed as an endangered species on June 2, 1970 (USFWS 1995a). Both species were listed because of declining numbers associated with overexploitation for commercial and other purposes (hunting, poaching, tortoise shell trade, etc.), gill net captures, habitat loss, and lack of effective regulations and enforcement (USPSTRT 1995a, 1995b). Spread of fibropapilloma has also slowed the recovery of green sea turtle populations (Balazs et al. 1992; Balazs and Pooley 1991).

There are no population estimates for the CNMI population of green and hawksbill sea turtles. In 1995, six to ten turtles were recorded nesting on the island of Tinian and a similar number probably nested there in 1994 (USFWS 1996). This implies that the nesting population in the CNMI is not very large presently, but at one time may have been much larger (USFWS 1996). Although no hawksbill turtles were observed nesting on Tinian in 1995, there has been an incidental report of a hawksbill nesting on Guam (USFWS 1996).

Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. The baseline includes State, local, and private actions that affect a species at the time the consultation begins. Unrelated Federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

a) Micronesian Megapodes

A total of four megapodes were discovered on FDM during a site visit on November 4, 1996 (Lusk and Kessler 1996). Two megapodes were found on the island during a Navy site visit on December 17, 1996 (Figure 2). The size of the island, 0.7 km^2, leads the Service to estimate that there are likely not more than ten megapodes on the island. This number represents less than 1.0% of the total estimated population within the Marianas archipelago. No nesting has been recorded on the island, but the possibility for nesting does exist. An aerial helicopter survey of

FDM by Tim Sutterfield, Fish and Wildlife Biologist, Navy, after the actions covered in the January 29, 1997, biological opinion revealed no take of the megapode. However, observations of megapodes on FDM indicate that they are likely to remain underneath brushy cover and, therefore, deaths or injury from either direct strikes or indirectly from shrapnel would be difficult to detect from aerial surveys. On-the-ground surveys are not possible due to the high incidence of unexploded ordnance distributed over the island. Due to these factors, the Service is unable to determine the amount of take from the training exercise covered under the January 29, 1997, biological opinion.

b) Green and Hawksbill Sea Turtles

The project area is the entire island of FDM, which includes two small beaches (both approximately 50 m long X 10 m wide), one on the southwestern corner and one on the northeastern corner of the main body of the island (Figure 2), that may provide nesting habitat for sea turtles. Sea turtles are known to occur in the waters surrounding FDM (U. S. Department of the Navy 1997), but no monitoring for sea turtle nesting on the island has ever been conducted. It is possible that several sea turtles could be using the beaches for nesting, although the beaches appear to be heavily wave-washed and are probably not prime nesting habitat. If beaches were used for nesting, each turtle using the beaches could average three to four clutches of eggs for the season. It is not possible to estimate the percentage of breeding sea turtles or nests this represents in the Marianas archipelago. An aerial helicopter survey of FDM and its surrounding waters by Tim Sutterfield after the actions covered in the January 29, 1997, biological opinion revealed no take of either turtle species. Destruction of nests on beaches, or adult turtles killed on beaches or in the water, may have been detectable by aerial helicopter surveys. Therefore, the Service does not believe that take of either turtle species resulted from the actions covered in the January 29, 1997, biological opinion.

Effects of the Action on Listed Species

a) Micronesian megapodes

The primary concerns of the Service with regard to the effects of gunnery and aerial bombardment practice on the Micronesian megapode are (1) direct death of megapodes and (2) the destruction or abandonment of active megapode nests.

The impact areas for gunnery and aerial bombardment practice cover the entire area of FDM and megapodes have been documented to occur on this island (Lusk and Kessler 1996, Tim Sutterfield, pers. comm.). Therefore, the Service anticipates the possible direct death of all megapodes and destruction of all nests occurring on the island at the time of Naval training.

b) Green and Hawksbill Sea Turtles

The primary concerns of the Service with regard to the effects of gunnery and aerial

bombardment practice on green and hawksbill sea turtles are (1) direct death of sea turtles on nesting beaches, (2) the destruction of active turtle nests, and (3) the creation of craters on beaches that can trap hatchlings moving from the nest to the ocean.

The impact areas for gunnery and aerial bombardment practice cover the entire area of FDM, including its two beaches. Although it is not certain that sea turtles use the beaches at FDM for nesting, it is possible that nesting does occur. Therefore, the Service anticipates the possible direct death of green sea turtles and hawksbill sea turtles and the destruction of all sea turtle nests from ordnance exploding on FDM's beaches.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service has not identified any cumulative effects in the project area that may impact Micronesian megapodes, green sea turtles, or hawksbill sea turtles.

The Service anticipates that a programmatic section 7 consultation will be initiated by the Navy in the near future associated with its analysis of all military training in the Mariana islands archipelago. During this programmatic consultation the cumulative effects of Navy training on FDM as well as throughout the Mariana islands will be fully evaluated.

Conclusion

After reviewing the current status of the Micronesian megapode, the green sea turtle, and the hawksbill sea turtle, the environmental baseline of the species in the action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that gunnery and aerial bombardment practice by the Navy for the purposes of aircraft carrier support training in May and July/August is not likely to jeopardize the continued existence of the Micronesian megapode, green sea turtle, or hawksbill sea turtle. No critical habitat has been designated for these species; therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the Act, as amended, prohibit the taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of a listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding,

feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are non-discretionary and must be implemented by the Navy in order for the exemption in section 7(o)(2) to apply.

The Navy has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Navy fails to adhere to the terms and conditions of the incidental take statement the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Because of the difficulties in documenting impacts by aerial helicopter surveys and the inability to conduct on-the-ground surveys, the Service believes that take of megapodes associated with gunnery and aerial bombardment practice on FDM to be indeterminate. Therefore, the Service anticipates the possible loss of all adult and juvenile megapodes and all active megapode nests on island at the time of the training activities. In addition, the Service anticipates the loss of one adult green sea turtle, one adult hawksbill sea turtle, and four active turtle nests as a result of the proposed training activities. Death of individual birds and turtles represents harm as defined under the Act. Destruction of an active megapode or sea turtle nest or disturbance that results in abandonment of an active nest represents harm as defined under the Act.

Effect of the Take

The Service has determined that this level of impact is not likely to result in jeopardy to the Micronesian megapode, green sea turtle, or hawksbill sea turtle because even though adult and/or juvenile mortality is likely, and active nests may be destroyed, such losses do not represent a threat to the stability of the overall population.

Reasonable and Prudent Measure

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of this measure, the Service believes that take of Micronesian megapodes and sea turtles will be minimized.

The Navy will minimize take of adult and juvenile megapodes, green sea turtles, and hawksbill sea turtles and minimize disruption to breeding activities (including destruction of any active nests) for all three species during project implementation.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, it is mandatory that the Navy

comply with the following terms and conditions, which implement the reasonable and prudent measure described above:

(1) The Navy shall restrict their impact zone to the central interior portion and/or southern tip of the island and cliff faces, to the extent possible.

(2) The Navy shall prohibit the use of cluster bombs in training on FDM.

(3) The Navy shall monitor the extent of take by conducting a helicopter overflight survey of FDM with a qualified biologist prior to bombardment and after the exercise is completed for both the May and July/August portions of the training.

(4) If a sea turtle is seen on a beach by participating aircraft, training will be altered until the turtle has left the beach and the nearby waters.

If, during the course of action, the amount or extent of the above-stated incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measure provided. The Navy must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In addition to the potential loss of green or hawksbill sea turtles on nesting beaches, the Service is also concerned that bombs exploding in the waters surrounding FDM may result in take. The Service advises the Navy to consult with the National Marine Fisheries Service on this issue. The Service also suggests that if an active sea turtle nest is discovered, and the possibility exists to recover the nest, eggs be recovered by a trained biologist and transported to a safe location for hatching.

Loss of even small numbers of megapodes, green sea turtles, hawksbill sea turtles, or their nests slow the recovery of these species and represents an adverse effect. Further, destruction of beach nesting habitat for turtles and nesting and foraging habitat for megapodes by bombing may not represent a permanent loss, but it does slow the recovery process of these species by requiring time for the habitat to recover suitably and therefore, represents an adverse effect. In order to minimize the effect of this loss of individuals and habitat on the Micronesian megapode, green sea turtle, and hawksbill sea turtle, the Service recommends that the Navy continue to assist the

CNMI Division of Fish and Wildlife (DFW) in its efforts to eradicate feral ungulates on the island of Sarigan and that the Navy consider funding additional conservation and recovery projects for these species in the Marianas. Examples of conservation and recovery projects that should be considered for funding include: (1) efforts to eradicate feral ungulates on uninhabited northern islands, (2) conduct surveys to assess status, distribution, and identify nesting areas of these species, (3) conduct basic research into the life history and demography of these species, and (4) eradication of rats (*Rattus* spp.) on FDM and/or other uninhabited northern islands.

In addition to providing habitat for and/or supporting populations of endangered and threatened species, FDM also supports colonies of breeding seabirds, including masked boobies (*Sula dactylatra*), brown boobies (*Sula leucogaster*), red-footed boobies (*Sula sula*), great frigatebirds (*Fregata minor*), common noddies (*Anous stolidus*), black noddies (*Anous minutus*), and white terns (*Gygis alba*). FDM is particularly important for great frigatebirds as it is one of only two small breeding colonies known to exist in the Mariana island chain and for masked boobies because it represents the largest known nesting site for this species in the Mariana or Caroline islands. Although none of these birds are listed, they are protected under the Migratory Bird Treaty Act of 1918 [16 U.S.C. 703-712; 40 Stat. 755], as amended. The Service recommends that the Navy concentrate impacts within the interior portion of the island to lessen harm to nesting and roosting seabirds and that the Navy establish a long-term monitoring program to evaluate the effects of aerial bombing and naval gunnery on seabird populations.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

This concludes formal section 7 consultation on this action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning any of the information contained in this biological opinion, please contact Interagency Program Leader Margo Stahl at or Wildlife Biologist Michael Lusk (phone: 808/541-3441, fax: 808/541-3470, e-mail: Michael_Lusk@mail.fws.gov).

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: CNMI, DFW, Saipan
NMFS, Honolulu

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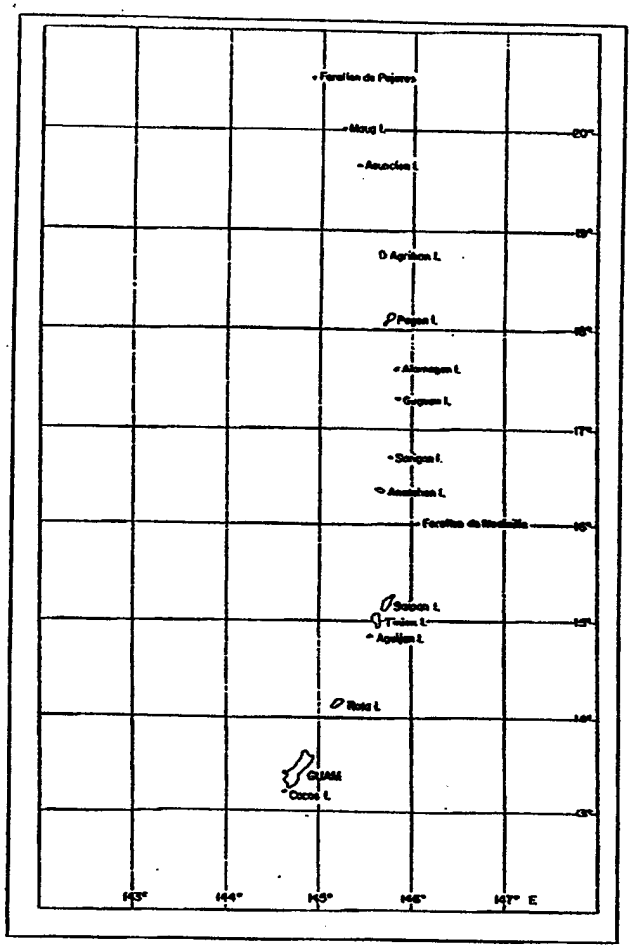


Figure 1. The Commonwealth of the Northern Mariana Islands and Guam.

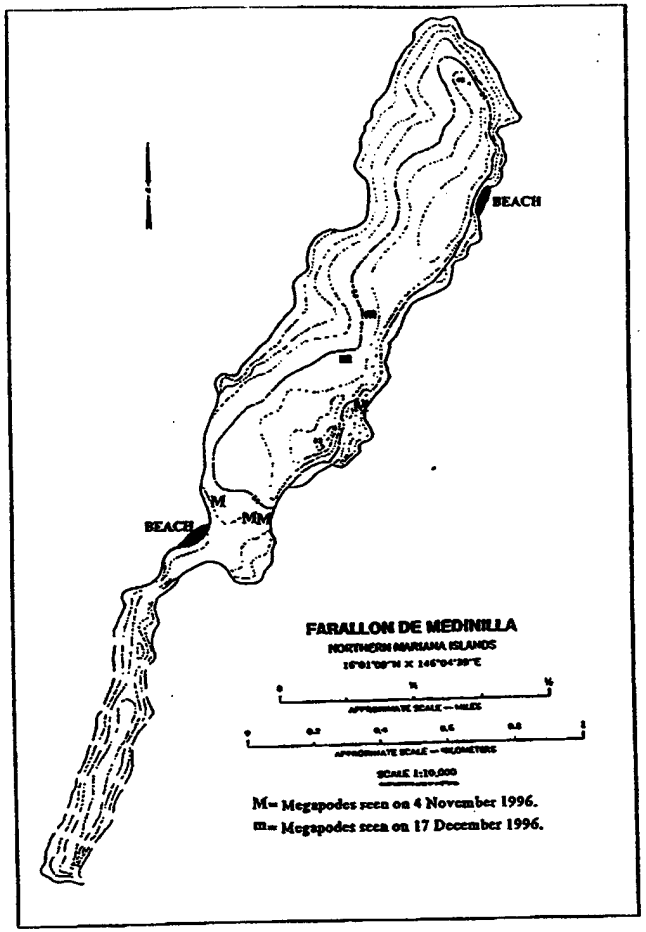


Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla.

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Appendix D-10
Wildlife Surveys of Farallon de Medinilla of May 17 and 27, 1997
(June 11, 1997)

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11 June 97

MEMORANDUM

From: PACNAVFACENGCOM Code 23, Tim Sutterfield
To: File
Via: Code 23

Subj: WILDLIFE SURVEYS OF FARALLON DE MEDINILLA OF MAY 17 AND 27, 1997

Ref: (a) Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at Farallon De Medinilla, Commonwealth of the Northern Mariana Islands, 16 May, 1997.

Encl: Map of Survey Routes and Stations

1. In accordance with reference (a) helicopter surveys were done at Farallon De Medinilla (FDM) prior to and after the aerial bombardment that took place from 19 to 24 May, 1997. The pre-bombardement survey was performed on 17 May and the post-bombardement survey was performed on 27 May. Enclosure (1) shows the routes taken during the marine surveys, and stations censused during the seabird surveys. The marine surveys were performed by following the coastline 300 meters offshore at an altitude of 500 feet and the seabird surveys were accomplished by flying just seaward of pre- established stations at an altitude of 300 feet or less. Larger nesting seabirds such as masked and red-footed boobies were counted at each of the stations. Weather conditions were excellent during both days of the survey and seas were moderate on 17 May and flat on 27 May.

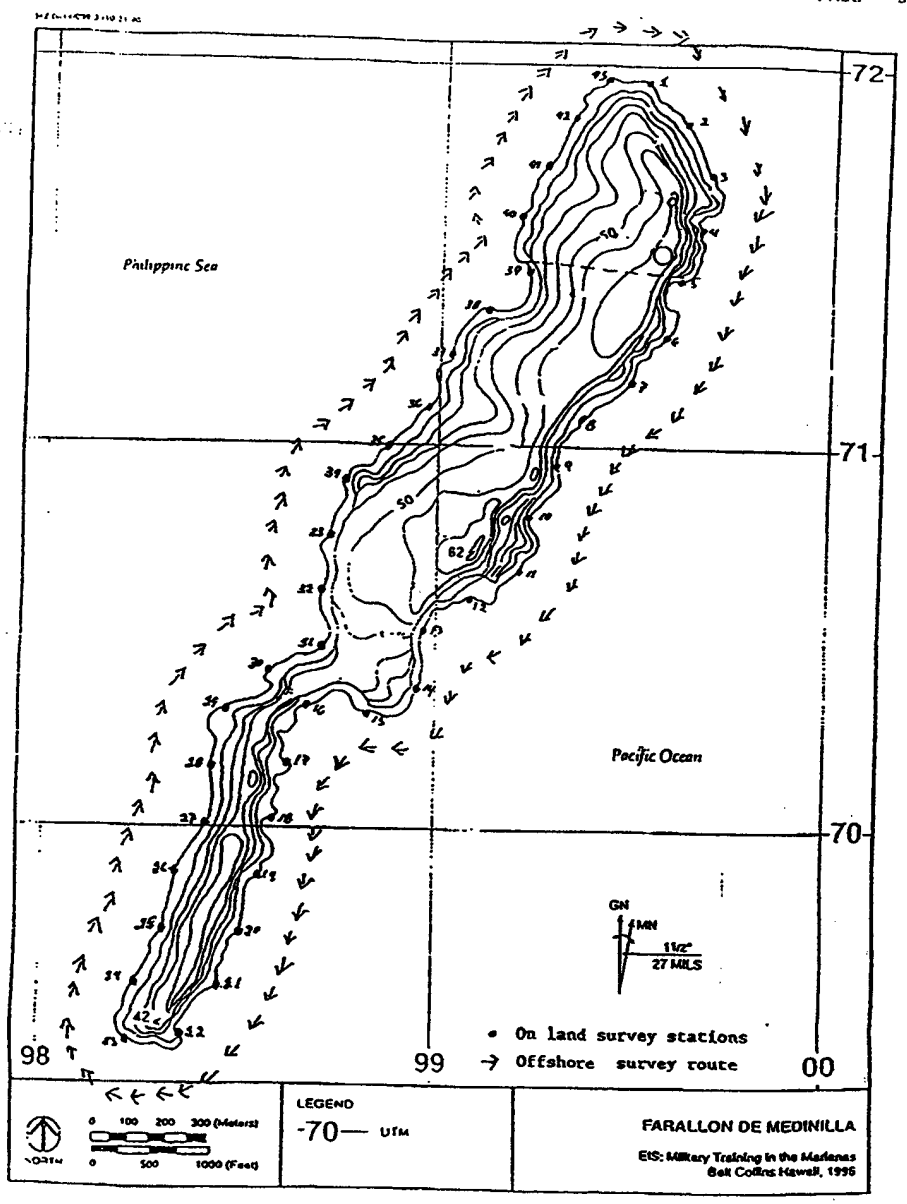
2. Transportation for the pre-bombardement survey was provided by a UH 1E Huey helicopter from one of the ships in the battle group. Pickup from Saipan International was at 0900 and departure from Saipan was at 0935. Arrival at FDM was at 1000. The marine survey began at the northern end of the island and skirted the eastern and western shores until the island was circumnavigated. No turtles or marine mammals were seen in the waters around the island and no turtles or marine mammals were seen while in transit to or from FDM. No turtle tracks were seen on either of the two beaches on FDM. A total of 497 larger nesting seabirds were censused at 40 stations for an average of 12.43 seabirds per station. Although it was not possible to survey the smaller seabirds on the island, it was obvious that the noddies were beginning to arrive by the thousands and will soon begin to nest. Also saw a few sooties, 3 great frigate birds, and 6 brown boobies. The survey was completed at 1100. Performed a flyover of Anatahan and returned to Saipan by 1245.

3. Transportation for the 27 May post-bombardment survey was provided by an HC-5 helicopter. Departure from Saipan was at 0806. The marine survey of FDM began on the southern end of the island circled the island once and then continued along the western shore a second time to station 1 on the northern end of the island. No sea turtles or marine mammals were seen in the vicinity of the island nor were any seen while in transit to or from the island. During the seabird survey 503 larger nesting seabirds were counted at 43 stations for an average of 11.7 birds per station. Noddies were still swarming by the thousands and saw a flock of 40-50 brown boobies fly out of a cave on the southern end of the island. No dead birds were seen on land and only a few new bomb craters were seen on the northern end of the island. Finished the survey 0950 and arrived on Saipan at 1020.

4. There was no evidence during the surveys that the bombardment of the island was having any negative impact on marine mammals or sea turtles. The impact of the bombardment on seabirds, if any, was not readily apparent. The difference in numbers of seabirds counted between the pre and post surveys was not significant. One juvenile red-footed booby was killed during the post survey when it flew into the rotor of the helicopter.

5. Should you require further information on this matter point of contact is Mr. Timothy Sutterfield, Fish and Wildlife Biologist at (808) 471-9338 or by facsimile transmission at (808) 474-5909.

Timothy Sutterfield
Fish and Wildlife Biologist


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FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Bell Collins Hawaii, 1995

ENCLOSURE(1)

Appendix D-11
Farallon de Medinilla (FDM) Ordnance Survey (July 15, 1997)

8027
15 July 1997
Det 05/034

MEMORANDUM

From: Officer in Charge, EODMU FIVE Det FIVE
To: Environmental Officer, COMNAVMAR
Via: (1) Operations Officer, EODMU FIVE
(2) Commanding Officer, EODMU FIVE

Encl: (1) FDM Chartlet

Subj: FARALLON DE MEDINILLA (FDM) ORDNANCE SURVEY

1. The following observation's were made during the FDM survey conducted 8-10 July 1997:

Approaching the island from a small boat, ordnance can be seen on the island itself; most with a 'nose-in' attitude. The majority of the ordnance on the island still has fins (primarily snake-eye and conical) attached. Parachutes are also visible hanging from some of the ordnance.

No personnel were authorized to go ashore, therefore an accurate recon of the island itself is not available. General locations of the ordnance as viewed from a small boat are indicated in enclosure (1).

Because diving was limited to 60 fsw, most of the ordnance indicated in enclosure (1) is within 200 yards of the island. Visibility was 80+ feet, with the strongest currents found on the north and south ends of the island. GPS coordinates were not used to mark the ordnance due to the high numbers found. The ordnance is marked in the 'zone' where it was found. These 'zones' correspond to those used by the Belt Collins researchers ('T' indicates where snorkelers were towed, 'S' indicates snorkeling and/or diving areas).

The majority of ordnance items found were MK-80 series bombs. Most were damaged to varying degrees, with quite a bit of marine growth. Because much of the ordnance was damaged, covered in growth, and/or buried, a visual ID for the presence of fuzes was impossible. For those that were visible, almost all were unfuzed with a few exceptions, however many had a ballistic nosecap in place so the presence of a fuze could not be ruled out. One 5 inch rocket motor was found without the warhead section.

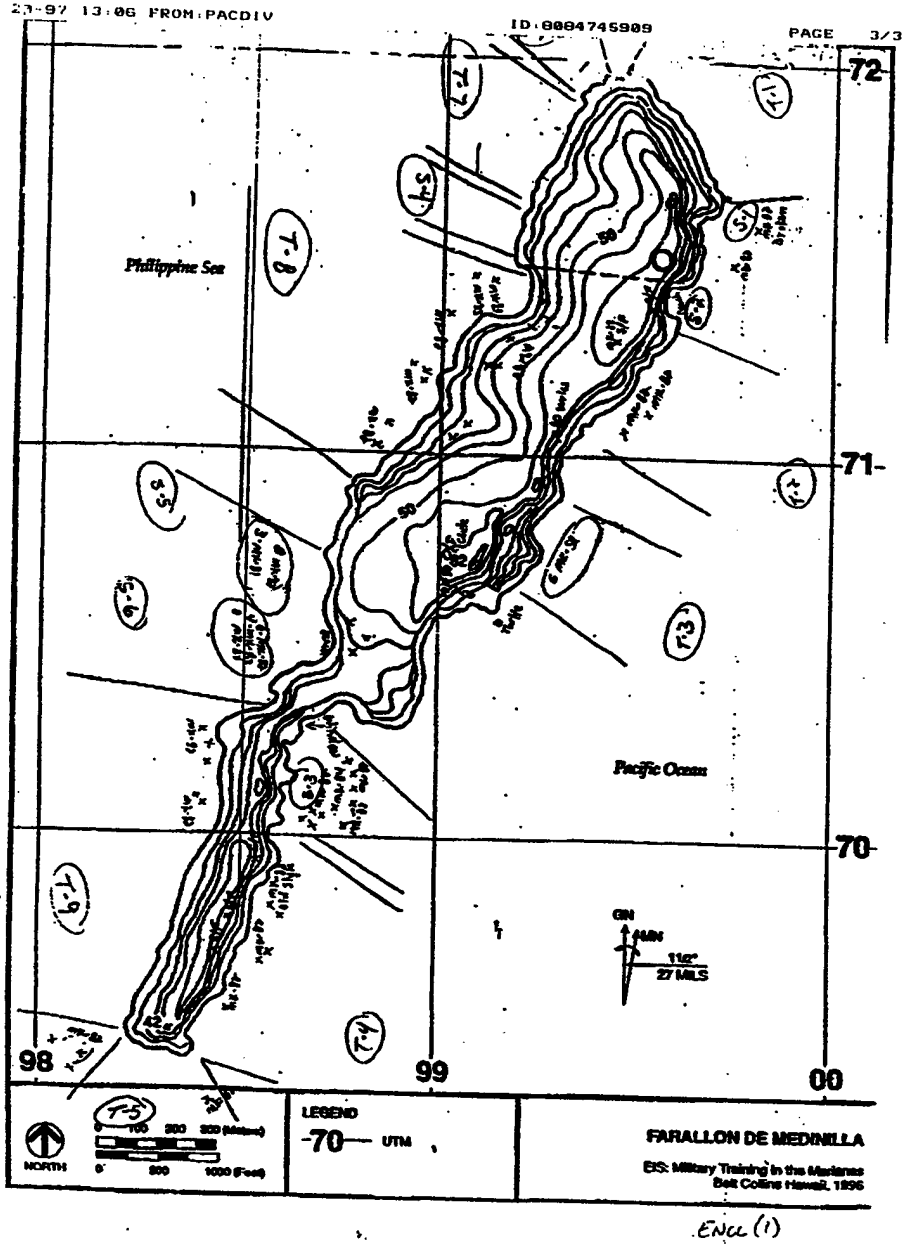
The ordnance is concentrated around the middle section of the island, and begins to thin out as you move towards either end.

The extreme north and south ends of the island had the fewest number of ordnance items.

Because of the unknown condition, age and location of all the ordnance, the safest and recommended method of disposal is to blow-in-place (BIP). Many of the MK-80 series bombs were buried under large rocks which would make moving them to a disposal area inherently dangerous, costly, and time consuming. The sheer number of ordnance items located on the island and in the surrounding waters will present a major search and disposal operation whether the items are blown-in-place or moved to a safe disposal area.

K. GILLAM

RECEIVED TIME AUG.20. 12:58PM PRINT TIME AUG.20. 12:59PM


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-70- UTM
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

Encl (1)

Appendix D-12
FDM Marine Biological Survey and Associated Marine Surveys on Guam, 7 to 13 July 1997 (July 18, 1997)

MEMORANDUM **18 JULY, 1997**

TO: **PACDIV (CODE 231)**
ATTENTION: **FRED MINATO**
FROM: **JOHN GOODY, BELT COLLINS HAWAII**
SUBJECT: **FDM MARINE BIOLOGICAL SURVEY AND ASSOCIATED MARINE SURVEYS ON GUAM, 7 TO 13 JULY 1997**

1. The purpose of the survey was to provide additional information on the marine biological conditions surrounding FDM and of two proposed training areas in waters south of Orote Point on Guam. The FDM survey was conducted 7 to 11 July with support of the MSC vessel USNS Niagara Falls, Detachment 5 of EODMU-5, and HC-5, all based in Guam. Marine survey of proposed underwater demolition site off Dadi Beach on Guam was conducted on 12 July, supported by Brock Durig of COMNAVMAR Environmental Department, who provided the diving platform; EODMU-5 had previously marked the location. Tipalao Cove survey was performed from shore on 13 July, as was the inshore portion of the Dadi Beach site.

2. Participants in the surveys included John Goody of Belt Collins with Dr. Steve Dollar performing the surveys for EIS purposes. Observing were John Naughton of NMFS, Mike Molina of USFWS, and Mike Trianni of CNMI. In principle, it was intended that the survey be conducted separately from the government observers; in practice, because of the difficult environment and for safety reasons, the survey effort and observer effort were combined. It was agreed that the agency observers would provide their observations to the survey team, and that this could be done without compromising the agency's independent oversight role, in that collection of data was the primary mission of the survey and the more eyes the better in this one time opportunity. Use of data, lists of fish species observed for example, provided by the agency observers in no way inhibits the agency from making appropriate comments during DEIS review regarding the interpretation and inferences of environmental effect derived from the information.

3. Summary results include the following:

FDM:

The entire perimeter of FDM was surveyed, with certain stations selected for more detailed evaluation.

No significant effects of range use were found in the waters surrounding FDM. One recent bomb scar in the reef was observed south of the island, and numerous items of UXO were observed, mostly inert.

Certain bottom areas were scoured and devoid of significant coral development; it is unclear the extent to which this is due to high wave energies, or to surface runoff bearing erosion sediments from the island and, if the latter, to what degree the bombardment has aggravated the rate of mass wasting.

Clear evidence was seen on certain portions of the island of ordnance impacts on the cliff faces and tops. Certain areas, primarily in the narrow middle, reflect active mass wasting and erosion.

Numerous (in the thousands) seabirds were observed, primarily noddy terns and brown boobies. Approximately 100 plus red footed boobies were observed roosting on the top portions of the island.

No marine mammals were observed. One sea turtle was observed. These observations were made in a period of three days on the water and one helicopter overflight of 30 minutes covering the waters out to a mile from the island.

Two beaches were emerged during the survey, neither of which had the potential for turtle nesting.

GUAM

The deep site off of Dadi Beach has sufficient area of sand to provide a suitable alternate underwater demolition area. No marine mammals were observed or heard during the two hour survey, although the presence of marine mammals would present a problem if it were to occur on a regular basis. This finding was concurred in by the two agency observers.

The Tipalao cove area is relatively devoid of coral development in the location proposed by the SEALs for placing small charges. It is proximate to family housing and therefore coordination would be needed with base security to maintain a clear safety area during use.

Appendix D-13
Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 19 July and 2 Aug 97 (August 21, 1997)

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

11015.4G23
Ser 232/3057
21 Aug 1997

From: Commander, Pacific Division, Naval Facilities Engineering Command
To: Commander in Chief, U.S. Pacific Fleet (N465)

Subj: FORWARDING RESULTS OF WILDLIFE SURVEYS OF FARALLON DE MEDINILLA (FDM) OF 19 JUL AND 2 AUG 97

Ref: (a) Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at FDM, Commonwealth of the Northern Mariana Islands of 16 May 97

Encl: (1) Map of Survey Routes and Stations
(2) Photos of Newly Burned Areas
(3) Photos of Bomb Craters North of the No Bomb Line
(4) Map of Biologically Sensitive Areas

1. In accordance with reference (a), helicopter surveys were done by the PACNAVFACENGCOM Fish and Wildlife Biologist at FDM prior to and after the naval aerial bombardment that took place from 21 July through 1 August 1997. Transportation for the surveys was provided by Macaw Helicopters, a private helicopter company based on Saipan. The pre and post-bombardment surveys were performed on 19 July and 2 August 1997 respectively. The recorder for the surveys was LCDR Jaego, COMNAVMARIANAS. Enclosure (1) depicts the routes taken during the marine surveys, and stations censused during the seabird surveys. The marine surveys were accomplished by following the coastline 300 meters offshore at an altitude of 300 feet. The seabird surveys were accomplished by flying just seaward of pre-established census stations at an altitude of 300 feet or less. Larger nesting and loafing seabirds such as masked and red-footed boobies were counted at each of the stations. Weather conditions were excellent during both days of the survey and seas were slight to moderate. It should be understood that these helicopter surveys are not intended to count the total numbers of birds using the island; they are only to determine what impact the use of the range is having on the larger nesting or roosting birds that are using the flat upper portion of the island. These surveys also incidentally record what species of birds are present on the island at the time of the survey.

2. Departure for the pre-bombardment survey on 19 July 1997 was at 0845 from the Coral Ocean Point Hotel located adjacent to the Saipan International Airport. Arrival at FDM was at 0920. As we approached the island a large flock of mixed seabirds species departed to the north. The marine survey began at the southern end of the island and skirted the western and eastern shores until the island was circumnavigated. No turtles or marine mammals were seen in the waters around the island nor were any seen while in transit to or from FDM. No turtle tracks were seen on either of the two beaches on FDM. A total of 330 larger nesting seabirds

were censused at 40 stations for an average of 8.25 seabirds per station. The noddies were still present in large numbers and the masked boobies had begun to nest again along the upper edge of the eastern cliffline. A flock of 40 or more brown boobies flew out of a cave on the southern end of the island.

3. Departure for the 2 August 1997 post-bombardment survey from the Coral Ocean Point helicopter landing pad was at 0855 and arrival at FDM was at 0925. Once again as we approached the island, a large flock of mixed seabird species departed to the north. The marine survey began on the southwestern end of the island and followed the shoreline until the island was circumnavigated. No sea turtles or marine mammals were seen in the vicinity of the island nor in transit to or from the island. During the seabird survey 336 larger nesting seabirds were counted at 40 stations for an average of 8.4 birds per station. One or possibly two dead seabirds were seen by LCDR Jaego near a new bomb crater on the southern end of the island. A flock of 50 to 100 brown boobies flew out of a cave on the northern end of the island and a flock of 50 or more flew out of a cave on the southern end of the island. Only one brown booby was seen nesting on the island; the increased numbers seen roosting in the caves indicates the likely beginning of the nesting season. There were fewer noddies present during this survey; they may have departed the island as we approached, or they may have left due to the disturbance caused by the exercise. No frigatebirds were observed. One red-footed booby was killed over the northern portion of the island when it flew through the main rotor blade. This necessitated an emergency landing to inspect for damages. The booby did not hit the tail rotor, nor was damage sustained, and the flight continued.

4. It was evident during the 2 August 1997 post survey that the bombardment of the island was intensive and on target, as 25 to 50 new bomb craters were observed. The valley in the middle of the northern portion of the island commonly known as megapode valley had burned to bare earth and there were several other smaller circular burn areas (enclosure (2)). There were numerous new bomb craters north of the no bomb zone and some of these were in the vicinity of the large red-footed booby nesting colony just south of the northern escarpment (enclosure (3)). The difference in numbers of nesting or roosting seabirds counted during the pre and post-surveys was not significant. Range control should insure that the pilots are aware of areas on the range that are outside of the target area, especially the area north of the no bomb line. Existing targets above the no bomb line should be relocated to areas that are within the active portion of the range. Enclosure (4) shows areas that are significant seabird nesting areas, targets should be placed to avoid these areas to the maximum extent possible. The southern end of the island below the saddle is the least important biologically and should be used to the maximum extent practicable.

5. As a result of the recent burning of some of the island vegetation, it is recommended that explosives ordnance disposal (EOD) go out and clear ordnance from

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these selected areas. The vegetation in these selected areas is virtually now non existent and bare soil is exposed. This burned-off area was amongst the most heavily vegetated with grasses and was one of the areas where submunitions were spotted during the on island surveys in November and December of 1996. Should EOD go on the island for ordnance clearing or should the Seabees go on island for target replacement, recommend PACNAVFACENGCOM assist you to do further biological investigations and coordinate in the placement of targets in the least biologically sensitive areas.

6. Should you require further information on this matter point of contact is Mr. Timothy Sutterfield, Fish and Wildlife Biologist at 471-9338 or by facsimile transmission at 474-5909.

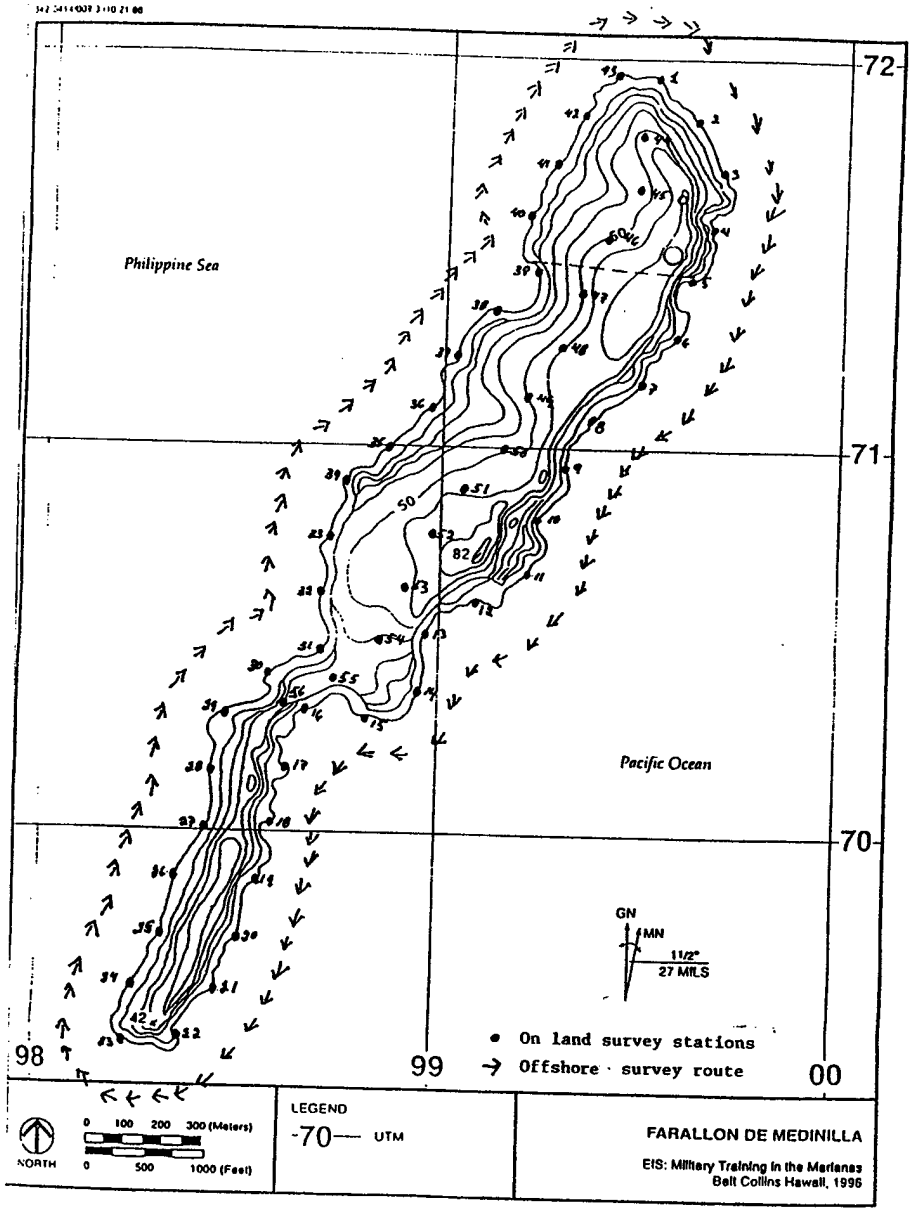
MELVIN N. KAKU
By direction

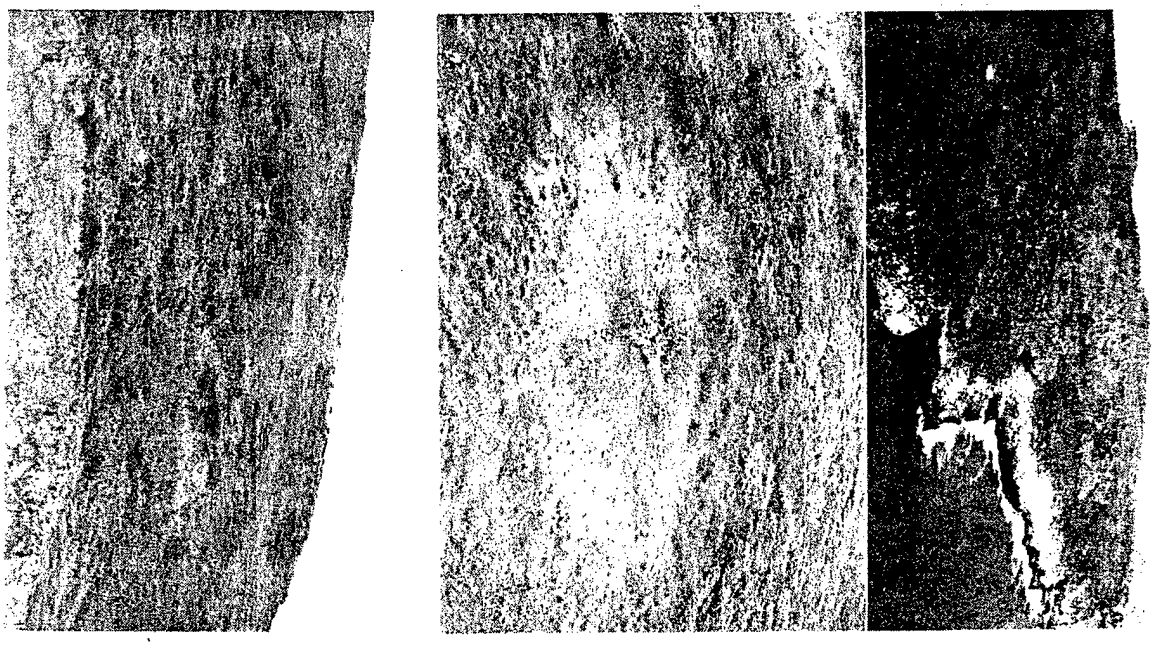
Copy to:
COMNAVMARIANAS (N4)

Ms. Karen Rosa
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3108
Box 50088
Honolulu, HI 96850

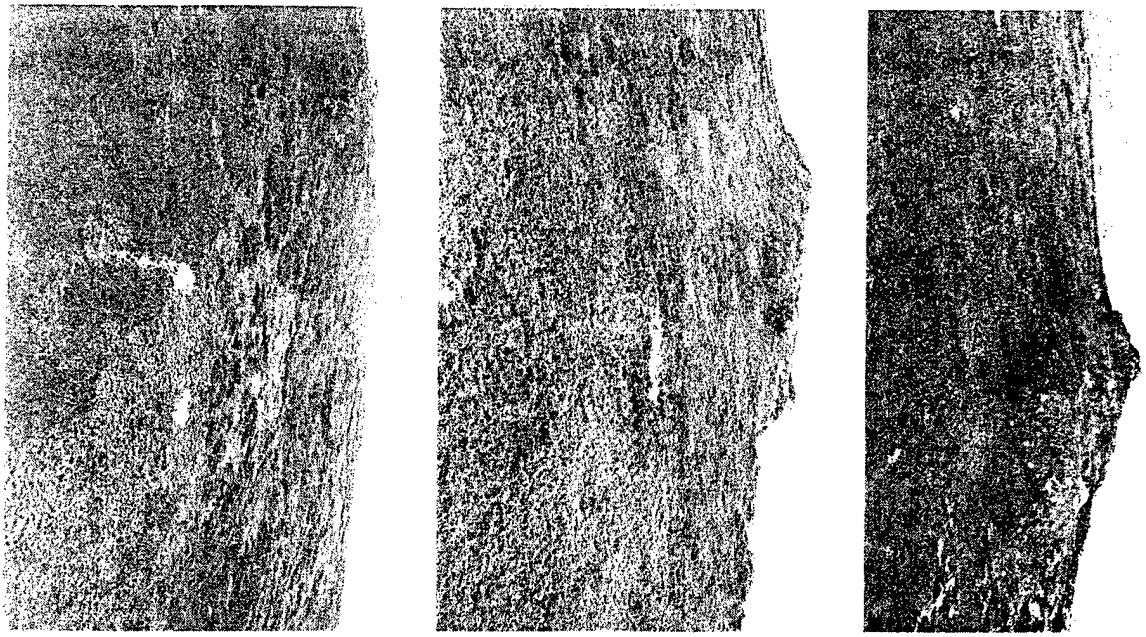
Mr. Eugene Nitta
Program Manager
National Marine Fisheries Service
2570 Dole Street
Honolulu, HI 96822-2396

Belt Collins Hawaii
680 Ala Moana Boulevard, First Floor
Honolulu, HI 96813-5406

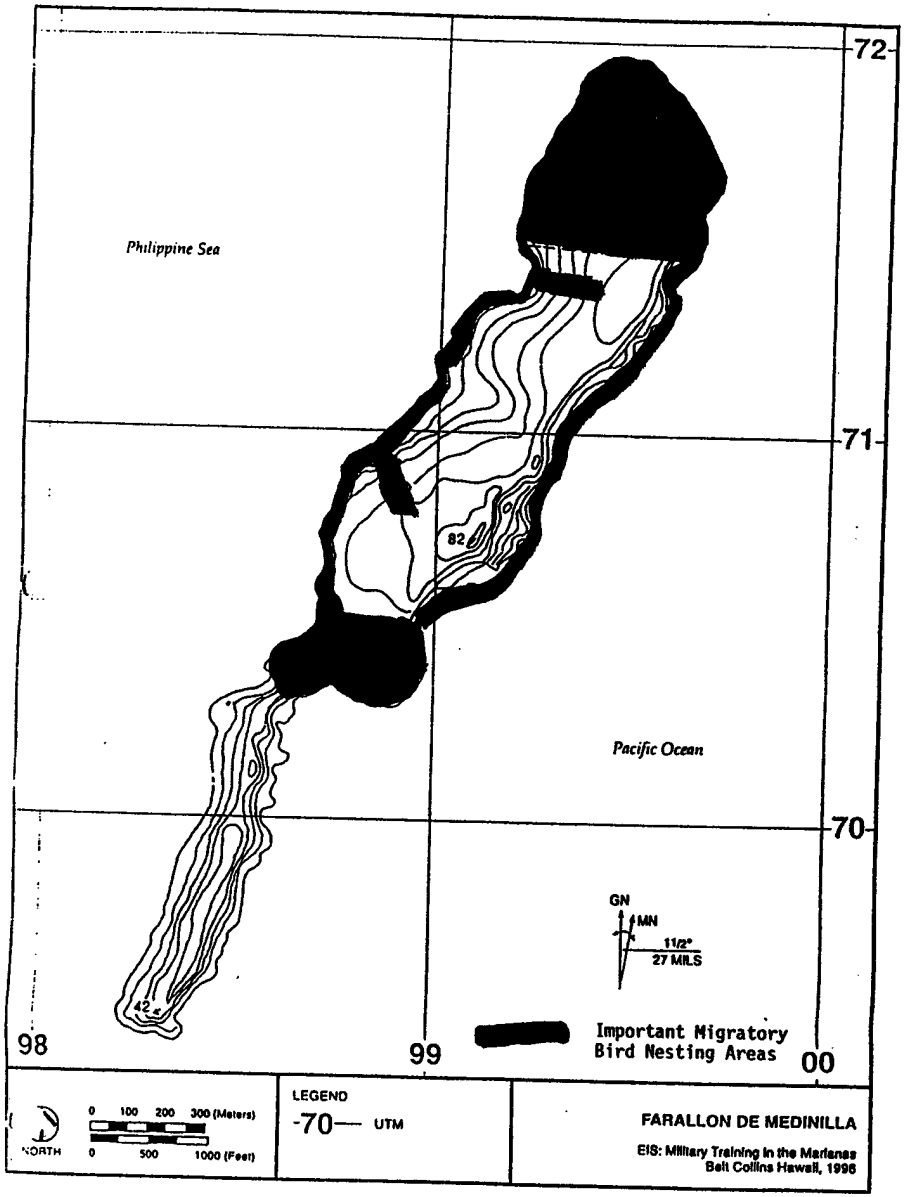




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FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

ENCLOSURE(4)

Appendix D-14
Assessment of the Marine Environment Farallon de Medinilla, CNMI, Military Training in the Marianas EIS (September 1997)

ASSESSMENT OF THE MARINE ENVIRONMENT
FARALLON DE MEDINILLA, CNMI

MILITARY TRAINING IN THE MARIANAS EIS

Prepared for:

Belt Collins Hawaii
680 Ala Moana Blvd.
Honolulu, HI 96813

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

September 1997

1.0 INTRODUCTION

The uninhabited island of Farallon de Medinilla (FDM), part of the Commonwealth of the Northern Marianas (CNMI), is located north of Saipan at approximately 16°01' N, 146° 04'30" E. Since 1971, FDM has been the target site of live-fire military exercises. These exercises consist primarily of ship-to-shore gunfire by the Navy and aerial gunnery and bombardment by the Air Force. In 1975, the CNMI covenant was created and included a provision for the United States navy to continue using FDM for naval and aerial bombardment. In 1981, a 100-year lease was negotiated for military use of several portions of the CNMI, including FDM.

In order to assess the nearshore marine resources at FDM, a field expedition was conducted in July 1997. A marine survey team was transported to the island aboard the USNS NIAGARA FALLS. Included in the marine survey team were S. Dollar (Marine Research Consultants), J. Goody (Belt Collins Hawaii), J. Naughton (U.S.N.M.F.S.), M. Molina (U.S.F.W.S.), and M. Trianni (CNMI). In addition, U.S. Navy EOD Mobile Unit 5 accompanied the investigative team during all field operations.

The NIAGARA FALLS departed Guam on July 7, 1997, reaching FDM on July 8. Underwater field investigations were conducted from July 8-10. On July 10, the NIAGARA FALLS proceeded to the island of Sarigan to air-lift materials as part of endangered species mitigation. The ship returned to Guam on July 11, 1997, and the mission was deemed completed.

The weather in which field work was conducted was unusually fortuitous in that winds were generally calm, and there was virtually no long-period swell. As a result, the area covered during the field investigation included virtually the entire circumference of the island. During the initial attempted survey in November 1996, weather conditions were substantially different; near gale-force tradewinds would have prevented investigations of the entire windward side of the island, and likely much of the leeward side.

2.0 OBJECTIVES

The primary objective of the marine investigations was to characterize the nearshore marine environment of FDM in order to observe for the presence of environmental damage attributable to past military training exercises, and to evaluate the potential for future damage should the training continue. Specific objectives were:

1) Evaluate the "undisturbed" condition of the marine resources in the nearshore habitats, and determine the major natural environmental factors that control community structure.

2) Determine the extent of environmental change caused by man-induced actions.

3) Evaluate the significance of the man-induced changes.

4) Determine what mitigative action, if any, is appropriate and feasible to reduce man induced changes in future actions.

3.0 SURVEY METHODS

Field surveys were conducted with the use of two boats supplied by the EOD team: a 12-foot inflatable hull, and a 19-foot aluminum "Monark" dive boat. Both boats were winched over the side of the NIAGARA FALLS each morning followed by divers climbing into the boats from rope ladders. The reverse process was conducted each evening following field work. During field operations, the civilian investigative team worked from the inflatable boat, while the EOD team worked from the Monark. During all diving operations, investigators were accompanied by EOD divers who evaluated the condition of unexploded ordnance that was observed underwater.

Because of the limited time available, and the large area to be covered, the survey was conducted as a "rapid ecological assessment." Two techniques were employed for the surveys designed to maximize results in the limited time available. The first method consisted of towing investigators along the side of the inflatable boat in water depths shallow enough to clearly observe the bottom. Such tows allowed for relatively rapid coverage of the entire circumference of the island, and were valuable in providing information of overall habitat types and community assemblages, and relative differences between habitats and communities. Because the entire island was covered in this manner, there is none of the uncertainty that would have resulted if only selected areas were investigated. This method can be considered similar to the "Manta tow" methodology that is often used in rapid ecological assessments. Tows 1-5 were conducted along the windward side of the island in a north to south direction, while tows 6-9 were conducted on the leeward side of the island, also in a north to south direction. The limits of each tow, designated by "T-" is shown in Figure 1.

The second method of investigation consisted of SCUBA dives at several areas that investigators agreed were the regions of primary concern (from information obtained during the tow surveys). The dive sites were selected based on the greatest relative abundance of biotic assemblages and greatest vertical relief (biotic

composition is generally a function of vertical relief). Such criteria for the selection of sites was judged to be the most important as the areas with the greatest biotic composition would likely have the highest potential for impacts from training activities. Because of the relatively large area of underwater terrain that required coverage in a relatively short period of time, intensive quantitative surveying techniques employing transects, quadrats, etc. were not employed. Rather, abundance and other characteristics of marine communities were evaluated by investigators during point-to-point underwater swims at each dive site. Investigations were limited to a maximum depth range of 20 meters (m). The location of each dive is marked as "S-" in Figure 1.

Surveys were conducted in this manner of the entire windward (eastern) side of the island on July 8, 1997 and the leeward (western) side on July 9-10, 1997.

4.0 OBSERVATIONS

4.1 Physical Structure

The island of FDM is formed from uplifted lithified limestone substrata with the margins consisting of steep vertical walls with numerous wave-cut caves and notches, as well as collapsed sinkholes. Owing to the easily dissolvable nature of the limestone, there is substantial erosion resulting in many regions of mass wasting where large sections of deteriorated rock have slid into the ocean. Underwater observations revealed several areas, primarily on the windward (eastern) side of the island, where large blocks of rock have broken off of the shoreline and presently rest in water depths extending to approximately 20 m (Figure 2).

The emergent shoreline consists either of smooth, nearly vertical surfaces of wave-polished limestone, or large boulders and rock outcrops that have calved off of the island margin. Two areas, one on the northern part of the windward (eastern) shoreline, and one in the central area of the leeward (western) shoreline contained small beaches composed of very coarse carbonate sand and small rubble/cobble fragments. Both of the beach areas terminate inland in cliffs, allowing little or no access to the upper vegetated surface of the island. It also appeared that there was no back-beach area at either location that was not exposed to overtopping by waves.

Below the waterline, the topographic structure around the island was generally similar, with several exceptions. The submerged shoreline just below water level consists of a nearly vertical wall which was the extension of the emergent cliffed area. The underwater cliff generally extends to a depth of approximately 10-12 m. In several areas, the submerged shoreline consists of large caves that extend into the base of the island.

The base of submerged shoreline cliff is delineated by a sharp decrease in slope. Bottom topography flattens to a gentler slope (~5-15°) in a zone termed the "reef terrace" (note that the term "reef" is used in the generic sense of a shallow area, and not necessarily a region of coral accretion). The terrace platform area extends in depth from approximately 10-25 m, with a width of 30-50 m. The reef terrace appears to be composed primarily of a fossilized limestone shelf.

The seaward edge of the reef terrace (~20 m depth) generally grades into a sandy slope zone that appears to extend to abyssal depths. The depth limits of the present survey did not extend beyond the sandy slope zone.

In several areas, particularly on the northern quadrant of the leeward (western) side of the island, the reef terrace zone terminates in a vertical wall, rather than a sloping, flat platform. In the areas where the terrace edge consists of a wall, the bottom edge of the wall terminates in a sharp boundary with the edge of the sandy slope zone. The vertical walls of the reef terrace were typically undercut by caves and ledges. Throughout the reef terrace and upper portions of the sandy slope, numerous unexploded ordnance (primarily Mark 80 series bombs) were observed. While unexploded bombs were observed throughtout the investigations around the entire island, the concentrations appeared to be densest at the southern end of the island and off the central region of the leeward side.

Photographs of FDM from various times revealed substantial sediment plumes carried off both the north and south ends of the island. These plumes appear to be the result of wave-induced suspension of particulate calcium carbonate originating from erosional surfaces on the sea. Subsequent entrainment of sediment in currents which flow around the ends of the island produce the plumes. During the field investigations of July 8-10, 1997 extensive plumes were not evident, and water clarity was high with estimated underwater visibility at 25-30 m. The only areas with noticeably turbid water were in the vicinity of the two beaches described above.

Weather conditions during the November 1996 field visit consisted of strong tradewinds that resulted in fully developed seas. These conditions are common throughout the year. In addition, FDM is subjected to numerous tropical storms and typhoons. Observations of the magnitude of wind-generated seas, and resulting large surf breaking on the shorelines of the windward side of the island provided an estimate of the physical rigors of the windward nearshore habitats during strong tradewinds. In addition, a summary of storm tracks shows that in the 49 years between 1945 and 1993, 63 tropical storms (winds between 34 and 64 knots) and 21 typhoons (winds greater than 64 knots) have passed within 75 nautical miles of FDM. Surf conditions during these tropical storms and typhoons is even more violent than during the observed tradewind condition.

4.2 Benthic Community Structure

Windward Communities

Tows 1-3 along the northeastern quadrant of the island revealed fairly homogeneous physical structure and benthic biota. The reef terrace in the area consists of a relatively flat waveswept pavement near the cliff edge with overall coral cover of less than 1%. Further from shore, coral cover increased to 10-20% of bottom area, primarily of flat encrustations of *Porites*, and colonies of the sturdy hemispherical branching species of *Pocillopora* (Figure 3). Interspersed on the pavement were large boulders that appeared to have originated from the cliff face. Coral cover on the tops and upper edges of the boulders is greater than on the reef surface consisting of 25-30% cover. Predominant genera of corals on the boulders was *Pocillopora, Porites, Montipora* and *Millepora*. In addition to corals, the predominant benthos was the green calcareous alga *Halimeda spp.* which covers substantial areas (50-60%) of the boulder and reef platform surfaces. The alga was particularly abundant near the juncture of the reef terrace and the sand slope zone. Other macroinvertebrates on the reef platform were holothurians (sea cucumbers) of the genera *Bohadshia, Stichopus* and *Thlenota*. Conspicuous by their absence were sea urchins, including both types which occur on the reef surface, and urchins which occupy crevices bored into the reef surface. In one area of the northeast quadrant, a talus slope consisting of fist-sized fragments covered approximately 400 m^2 of the reef terrace.

On the sandy slope zone, several isolated large (1-2 m in diameter) conical heads of *Porites* were observed. Otherwise, corals were uncommon rare on the sand flats, comprising less than 5% of cover (Figure 4). Numerous unexploded bombs were observed near the juncture of the reef terrace and on the sand slope (Figure 5).

Investigation of the small beach area on the windward shoreline revealed that the inshore area consisted of large boulders interspersed with a cobble-covered bottom. Water clarity off the beach was severely limited owing to localized turbid plumes generated by wave suspension of calcium carbonate particulates from eroded cliff material. No corals were observed on the boulder surfaces near the beach; however, the boulders were covered with dense growths of macroalgae of the genera *Padina, Liagora* and *Asparagopsis*. Near the shore, algal cover on boulders was estimated at 70-80%. The emergent portion of the beach consisted of rubble/cobbles with little sand and no vegetation.

Bottom topography changed somewhat in the region of the isthmus between the two main sections of the island (near S-3 in Figure 1). In this area the reef terrace takes on the form of a ridge and spur system, with sand channels lying between mound-shaped lobes of the reef terrace that run perpendicular to the axis of the

island (Figure 6). Corals, consisting primarily of the genera *Porites* and *Pocillopora* occur on the tops of the ridges with coverage of 15-20%; the lower portions of the ridges were essentially devoid of coral. The most striking difference between this region and the more northerly sections of the windward reef was the abundance of macroalgae. Alga of the genera *Padina, Halimeda, Lyngbya, Liagora, Dictyota, Neomeris* and *Caulerpa* covered nearly the entire upper surfaces of the ridges. Masses of broken algal thalli (predominantly *Liagora*) were accumulated in the sand channels.

Topographical composition of the nearshore zone changed considerably along the southern quarter of the windward coastline. Rather than the relatively flat terrace grading into the sandy slope zone, the nearshore zone at the southern end of the island consists of accumulations of massive blocks of rock strewn on the bottom. Coral cover on these large blocks is similar in form and abundance (10-20%) as on the terrace, consisting of flat encrustations of *Porites* and hemispherical colonies of *Pocillopora*. At the extreme southern end of the island, an assemblage of 80-100 small gray reef sharks was observed. Re-survey of the area the following day revealed that the sharks were not present suggesting that the site is not a permanent point of aggregation.

A shallow shoal off the southern end of the island rises to within approximately 2 m of the surface. Drifting over the area with the current revealed that the upper surface of the shoal consisted of a relatively flat limestone surface with little habitat complexity. The predominant biota on the shoal was flat encrustations of *Porites*, with scattered colonies of *Pocillopora* and *Millepora*.

An apparently recent indentation in the top edge of the shoal appeared to be the result of an explosive impact. The area of impact was at a water depth of 2-3 m, and was roughly oval in shape (approximately 2 m x 1 m) in dimension (Figure 7). The indentation was noted by smooth rock surface that was noticeably lighter in color than the surrounding cliff. This crater was the only such evidence of explosive damage observed throughout the survey.

Leeward Communities

The overall topographical structure of the reef habitats of the leeward region was similar to that of the windward area, with near-vertical cliffed shorelines extending to depths of up to 10 m, and a limestone reef terrace that grades into a sandy slope zone at a depth of approximately 20 m. The series of tows and dives along the leeward coastal area revealed that, as is usually the case, the reef communities on the leeward side of FDM contained higher densities and diversity of biota than the windward coast.

A major difference between the sides of the island was the substantially higher coral cover on the reef terrace on the leeward compared to the windward reefs. The reef platform and boulders on the leeward consistently contained greater coral cover than windward areas. On the reef terrace, coral cover consisted primarily of hemispherical heads of *Pocillopora*, and some flat encrustations of *Porites* and *Montipora*. Cover of these corals was particularly high (50-70%) on the tops of large boulders and elevated sections of the reef platform (Figure 8). Boulders were also colonized by abundant fleshy algae, predominantly of the genera *Padina* and *Neomeris*. Motile invertebrates that were abundant throughout the leeward reef were the same holothurians (sea cucumbers) that were described for the windward reef. The only sea urchins that were observed were several *Echinometra* bored into the limestone surface. Approximately 10 giant clams (*Tridachna*) were observed throughout the leeward area. These clams were all in the size range of 18-25 cm.

Several areas along the leeward coastline were structurally unique. The most striking area, both from a physical structure and biotic assemblage, was at dive site S-4. In this area, the reef platform formed a nearly vertical wall from a depth of approximately 15 m to 22 m (Figure 9). The wall was undercut by numerous ledges and caves. The undercut surfaces of the wall were colonized by a variety of invertebrates including the ahermatypic corals *Stylaster* and *Antipathes*, along with numerous *hydroids*, and *sponges*. The exposed face of the wall was colonized by the green calcareous alga *Halimeda*, as well as encrusting calcareous red algae. Spiny lobsters (*Panulirus penicillatus*) were observed in low numbers, mostly within holes and crevices on the vertical walls. Also present on the wall were small colonies of stony corals of the genus *Acropora*, which were largely absent from the typical reef terrace habitat that surrounded the island.

Dive sites 5 and 6 were located in the vicinity of the cobble beach. As with the beach on the windward shoreline, the leeward beach backed a cliffed area with no vegetation and provided little access to the upper reaches of the island. Offshore of the beach, bottom topography consisted primarily of algae-covered boulders with little (<1%) coral cover. Primary genera of algae included *Padina, Neomeris, Jania,* and *Dictyota*. At the seaward edge of the reef platform, coral cover increased substantially in the form of a massive hemispherical colonies, primarily consisting of large *Porites* colonies that covered 40-60% of the bottom.

This area contained the largest concentration of unexploded ordnance of any underwater region observed at FDM, mostly Mark 80 series bombs. The large majority of bombs were intact, with very few observations of metal fragments that would have resulted from exploded ordnance. There was little or no indication that the unexploded bombs caused any damage to the habitat, and many of the bombs were colonized by living coral colonies and algae (Figures 10-13).

The southern half of the leeward side of the island (T-9) had substantially less benthic biota than the central and northern sectors. Much of the reef terrace in the southern quadrant consisted of barren bottom that appeared to be heavily scoured with coral cover less than 1% (Figure 14). In one area, abrasions on the reef surface suggested anchor damage.

4.3 Fishery Resources

The greatest abundance and diversity of reef fishes at FDM was associated with areas of complex and rugged substratum, particularly underwater escarpments, large boulders and associated caves and undercuts. This type of habitat was found mainly on the leeward (western) side of the island in the area designated as T-8 in Figure 1. The windward (eastern) side of the island supported fewer fish. Counts of species and abundance estimates during SCUBA dives on the windward side revealed counts of 10 (S-1) and 21 (S-3) species, while dives on the leeward side revealed counts of 29 (S-4), 18 (S-6) and 34 (S-7) species.

One interesting observation was the dominance of the surgeonfish *Acanthurus olivaceus* on the windward side, while the leeward side was dominated by *Acanthurus lineatus*. An unusual concentration of juvenile gray reef sharks (*Carcharhinus amblyrhunchos*) was observed at the extreme southern tip of FDM. Between 80 and 100 individuals were observed milling on the reef platform at a depth of approximately 15 m. Another unusual observation was an individual knifejaw (*Oplegnathus punctatus*) in a cave on the leeward side of the island. This fish is extremely rare in the Mariana Islands.

Several families of commercially desirable reef fish were either absent of observed in low numbers at FDM. These included the Emperors (Lethrinidae) and the groupers (Serranidae). In comparison, other much less commercially desirable fish families were quite abundant, such as the Surgeonfishes (Acanthuridae) and Rudderfishes (Kyphosidae). Fishing gear (lines, hooks and weights) observed tangled on rocks on the reef terrace (dive site S-7) indicate some nearshore fishing activities at FDM. However, it was not clear how long the gear had been in place.

The banks and reefs surrounding FDM that comprise the depth range of 60 to 100 meters are considered the richest shallow water bottom fishing grounds in the Northern Marianas Islands. A major locally based fishery targeting the shallow water Emperor(Family Lethrinidae) complex is presently in operation. Two commercial vessels from 14-17 m make regular monthly trips to the rich banks around FDM. Typically one to two trips per month are made, landing upwards of 500 kg of "Mafute", as these fish are known locally (M. Triani, CNMI Fisheries, personal communication).

4.4 Threatened and Endangered Species

During all surveys, particular attention was given to observing any threatened or endangered species which may occur in waters surrounding FDM. No marine mammals were observed or heard vocalizing underwater.

Two juvenile green sea turtles (*Chelonia mydas*) were observed, both approximately 45 cm in carapace length. The turtles were observed swimming near stations T-3 and S-7. No turtles or marine mammals were observed during a one hour low-level aerial reconnaissance helicopter flights around FDM and shoal areas to the north.

5.0 DISCUSSION

The primary objective of the underwater investigation of FDM was to evaluate: 1) the natural environmental setting of the nearshore habitats, including characterization of the natural factors that control biotic community structure, 2) changes to community structure resulting from man-induced activities, 3) the significance of the man-induced changes, and 4) mitigation that would be appropriate to reduce or eliminate the man-induced changes.

Reef building corals are considered "keystone" species in that they form a portion of the physical structure of the habitat, as well as provide a source of food and shelter for other benthic and motile community members. As a result, coral community structure can serve as a surrogate measure of habitat suitability. As is often the case in areas exposed to open seas, the major determinate of reef community composition at FDM is exposure to sea and swell, and the degree of substratum complexity. With respect to natural controlling environmental factors at FDM, our observations reveal that the combination of steep vertical profiles of the submarine shoreline, and the massive physical forces from breaking waves appear to be the major controls of coral community structure, at least to the depth of wave base. Both tradewinds and typhoons appear to produce destructive wave forces on nearly continual basis throughout the annual and interannual cycles. Deeper areas, below wave base, are composed primarily of sand plains, which are not ideal habitats for extensive coral communities. Because wave stress is substantially greater on the windward side of the island, coral community structure on the leeward side is substantially richer than on the windward side. Correspondingly, reef fish community structure is also richer on the leeward side compared to the windward reef.

Another physical factor that may exert some effect on biotic composition is the substantial erosion and mass wasting of the limestone cliffs that form the shorelines of FDM. Sediment plumes from resuspension of fine particulate material likely have a negative effect on community structure, especially on the protected leeward

side of the island. While much of the erosion appears to be a natural process, it is likely that impact from ordnance on the margins of the island has also caused or amplified some of the fracturing and erosion. However, it does not appear possible to evaluate the fraction of erosion that is a result of explosives compared to natural processes.

Survey results show that FDM does not appear to be a favored habitat for protected or endangered species. Low level reconnaissance flights resulted in no sightings of endangered or protected species. Only two small green sea turtles were observed throughout the study. Both of the small sand beaches on the island are subjected to wave over-topping and soil/rock slumping from above, and could not support turtle nesting.

With respect to the effects of man-induced activities, the most important consideration is the effect of prior miliary target training exercises. Extensive underwater surveys revealed numerous intact unexploded bombs on the reef within 200 m of the island. The majority of ordnance items were MK-80 series bombs. Most were damaged to varying degrees, covered in marine growth or partially buried. Of the bombs that were visible, almost all were unfused practice bombs, however, many had a ballistic nosecap in place so the presence of a fuse could not be ruled out. Ordnance was concentrated around the middle section of the island, and was least abundant at the extreme north and south ends of the island.

With the exception of one crater on the underwater shoal near the southern tip of the island, there was no clearly discernible damage to the reef surface and associated biota from explosive ordnance. Numerous bombs were noted to serve as substratum for successful coral settlement and growth. Few fragments of exploded ordnance were noted on the reef surface. In the opinion of the EOD personnel, armed bombs striking the ocean and functioning normally would detonate on impact with the sea surface, rather than the sea floor. Explosive detonation at the surface would likely result in complete destruction of the ordnance, and any resulting fragments would likely be transported from the area by currents and wave surge. Such transport would explain the lack of fragments on the reef. Should bombs have detonated on the reef surface it would be expected that the resulting craters would be large and very noticeable by the survey team. These observations indicate that the previous military training at FDM does not appear to have had a significant, or even detectable, impact on marine communities.

Another activity of man that may be affecting marine resources at FDM is fishing. Observations of fouled fishing gear on the reef surface, and a distinct paucity of several commercially desirable reef fish species indicate fishing pressure is being exerted on the nearshore fishery resources surrounding FDM. Because the overall

fish communities contained numerous species and diversity, it is not likely that the reduced abundance of food fish is a result of military exercises.

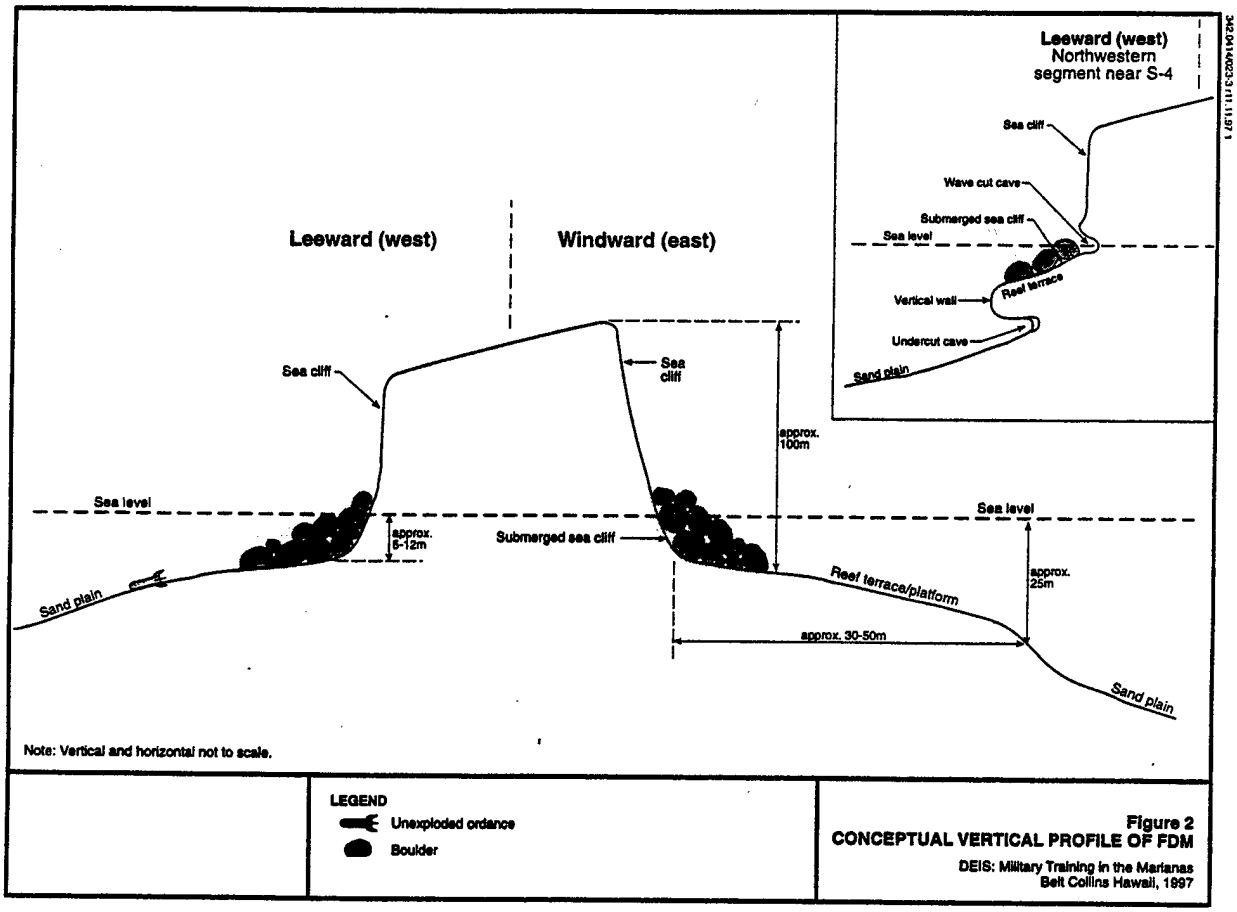


Figure 2
CONCEPTUAL VERTICAL PROFILE OF FDM
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

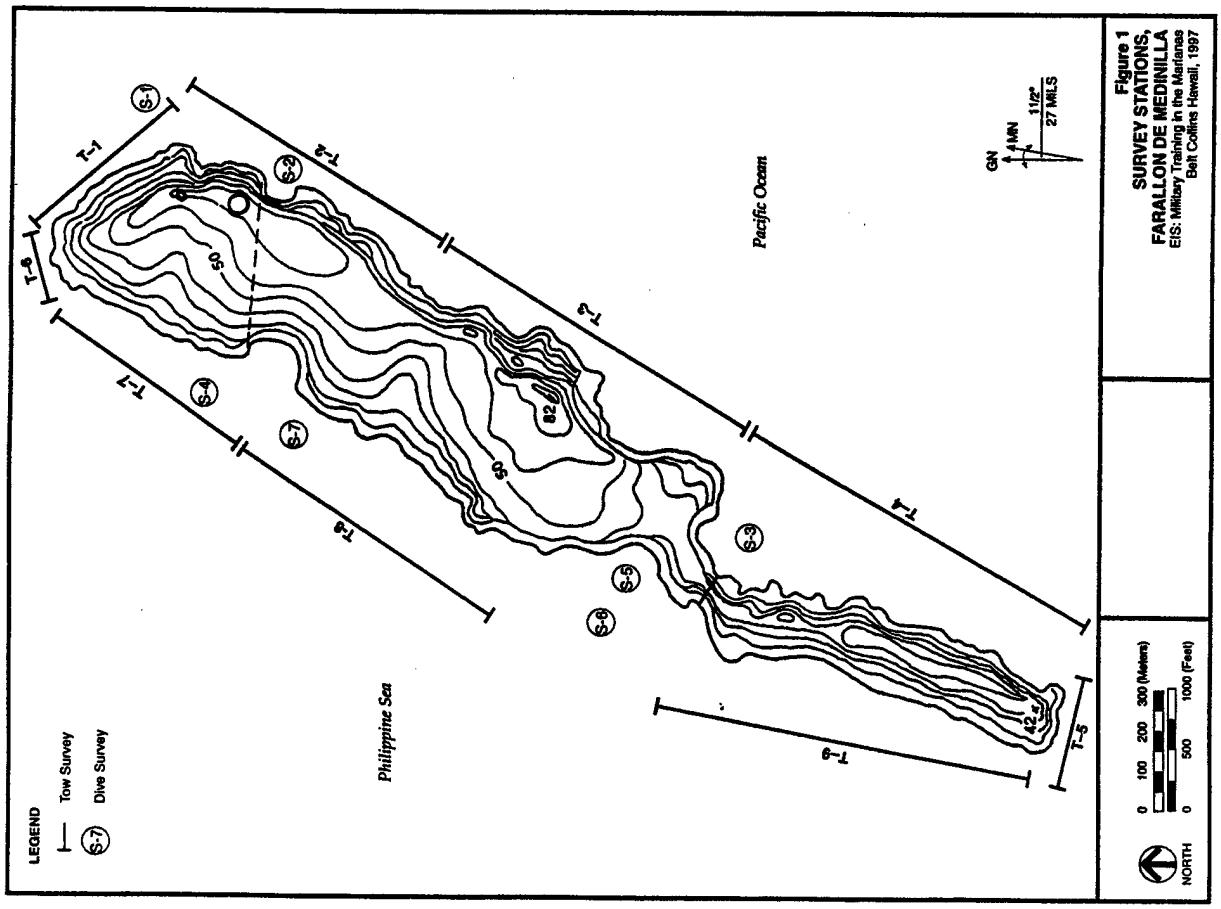


Figure 1
SURVEY STATIONS, FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

SLIDE FIGURE CAPTIONS - FDM Marine Assessment

Figure 3. View of windward reef terrace at Dive site S-1.

Figure 4. Juncture of reef terrace and sand flat at Dive site S-1.

Figure 5. Unexploded MK-80 bomb at lower edge of reef terrace at Dive site S-1.

Figure 6. Sand channel and reef spur at Dive site S-3.

Figure 7. Impact crater on underwater seacliff at southern end of FDM (T-5).

Figure 8. Abundant colonies of *Pocillopora* on upper reef terrace at dive site S-4.

Figure 9. Vertical wall at outer edge of reef terrace at Dive site S-4.

Figure 10. Unexploded bomb at lower edge of reef terrace at Dive site S-7.

Figure 11. Unexploded bomb with growing coral colonies at Dive site S-7.

Figure 12. Unexploded bomb with growing coral colonies at Dive site S-6.

Figure 13. Unexploded "snake-eyes" bomb at Dive site S-6.

Figure 14. Scoured bottom of inner reef terrace in southwestern quadrat (T-9).

Figure 3. View of windward reef terrace at Dive site S-1.



Figure 4. Juncture of reef terrace and sand flat at Dive site S-1.



Figure 5. Unexploded MK-80 bomb at lower edge of reef terrace at Dive site S-1.



Figure 6. Sand channel and reef spur at Dive site S-3.



Figure 7. Impact crater on underwater seacliff at southern end of FDM (T-5).

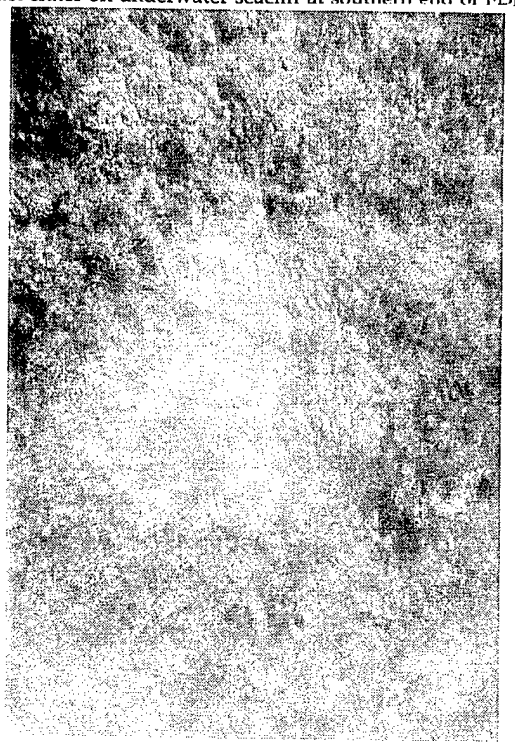


Figure 8. Abundant colonies of *Pocillopora* on upper reef terrace at dive site S-4.

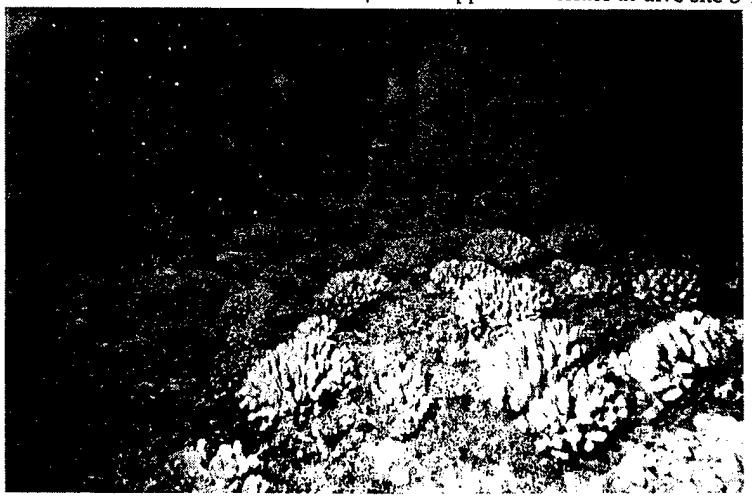


Figure 9. Vertical wall at outer edge of reef terrace at Dive site S-4.



Figure 10. Unexploded bomb at lower edge of reef terrace at Dive site S-7.



Figure 11. Unexploded bomb with growing coral colonies at Dive site S-7.



Figure 12. Unexploded bomb with growing coral colonies at Dive site S-6.



Figure 13. Unexploded "snake-eyes" bomb at Dive site S-6.

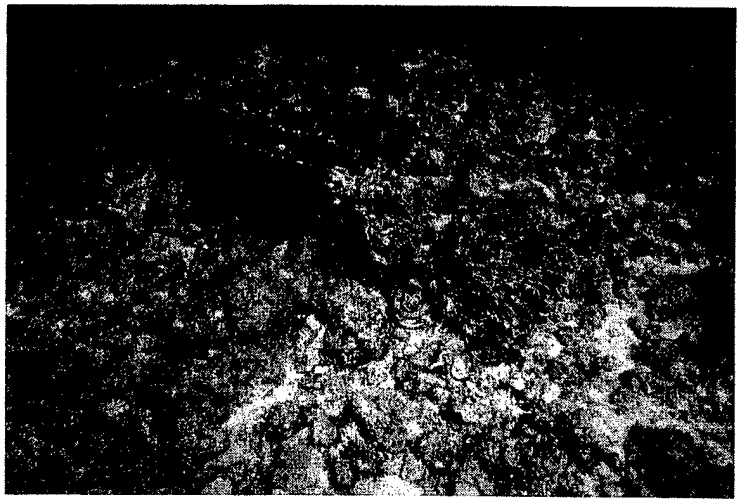
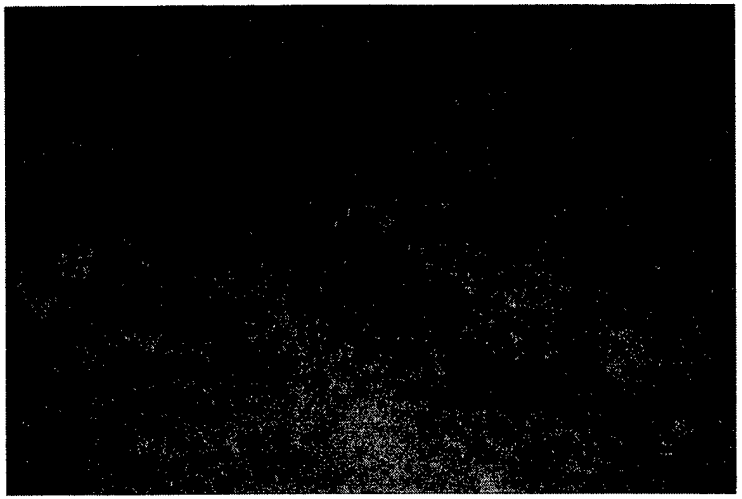


Figure 14. Scoured bottom of inner reef terrace in southwestern quadrat (T-9).



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PROFESSIONAL SERVICE

Editorial Board, Coral Reefs 1992-1996.

Appendix D-15
Biological Opinion of the U.S. Fish and Wildlife Service for Ship to Shore Gunnery Practice at Farallon de Medinilla, CNMI (September 11, 1997)

BIOLOGICAL OPINION
of the
U.S. FISH AND WILDLIFE SERVICE
for
SHIP TO SHORE GUNNERY PRACTICE
AT FARALLON DE MEDINILLA,
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

September 11, 1997

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United States Department of the Interior

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In Reply Refer To: 1-2-97-F-08

Melvin N. Kaku
Director, Environmental Planning Division
Department of the Navy
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

SEP 11 1997

RE: Biological Opinion (Log Number 1-2-97-F-08), Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI).

Dear Mr. Kaku:

This represents the biological opinion of the U.S. Fish and Wildlife Service (Service) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544; Stat. 884), as amended, (Act) regarding potential impacts to the federally endangered Micronesian megapode, *Megapodius laperouse laperouse*, from proposed ship to shore gunnery practice. The Department of the Navy (Navy), as range managers, proposes to use FDM for ship to shore gunnery practice during September 1997. Your request for formal consultation was received on August 27, 1997.

This biological opinion is based upon 1) information presented in your August 26, 1997, letter requesting formal consultation, 2) information provided in the Service's *Draft Recovery Plan for the Micronesian Megapode* (USFWS in prep. 1997), 3) information provided in the *Draft Recovery Plan for U.S. Pacific Populations of the Green Turtle* and in the *Draft Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, 4) information provided in the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*, 5) literature published on megapodes, green sea turtles, and hawksbill sea turtles, 6) a site visit to FDM on November, 4, 1996, 7) a March 24, 1997, memorandum from Tim Sutterfield (Navy) assessing impacts to the fauna of FDM as a result of the training activities covered in the Service's January 29, 1997, biological opinion, and 8) an August 21, 1997, memorandum from Melvin Kaku assessing impacts to the fauna of FDM as a result of the training activities covered in the Service's May 16, 1997, biological opinion.

The log number for this consultation is 1-2-97-F-08. A complete administrative record of this consultation is on file in the Service's Pacific Islands Office in Honolulu, Hawaii.

Consultation History

Farallon de Medinilla has been used as a bombardment range by the Navy and Air Force since at least 1971. An Environmental Assessment was completed for the use of FDM as a bombardment range by the Navy in 1975. The Navy initiated formal consultation with the Service for naval and aerial bombardment of FDM on December 6, 1996, and April 4, 1997, respectively. The Service completed biological opinions for these actions on January 29, 1997 and May 16, 1997, respectively. In the January 29 biological opinion the Service authorized incidental take of ten adult or juvenile megapodes, four active megapode nests, one green sea turtle, one hawksbill sea turtle, and four active turtle nests. In the May 16 biological opinion, the Service determined that take of megapodes was indeterminate and anticipated the loss of all adult and juvenile megapodes and their nests. The sea turtle take remained the same. In both biological opinions the Service determined that the level of take was not likely to jeopardize the continued existence of the Micronesian megapode, the green sea turtle, or the hawksbill sea turtle.

During July 8-10, 1997, the Navy sponsored an assessment of FDM's marine resources in preparation for the development of an Environmental Impact Statement covering all training in the Mariana Islands archipelago. During this assessment, Service biologist Michael Molina determined that the two beaches on FDM do not represent suitable nesting habitat for sea turtles, due to the extremely shallow nature of the beaches, the fact that the beaches are entirely or almost entirely overwashed during periods of high tide or swell, and the rocky nature of much of their substrate. Therefore, the Service finds that the ship to shore gunnery practice is not likely to adversely affect green and hawksbill sea turtles on land. The effects of the proposed action on these species in the waters surrounding FDM should be addressed by the National Marine Fisheries Service (NMFS).

BIOLOGICAL OPINION

Description of the Proposed Action

The Navy proposes to engage in gunnery practice during September 1997 on FDM, CNMI. Ammunition used during the practice will consist of 200 high explosive ship five inch live shells and ten illumination rounds. It is possible that naval gunfire will occur at night. The Navy will conduct both pre- and post-exercise helicopter overflights to monitor training impacts and assess take of threatened and endangered species for this exercise. According to your August 26, 1997, letter, the proposed action is the same or similar to the ship to shore gunnery practice covered in the Service's May 16, 1997, biological opinion.

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Biology and Population Status of the Species

The Micronesian megapode was listed as endangered without critical habitat on June 2, 1970 (35 FR 8491-8498). This species formerly occurred on all of the islands in the Marianas archipelago (Figure 1) but declined to extinction on Guam, Rota, and Saipan in the 19th and early 20th centuries. It is currently found on 12 islands. Small remnant populations persist on Aguiguan, Tinian, and Farallon de Medinilla, along with a very small reintroduced population on Saipan, while relatively large numbers remain on the small, uninhabited northern islands of Anatahan, Sarigan, Guguan, Pagan, Maug, Alamagan, Ascuncion, and possibly Agrihan. Recent estimates yield a total of about 1,440 to 1,975 birds for the entire archipelago.

The Micronesian megapode is a small, pigeon-sized bird in the family Megapodiidae, a family comprised of seven genera found only in the Australasian region. Members of this family are known as "incubator birds" because of their reliance on external heat sources, such as solar energy, volcanic activity, or microbial decay, to incubate their eggs (Clark 1964). Micronesian megapodes apparently use both burrow nesting and mound building in egg incubation (USFWS in prep. 1997), are believed to be monogamous, and may defend a territory of approximately 1 hectare (ha) on a year-round basis (Glass and Aldan 1988). Exact nesting seasons for this subspecies are not known; however, nesting probably occurs year-round on some of the Mariana Islands and seasonally on others, depending upon the heat sources used for incubation (USFWS in prep. 1997). These birds are omnivorous and have been observed to feed on seeds, beetles, ants, other insects, and plant matter (Glass and Aldan 1988, Stinson 1993).

Historical extinctions of Micronesian megapodes on Guam, Rota, Tinian, and Saipan were likely due to over exploitation by humans and habitat losses associated with agricultural practices and introduced ungulates. Loss of habitat through the effects of vulcanism is also known to have caused serious declines. Loss of habitat due to development projects and predation by introduced monitor lizards, feral dogs, cats, rats, and pigs are known current threats to this subspecies. Perhaps the most serious potential threat, however, is the possible establishment of the brown tree snake (*Boiga irregularis*) on islands other than Guam in the Marianas archipelago.

There are an estimated 10-15 Micronesian megapodes on the island of Aguiguan, less than 10 birds on Tinian, 10-25 on Saipan, less than 10 on Farallon de Medinilla, 200-300 on Anatahan, 545-810 on Sarigan, 500 on Guguan, less than 30 on Alamagan, 50-100 on Pagan, less than 25 on Asuncion, 50-150 on Maug, and an unknown number on Agrihan. Recent estimates yield a total of about 1,440 to 1,975 birds (USFWS in prep. 1997).

Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. The baseline includes State, local, and private actions that affect a

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species at the time the consultation begins. Unrelated Federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

A total of four megapodes were discovered on FDM during a site visit on November 4, 1996 (Lusk and Kessler 1996). Two megapodes were found on the island during a Navy site visit on December 17, 1996 (Figure 2). The size of the island, 0.7 km^2, leads the Service to estimate that there are likely not more than ten megapodes on the island. This number represents less than 1.0% of the total estimated population within the Marianas archipelago. No nesting has been recorded on the island, but the possibility for nesting does exist.

The Navy has conducted bombing exercises on FDM regularly over the past 20 years and intends to continue to do so in the future. Two such exercises occurred in January and May 1997. After each exercise, Tim Sutterfield, Fish and Wildlife Biologist for the Navy, conducted helicopter surveys in accordance with the Terms and Conditions of the January 29 and May 16 biological opinions. Sutterfield's surveys revealed no direct evidence of death or injury to megapodes. However, observations of megapodes on FDM indicate that they are likely to remain underneath brushy cover and, therefore, deaths or injury from either direct strikes or indirectly from shrapnel would be difficult to detect from aerial surveys. On-the-ground surveys are not permitted due to the high incidence of unexploded ordnance distributed over the island.

Effects of the Action on Listed Species

The primary concerns of the Service with regard to the effects of ship to shore gunnery practice on the Micronesian megapode are (1) direct death of megapodes, (2) destruction or abandonment of active megapode nests, and (3) destruction of required foraging and nesting habitat. The potential for all these results were apparent when on August 2, 1997, the Navy conducted post-bombardment surveys of FDM in accordance with the terms and conditions set forth in the Service's May 16, 1997, biological opinion. As detailed in the Navy's August 21, 1997, memorandum, 25 to 50 new bomb craters were observed and a large section of the central northern portion of the island, an area believed to represent megapode habitat, was burned to bare earth. Although the action covered under this biological opinion is not as likely to result in the degree of habitat impact as the actions covered under the May 16 biological opinion, the Service believes the August 2 surveys to be representative of the type of damage that can occur during naval bombardment.

The impact areas for gunnery practice cover the entire area of FDM. Therefore, the Service anticipates the possible direct death of all megapodes and destruction of all nests occurring on the island at the time of Naval training.

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Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service has not identified any cumulative effects in the project area that may impact Micronesian megapodes.

The Service anticipates that a programmatic section 7 consultation will be initiated by the Navy in the near future associated with its analysis of all military training in the Mariana islands archipelago. This programmatic consultation will alleviate the burden of addressing individual training exercises that are similar in nature.

Conclusion

After reviewing the current status of the Micronesian megapode, the environmental baseline of the species in the action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that ship to shore gunnery practice by the Navy in September 1997 is not likely to jeopardize the continued existence of the Micronesian megapode. No critical habitat has been designated for this subspecies; therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the Act, as amended, prohibit the taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of a listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are non-discretionary and must be implemented by the Navy in order for the exemption in section 7(o)(2) to apply.

The Navy has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Navy fails to adhere to the terms and conditions of the incidental take statement the protective coverage of section 7(o)(2) may lapse.

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Amount or Extent of Take

The Service believes that the last bombing exercise, which occurred from July 21 to August 1, 1997, likely resulted in the taking of all the megapodes that occurred on FDM at the time of the bombing. Such taking likely took the form of direct death or injury, harm and harassment. We, therefore, believe that the level of incidental take authorized in biological opinion #1-2-97-F-05 has been met. We anticipate that any megapode still present on FDM, or that may colonize the island prior to the onset of the September ship to shore gunnery practice, will also be incidentally taken during the bombing.

Effect of the Take

The Service has determined that this level of impact is not likely to result in jeopardy to the Micronesian megapode because, even if all birds are extirpated from FDM, such losses do not represent a threat to the stability of the overall population in the Marianas archipelago.

Reasonable and Prudent Measure

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of this measure, the Service believes that take of Micronesian megapodes will be minimized.

The Navy will minimize take of adult and juvenile megapodes and minimize disruption to breeding activities (including destruction of any active nests) during project implementation.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, it is mandatory that the Navy comply with the following terms and conditions, which implement the reasonable and prudent measure described above:

(1) The Navy shall restrict their impact zone to the central interior portion and/or southern tip of the island and cliff faces, to the extent possible.

(2) The Navy shall prohibit the use of cluster bombs in training on FDM.

(3) The Navy shall monitor the extent of take by conducting a helicopter overflight survey of FDM with a qualified biologist prior to bombardment and after the exercise is completed for the September training.

If, during the course of action, the amount or extent of the above-stated incidental take is exceeded, such incidental take would represent new information requiring review of the

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reasonable and prudent measure provided. The Navy must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Loss of even small numbers of megapodes and their nests slows the recovery of these species and represents an adverse effect. Further, destruction of nesting and foraging habitat for megapodes by shell impacts may not represent a permanent loss, but it does slow the recovery process of this species by requiring time for the habitat to recover suitably and therefore, represents an adverse effect. In order to minimize the effect of these losses of individuals and habitat, the Service recommends that the Navy continue to assist the CNMI Division of Fish and Wildlife (DFW) in its efforts to eradicate feral ungulates on the island of Sarigan and that the Navy consider funding additional conservation and recovery projects for the megapode in the Marianas. Examples of conservation and recovery projects that should be considered for funding include: (1) efforts to eradicate feral ungulates on uninhabited northern islands, (2) surveys to assess status, distribution, and nesting areas, (3) basic research into the life history and demography of the megapode, and (4) rat (*Rattus* spp.) eradication on FDM and/or other uninhabited northern islands.

In addition to providing habitat for and/or supporting populations of the Micronesian megapode, FDM also supports colonies of breeding seabirds, including masked boobies (*Sula dactylatra*), brown boobies (*Sula leucogaster*), red-footed boobies (*Sula sula*), great frigatebirds (*Fregata minor*), common noddies (*Anous stolidus*), black noddies (*Anous minutus*), and white terns (*Gygis alba*). FDM is particularly important for great frigatebirds as it is one of only two small breeding colonies known to exist in the Mariana Island chain (Stinson 1994) and for masked boobies because it represents the largest known nesting site for this species in the Mariana Islands (Reichel 1991). All of these birds are protected under the Migratory Bird Treaty Act of 1918 [16 U.S.C. 703-712; 40 Stat. 755], as amended. The Service recommends that the Navy concentrate impacts within the interior portion of the island to lessen harm to nesting and roosting seabirds and that the Navy establish a long-term monitoring program to evaluate the effects of aerial bombing and naval gunnery on seabird populations.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

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This concludes formal section 7 consultation on this action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning any of the information contained in this biological opinion, please contact Interagency Program Leader Margo Stahl at or Wildlife Biologist Michael Lusk (phone: 808/541-3441, fax: 808/541-3470, e-mail: Michael_Lusk@mail.fws.gov).

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: CNMI, DFW, Saipan
NMFS, Honolulu

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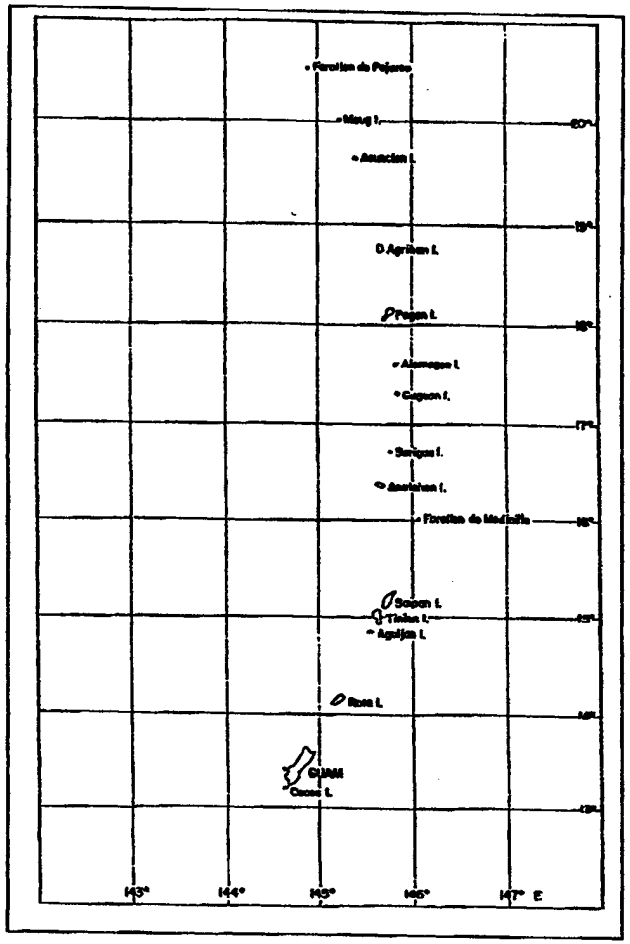


Figure 1. Mariana Islands archipelago.

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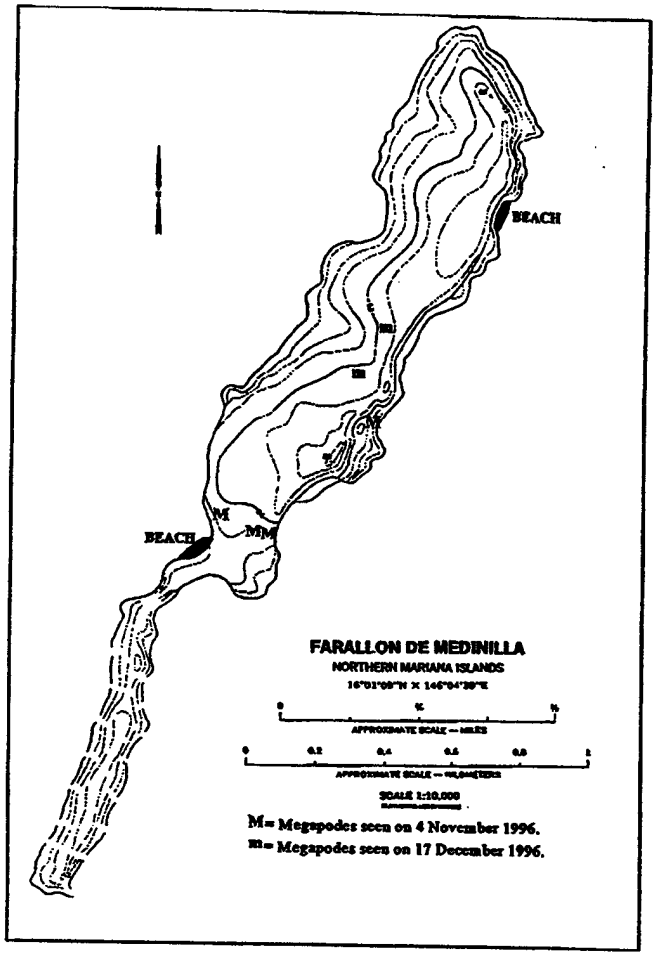


Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla (beaches are not to scale).

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Appendix D-16
Farallon de Medinilla Survey, July 8-10, 1997 (September 16, 1997)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

September 16, 1997 F/SWO23:JJN

Commander
Pacific Division Naval Facilities Engineering Command
ATTN: Mr. Fred Minato (Code 238)
Pearl Harbor, Hawaii 96860-7300

Dear Commander:

Attached is the National Marine Fisheries Service (NMFS) report from the July 8-10, 1997 survey of Farallon de Medinilla. The multi-agency underwater survey was conducted from the USS Niagara Falls, with the support of Navy EOD (MU-5 DET 5) personnel.

The attached report represents the findings of the NMFS. Separate reports should reach you shortly from the U. S. Fish and Wildlife Services and the Division of Fish and Wildlife, Commonwealth of the Northern Mariana Islands. Should you have any questions, please call me (808)973-2940 at our Pacific Area Office in Honolulu.

Sincerely,

John J. Naughton
Pacific Islands
Environmental Coordinator

cc: F/SWO-2, Long Beach, CA
FWS, Honolulu
DFW, Saipan
COMNAVMAR (Roy Tsutsui)

FARALLON DE MEDINILLA SURVEY
July 8-10, 1997

John J. Naughton
National Marine Fisheries Service

A qualitative survey of the nearshore waters of Farallon de Medinilla (FDM) was conducted from July 8-10, 1997. A total of 16 stations were established and surveyed, either by surface towing (T) or by the use of scuba and free diving(S).

The following list of fishes observed was compiled by station. Because of the short amount of time at FDM and the large survey area, the survey was conducted by the rapid ecological assessment (REA) technique, recording only the conspicuous and dominate fish species (particularly those of importance for commercial or subsistence use).

Species abundance: - A = Abundant
C = Common
O = Occasional
R = Rare

Station T-1:

Trachinotus blochii(schooling)	(A)
Carangoides orthogrammus	(O)
Variola louti	(R)
Acanthurus olivaceus	(A)
Siganus spinus (schooling)	(C)

Station S-1:

Sphyraena barracuda	(R)
Variola louti	(O)
Cephalopholis urodeta	(R)
Lutjanus bohar	(O)
Lethrinus rubrioperculatus	(R)
L. harak	(R)
Acanthurus olivaceus	(A)
Sargocentron spinifirum	(O)
Siganus spinus	(C)
Melichthys niger	(C)

Station S-2:

Carcharhinus melanopterus	(R)
Acanthurus triostegus	(C)
A. guttatus	(A)
Kyphosus cinerasceus	(C)
K. vaigiensis	(O)

Station T-2:

Carcharhinus melanopterus	(R)
Lutjanus bohar	(O)
Lethrinus harak	(R)
Scarus rubroviolaceus	(O)

Station T-3:

Caranx melampygus	(O)
Aprion virescens	(R)
Variola louti	(O)
Acanthurus olivaceus	(C)

Station S-3:

Carcharhinus amblyrhynchos	(R)
Nebrius ferruginius (two in a cave)	(R)
Caranx ignobilis	(R)
C. melampygus	(O)
Aprion virescens	(O)
Aphareus furca	(C)
Lutjanus bohar	(C)
L. fulvus	(C)
Lethrinus erythracanthus	(R)
Macolor macularis	(O)
Monotaxis grandoculus	(C)
Variola louti	(O)
Cephalopholis urodeta	(R)
Naso lituratus	(C)
N. unicornis	(C)
N. tuberosus	(R)
N. brevirostris	(C)
Acanthurus dussumieri	(O)
A. olivaceus	(A)
Parupeneus multifasciatus	(C)
P. barberinus	(O)

Station T-4:

Carcharhinus amblyrhynchos (school of 80-100 juveniles)	(A)
Caranx melampygus	(C)
Elegatis bipinnulatus (schooling)	(A)
Spratelloides sp. (schooling)	(A)

Station T-5:

Acanthurus triostegus	(C)
A. nigrofuscus	(O)

Station T-6:

Caranx melampygus	(O)
Trachinotus blochii	(A)
Scomberoides lyson	(R)
Lutjanus bohar	(O)
Pterocaesio tile (schooling)	(A)
Scarus rubroviolaceus	(C)
S. altipinnis	(O)
Kyphosus cinerascens	(C)
K. vaigiensis	(O)
K. bigibbus	(O)
Naso lituratus	(C)
N. unicornis	(O)
Acanthurus lineatus	(A)
A. dussumieri	(O)

Station T-7:

Caranx melampygus	(O)
Aphareus furca	(C)
Caesio caerulaurea	(C)
Monotaxis grandoculus	(C)
Naso lituratus	(C)
N. unicornis	(O)
Acanthurus lineatus	(A)
Spratelloides sp. (schooling)	(A)

Station S-4:

Carcharhinus amblyrhynchos	(C)
Triaenodon obesus	(R)
Taeniura melanospilos	(R)
Gymnosarda unicolor (up in water column)	(R)
Caranx ignobilis (schooling in cave)	(C)
C. lugubris (schooling)	(C)
C. melampygus	(C)
Lutjanus bohar	(C)
L. gibbus	(C)
L. kasmiri	(O)
Aphareus furca	(O)
Monotaxis grandoculus	(C)
Macolor niger	(R)
Pterocaesio tile	(C)
Variola louti	(O)
Cephalopholis urodeta	(R)
Scarus rubroviolaceus	(O)
Naso lituratus	(C)
Acanthurus lineatus	(A)
Pomacanthas imperator	(R)
Pempheris oulensis	(O)
Zanclus cornutus	(O)
Myripristis murdjan	(C)
M. berndti	(C)
Sargocentron spiniferum	(O)
Pterois volitans	(R)
Mulloidichthys vanicolensis	(O)
Melichthys vidua	(O)
Oplegnathus punctatus	(R)
(in cave with C. ignobilis school)	

Station T-8:

Caranx melampygus	(O)
Aphareus furca	(C)
Pterocaesio tile (schooling)	(A)
Variola louti	(O)
Naso lituratus	(C)
N. unicornis	(C)
Acanthurus lineatus	(A)
Kyphosus bigibbus	(O)
Spratilloides sp. (schooling)	(A)

Station S-5:

Carcharhinus melanopterus	(O)
Caranx melampygus	(O)
Aprion vinescens	(R)
Lutjanus bohar	(C)
L. fulvus	(C)
Acanthurus olivaceus	(C)
A. lineatus	(A)
A. guttatus	(O)
Kuhlia mugil (schooling)	(C)
Rhinecanthus rectangulus	(O)

Station T-9:

Carcharhinus melanopheus	(R)
Trianodon obesus	(R)
Taeniura melanospilos	(R)
Scarus microrhinos	(O)
Naso unicornis	(O)

Station S-6:

Caranx melampygus	(R)
Trachinotus blochii (schooling)	(A)
Lutjanus bohar	(C)
L. kasmiri	(C)
Aphareus furca	(C)
Variola louti	(O)
Epinephelus merra	(R)
E. hexagonatus	(R)
Cephalopholis urodeta	(R)
C. argus	(O)
Caesio teres (schooling)	(A)
Monotaxis grandoculus	(C)
Scarus microrhinos	(O)
Acanthurus pyroferus	(R)
A. xanthopterus	(R)
A. olivaceus	(C)
A. triostegus	(C)
A. lineatus	(A)
A. guttatus	(C)
Naso lituratus	(C)
Siganus spinus	(O)
Parupeneus multifasciatus	(C)

Station S-6 (cont'd)

Kuhlia mugil (schooling)	(C)
Myripristis murdjan	(C)
Sargocentron spiniferum	(O)
Kyphosus cinerascens	(C)
K. bigibbus	(O)
Amphriprion sp. (with anemones)	(R)
Melichthys vidua	(O)

Station S-7:

Carcharhinus amblyrhynchos	(O)
Trianodon obesus	(R)
Taeniura melanospilos	(R)
Gymnosarda unicolor (Up in water column)	(R)
Lutjanus bohar	(C)
L. gibbus	(A)
L. monostigma	(R)
Aphareus furca	(C)
Pterocaesio tile (schooling)	(A)
Macolor niger	(O)
Plectorhinchus orientalis	(R)
Monotaxis grandoculus	(O)
Lethrinus rubrioperculatus	(R)
Variola louti	(O)
Cephalopholis urodeta	(R)
C. argus	(R)
Scarus microrhinos	(O)
S. rubroviolaceus	(O)
Calotomus carolinus	(R)
Naso lituratus	(C)
N. hexacanthus	(O)
Acanthurus olivaceus	(C)
A. lineatus	(A)
A. triostegus	(C)
A. pyroferus	(O)
Ctenochaetus striatus	(O)
Myripristis murdjan	(C)
M. berndti	(C)
Sargocentron spiniferum	(O)
Pomacanthus imperator	(R)
Siganus spinus	(O)
Zanclus cornutus	(O)
Parupeneus multifasciatus	(C)
P. bifasciatus	(R)

CONDITIONS OF MARINE ENVIRONMENT AT FDM

Qualitative observations of the environmental conditions in waters surrounding FDM were made while conducting the underwater resource inventories. Particular attention was given to observations on impacts from ordnance, both exploded and unexploded, and indications of fishing pressure.

Conditions of the nearshore marine environment surrounding FDM in general are good. The immediate nearshore zone is subject to wave assault and is generally a smooth hard pavement supporting sparse, robust and encrusting coral growth. This is particularly true along the eastern or windward side of FDM. Several areas of large boulders are evident which originated from the adjacent cliffs (Stations S-4, S-7, T-5, T-4) as well as several areas of underwater rubble fields (T-1, T-6). Whether the fallen boulders and rubble were generated by ordnance or normal erosional processes, could not be determined. The entire area is periodically swept by strong tidal currents, particularly in the vicinity of the north and south points.

Impacts From Ordnance:

Unexploded ordnance was found on the bottom of most stations, with large bombs particularly common at S-6, S-7, and S-3. However, surprisingly little direct damage (i.e. cratering, fractures) was evident underwater. Only one recent crater was observed (Station T-5). Recent scarring of the reef pavement was observed at Station T-9, but it could not be determined if this was from exploding ordnance or possible anchor damage. As mentioned above, it also could not be determined if boulders and rubble on the bottom had been the result of ordnance detonation or natural erosion. It is probable that large ordnance detonation on the cliff faces contributes significantly to erosion.

Many pieces of unexploded ordnance (primarily aerial bombs) were closely observed and photographed, both by Navy EOD personnel and biologists. Healthy coral growth was found on or immediately surrounding pieces of ordnance. No evidence of adverse environmental impacts from chemicals associated with unexploded ordnance was observed.

Impacts From Fishing Pressure:

Evidence of fishing activities in close proximity to FDM was found. At Stations S-5 and S-6, lost bottom fishing gear (lines, hooks and weights) was found tangled on the bottom. Possible anchor damage was also observed in Station T-9.

Several families of commercially desirable reef fish were either absent or observed in low numbers at FDM. These included the Emperors (Lethrinidae) and the groupers (Serranidae). In comparison, other much less commercially desirable fish families were quite abundant, such as the Surgeon Fishes (Acanthuridae) and Rudder Fishes (Kyphosidae).

The above observations indicate a degree of fishing pressure is being exerted on the nearshore fishery resources surrounding FDM. Reports by the CNMI, Division of Fish and Wildlife, that at least two bottomfish vessels regularly fish FDM supports these observations.

Threatened and Endangered Species:

Particular attention was given to locating any threatened and endangered species which may occur in waters surrounding FDM. Observations were conducted at the surface from small boats , by divers underwater, and during an approximately one-hour helicopter overflight of FDM and several nearby shallow pinnacles.

No marine mammals were observed or heard vocalizing underwater. Two juvenile green turtles (Chelonia mydas) were observed, both approximately 45 centimeters in carapace length. The turtles were observed swimming within stations T-3 and S-7.

Two reported potential turtle nesting beaches were investigated (at Stations S-2 and S-5). Both small sand beach areas are subjected to wave over-topping and soil/rock slumping from above, and could not support successful turtle nesting.

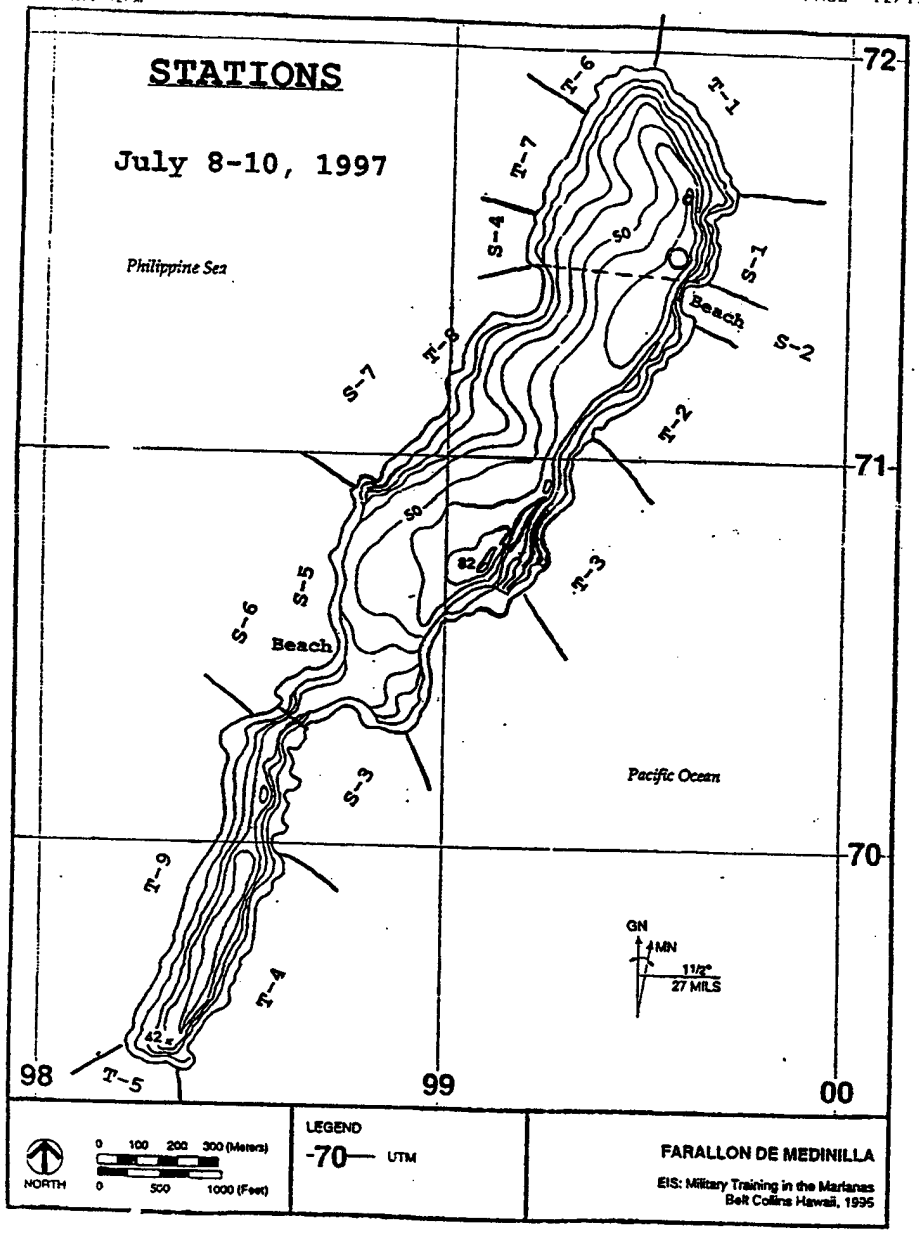
Fishery Resources and Habitat:

The greatest abundance and diversity of reef fishes at FDM was associated with areas of complex and rugged substrate, particularly underwater escarpments, large boulders and associated caves and undercuts. This habitat type was found mainly on the lee (west) side, within Stations S-4 and S-7, where the greatest diversity of reef fish was observed. Caves also provide resting habitat for green turtles, one of which was observed in S-7.

The windward (east) side of FDM in general supported fewer reef fish and invertebrates. The bottom on this side was more scoured and wave swept, thereby reducing substrate complexity, and therefore, diversity and abundance of fishery resources. One interesting occurrence was the dominance of the surgeon fish Acanthurus olivaceus on the windward side, while the leeward side was dominated by Acanthurus lineatus.

An unusual concentration of juvenile gray reef sharks (Carcharhinus amblyrhynchos) was observed at the extreme southern tip of FDM. Between 80 to 100 individuals were observed milling at the bottom of an escarpment at the south end of Station T-4. This indicates a possible important nursery area for this species of shark at FDM. Another unusual observation was an individual knifejaw (Oplegnathus punctatus) observed in a cave at Station S-4. This fish is extremely rare in the Mariana Islands.

In addition to fishes, invertebrate fishery resources were recorded at FDM. Mollusks were generally found in low numbers, with only a few giant clams (Tridacna maxima) and trochus (Trochus niloticus) observed. Spiny lobsters (Panulirus penicillatus) were also observed in low numbers, mostly within the cave complexes of Stations S-4 and S-7.


STATIONS
July 8-10, 1997
Philippine Sea
Pacific Ocean
Beach
Beach
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
S-1
S-2
S-3
S-4
S-5
S-6
S-7
50
82
42
72
71
70
98
99
00
GN
MN
11/2°
27 MILS
NORTH
0 100 200 300 (Meters)
0 500 1000 (Feet)
LEGEND
-70- UTM
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1995

Appendix D-17
Farallon de Medinilla Nearshore Reef Survey, July 8-10, 1997
(October 31, 1997)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3108
Box 50088
Honolulu, Hawaii 96850

In Reply Refer To: MEM

OCT 31 1997

Fred Minato
Environmental Planning Division
NAVFACENGCOM
U.S. Navy, Pacific Division
Pearl Harbor, Hawaii 96860-7300

Re: Nearshore Reef Survey at Farallon de Medinilla, Commonwealth of the Northern Mariana Islands.

Dear Mr. Minato:

During July 8-10, 1997, the U.S. Fish and Wildlife Service (Service) participated in a marine survey sponsored by the U.S. Navy (Navy) at Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI). Also participating in the survey were biologists from the National Marine Fisheries Service, the CNMI Division of Fish and Wildlife, and the consulting firm contracted by the Navy to produce the Draft Environmental Impact Statement for Military Training in the Mariana Islands. Enclosed with this letter is a report that summarizes the observations made by the Service during the survey. Information in the enclosed report should be considered along with the survey data and observations reported by the other members of the survey team.

The Service appreciates the opportunity to participate in the FDM survey and is especially grateful to the Navy for the excellent logistical support that was afforded the survey team. If you have any questions regarding the enclosed report, please contact Fish and Wildlife Biologist Michael Molina by telephone at (808) 541-3441 or by facsimile transmission a (808) 541-3470.

Sincerely,

for/ Brooks Harper
Field Supervisor
Ecological Services

cc: NMFS-PAO, Honolulu
COMNAVMAR, Guam
CNMI Governor's Office, Saipan
DFW, Saipan

FARALLON DE MEDINILLA NEARSHORE REEF SURVEY July 8-10, 1997

U.S. Fish and Wildlife Service
Pacific Islands Office, Honolulu, Hawaii

Introduction

During July 8-10, 1997, the U.S. Fish and Wildlife Service (Service) participated in a marine survey sponsored by the U.S. Navy (Navy) at Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI). Also participating in the survey were biologists from the National Marine Fisheries Service (NMFS), the CNMI Division of Fish and Wildlife (DFW), and a consulting firm under contract to the Navy. The purpose of the site visit was to make a cursory assessment of the condition of the coral-reef habitat surrounding FDM. Transportation to and from FDM was provided to the survey team by the Navy aboard the Guam-based USS Niagra Falls. Dive support at FDM was provided by the Navy's Explosive Ordnance Disposal (EOD) Unit (MU-5 DET5) based in Guam.

Methods

A total of 16 stations were established and surveyed within the nearshore portions of the fringing reef surrounding FDM (Figure 1). Qualitative observations on the general condition of reef habitat within each station were recorded on waterproof paper fastened to a clipboard. At the request of the Navy's consultants, the Service also compiled a list of the reef fishes seen at each station.

Seven stations were surveyed by divers with scuba (S-1, S-3, S-4, S-6, and S-7) or snorkel gear (S-2 and S-5). For safety reasons, the Navy limited approved scuba diving to a maximum depth of 60 feet (ft) and all divers were continuously accompanied by EOD personnel. Each dive entailed swimming over the reef in a meandering fashion with a minimum of backtracking while recording observations. Due to the restricted amount of time available for surveying the entire island, only 15 minutes per dive could be devoted to recording fish species and ranking their relative abundances. Emphasis was placed on identifying conspicuous, diurnally active fishes, and therefore, small, cryptic, very rare, and nocturnally active species are under represented in the data.

Nine stations were surveyed by snorkelers being surface-towed (T-1 through T-9) by a small inflatable boat. Each tow included a single pass through a station over substrate that was estimated to be between 10 and 40 ft deep with an average depth of approximately 25 ft. Due to the difficulty in making observations of the reef substrate while being towed by a boat on the ocean surface, the information that was collected during the tows was considered somewhat limited. Due to the fundamental differences in the methods used to survey the dive stations versus the tow stations, a valid comparison of the reef fishes observed during the dives and tows cannot be made.

Results

The results of the survey are summarized below. For reporting purposes, observations made at the dive stations (S-1 to S-7) are presented separately from those made at the tow stations (T-1 to T-9). The locations of the stations are identified in Figure 1. A table listing the species of reef fishes seen at the dive and tow stations is included after each group of summary observations (Tables 1 and 2, respectively).

Dive Stations:

S-1:
Low coral cover was seen over broad areas of reef, especially near shore, with moderate coral cover on high spots, along the tops of ridges, and in deeper water (40+ ft) farther away from shore. Fairly high algal growth was present over broad areas. Many medium- to large-sized boulders were seen in shallow water near shore. Forty-four species of reef fishes were recorded at this station. Overall habitat value was considered to be medium.

S-2:
Very low coral cover was present on the shallow reef immediately in front of the small sand beach on the windward side. Corals were rare and mostly restricted to the upper surfaces of scattered, medium-sized boulders. Visible erosion of the steep cliff face behind the beach appeared to be causing a turbidity plume immediately offshore. The beach appeared to be an accumulation of fine terrigenous sediments eroding from the cliff mixed with oceanically derived bioclastic sediments. The beach was relatively narrow in width and apparently has been subjected to regular tidal inundation against the steep cliff. Six species of reef fishes were recorded at this shallow station. Habitat value of the reef was considered to be low. Habitat value of the beach for successful sea turtle nesting appeared to be nil.

S-3:
Coral cover on the reef was low over broad areas, especially near shore, with moderate coral cover on high spots, along the tops of ridges, and in deeper water (40-60 ft) farther away from shore. Fairly high algal growth was present over broad areas. A large rubble berm was seen near the southern end of the station. Many large boulders were present, especially in shallower water near shore, providing increased vertical substrate relief. Hydrocorals (*Disticophora* sp.), giant clams (*Tridacna maxima*), sea cucumbers (*Stichopus chloronotus*), wire corals (*Cirrhipathes* sp.), and spiny lobsters (*Panulirus penicillatus*) were among the most conspicuous, noncoral benthic macroinvertebrates. Forty-one species of reef fishes were recorded at this station. Habitat value of the reef was considered to be medium.

S-4:
High coral cover was observed on the tops and vertical sides of very large boulders and huge escarpment features that dropped precipitously into deep water very close to steep shoreline cliffs. These features along with large submarine caves, cracks, crevices, and short tunnels provided excellent substrate relief that supported abundant biota. Hydrocorals (*Disticophora* sp.), wire coral (*Cirrhipathes* sp.), sea cucumbers (*S. chloronotus, Thelanota ananas,* and *Bohadschia graffei*), feather stars (*Comanthina schlegeli* and *Oxycomanthus bennetti*), giant clams (*T. maxima*), and spiny lobsters (*P. penicillatus*) were among the most conspicuous, noncoral benthic macroinvertebrates. One dogtooth tuna (*Gymnosarda unicolor*) and sixty-five other species of reef fishes were recorded at this station. Habitat value of the reef was considered to be very high.

S-5:
Very low coral cover was seen on upper surfaces of scattered, medium-sized boulders on the shallow reef immediately seaward of the sand beach. The beach appeared to be an accumulation of fine terrigenous sediments eroding from the cliff mixed with marine bioclastic sediments. Numerous large rocks that apparently have fallen from the cliff face were present along the back of the beach. A recent land slide had covered part of the southern end of the beach. The entire beach looked like it had been regularly inundated by high tides and surf. Visible erosion of the steep cliff face behind the beach appeared to be causing a turbidity plume immediately offshore. Blue-green algae (*Lyngbya* sp.) and brown algae (*Padina* sp.) were abundant on the scattered boulders within the plume, where no corals and few reef fish were seen. Toward the southern end of the station, the water was clearer and the abundance of *Padina* sp. was greater. A large area of rubble extended south from the beach to where a hole through the narrowest point of the island had formed at sea level. The rubble appeared to increase with nearness to the hole, and the entire area appeared heavily impacted. Habitat value of the reef near shore was considered to be low. Habitat value of the beach for successful sea turtle nesting appeared to be nil.

S-6:
High coral cover was observed in deeper water (35-50 ft) on the gently sloping shelf that extended seaward of the sand beach at S-5. Widely spaced sand channels oriented perpendicular to shore extend across the shelf into deeper water. Very large *Porites* heads (6 ft diameter and height) were present in deeper water. Sea cucumbers (*S. chloronotus* and *B. graffei*), feather stars (*C. schlegeli* and *O. bennetti*), and giant clams (*T. maxima*) were among the most conspicuous, noncoral benthic macroinvertebrates. A single Triton's trumpet (*Charonia tritonis*) was seen. Seventy- four species of reef fishes were recorded at this station. Habitat value of the reef was considered to be high.

S-7:
The northern end of this station was an extension of station S-4 and contained high coral cover on the tops and vertical sides of very large boulders and huge escarpment features. These features along with submarine caves and crevices provided excellent substrate relief that supported abundant biota over broad areas. However, swaths of relatively barren reef with sediment/rubble deposition

extended down slope through the area intermittently, especially toward the central portion of the station. The southern end of the station was an extension of station S-6. Noncoral benthic macroinvertebrates were not very conspicuous except for ascidians (*Didemnum* sp.) and cup sponges (*Phyllospongia foliascens*), which were both very abundant, sea cucumbers (*S. chloronotus* and *B. graffei*), sea feathers (*C. schlegeli* and *O. bennetti*), and giant clams (*T. maxima*). Eighty species of reef fishes were recorded at this station. Habitat value of the reef appeared high, except that near the northern end of the station the habitat value was considered to be very high.

Tow Stations:

T-1:
Coral cover was very low over broad areas of low-relief reef pavement, especially near shore, with moderate coral cover in deeper water (40+ ft) on the tops of ridges and outcrops along the periphery of a large shelf that extends north. A rubble berm in approximately 35 ft of water was seen near the eastern end of the station. Although it was difficult to identify the presence of marine organisms while being towed, especially noncoral benthic macroinvertebrates, hydrocorals (*Millepora* sp.) and one recently molted lobster exoskeleton were seen. Only two species of reef fishes were recorded at this station. Habitat value of the reef was considered to be low.

T-2:
Coral cover was very low over broad areas, except for moderate coral cover on the tops of large outcrops, which were very scarce. An area of sediments that appeared to be comprised of marine bioclastic sediments with a large terrigenous sediment component was seen. Many rocks and large boulders that looked like they were once part of the island and had tumbled down into the ocean were seen. Fish diversity and abundance appeared low; no fishes were observed. Habitat value of the reef was considered to be low.

T-3:
Fairly barren, low-relief pavement surrounded by extensive areas of unconsolidated sand/rubble were seen. The origin of these sediments appeared to be both marine bioclastic and terrigenous. Several large boulders that appeared to have tumbled off the island were present in shallow water. The water itself was moderately turbid, apparently as a result of erosion off the island. One subadult green sea turtle (*Chelonia mydas*) was seen on surface of water near the south end of the station. Overall fish diversity and abundance appeared low. Habitat value of the reef was considered to be low.

T-4:
Coral cover was low throughout most of this station. Many large boulders that appeared to have tumbled off the island were present in shallow water. Huge blocks of reef framework were prevalent toward the south end of the station where these features provided good vertical relief with many holes and fissures as the substrate dropped precipitously into very deep water. A school of baitfish (*Spratelloides delicatulus*) was present in shallow water above the dropoff. An aggregation

(approximately 80+ individuals) of juvenile gray reef sharks (*Carcharhinus amblyrhynchos*) was present in deep water immediately seaward of the dropoff. We returned to this site the following day and observed only four gray reef sharks. Habitat value of the reef was considered to be medium, except that near the southern end of the station the habitat value was considered to be high for its potential importance as a nursery ground for gray reef sharks.

T-5:
The substrate in the eastern part of this station was an extension of the precipitous dropoff seen near the southern end of T-4. Coral cover was high on the shallow top of the shelf, which extended seaward from the southern end of the island, and less on the portions of the shelf that dropped precipitously on its eastern side and sloped gradually into deeper water on its western side. Water visibility was relatively poor due to suspended solids. One apparently recent bomb crater was seen on the southern end of the shelf in about 10 feet of water. Habitat value was considered to be high on the top and eastern sides of the shelf and medium on its western side.

T-6:
Coral cover was good within a restricted area just off the northwest end of the island, especially on ridges and tops of some boulders which appear to have been spared impacts for a long period of time. However, areas of scoured reef pavement and rubble were present through most of the station and overall coral cover was low. Habitat value of the reef was considered to be low, except that adjacent to the northwest corner of the island it was considered to be high.

T-7:
Coral cover was low through most of this station, which was largely comprised of low-relief reef pavement surrounded by rubble. Close to the shoreline and just below the sea surface were numerous substrate holes that gave the reef a somewhat "Swiss cheese-like" look. Coral cover was greater near the southern end of the station where it was high on the tops of large blocks and boulders that had steeply descending vertical sides covered with abundant marine life. The southern end of this station was an extension of the coral-rich, high-relief habitat seen in S-4. Habitat value of the reef was considered to be low, except that near the southern end of the station it was considered to be high.

T-8:
Coral cover was low throughout this station, which appeared to be mostly scoured, low-relief reef pavement with small to medium-sized boulders. A small school (approximately 20 individuals) of squid was observed, but few reef fish were seen. Habitat value of the reef was considered to be low.

T-9:
Coral cover was low throughout this station although evidence of recent coral recruitment was observed just below the surge zone toward the center and southern ends of the station. Extensive beds of brown algae (*Padina* sp.) were present in the shallow areas near the northern end of the

station. The substrate was mostly low-relief reef pavement with scattered, large areas of rubble surrounding high-relief reef outcrops. A recent scar on the reef, possibly anchor damage, was seen. One spiny lobster (*Panulirus versicolor*) and one black-tip reef shark (*Carcharhinus melanopterus*) were observed. Habitat value of the reef was considered to be low.

Discussion and General Conclusions:

In general, the habitat value of the fringing reef surrounding FDM appeared to increase with distance from shore. In waters deeper that 35 ft and over 150-300 ft away from shore, habitat conditions were relatively good. The best reef habitat was found within stations S-4, S-6, and S-7. Compared with the other stations, coral development within these three stations was far greater and more typical of normal fringing reefs in the Mariana Islands. The best habitat at FDM was found within Station S-4 and the northern part of Station S-7, based on the combination of coral cover, vertical relief, and presence of large submarine fissures, caves, and other features that added to substrate complexity. The habitat within the rest of Station S-7 and within Station S-6 were also considered valuable on the basis of coral cover. Among the 153 species of reef fishes recorded during the survey, reef fish diversity was highest within these same three stations.

By contrast, the fringing reef in shallow water immediately adjacent to the island generally appeared very disturbed and was relatively barren of corals, especially on the eastern (windward) side. The substrate within this zone (approximately 150-300 ft wide) consisted mostly of low-relief reef pavement and extensive areas of sediment/rubble accumulation. In addition, large rocks and boulders, which appeared to have fallen into the water after breaking away from the cliffs above, were commonly seen adjacent to the shoreline within this zone. Unexploded ordnance (UXO) was common on the reef all around FDM, especially within this shallow zone. This UXO appeared to be concentrated roughly within the stations adjacent to the middle third of the island. Very little evidence of direct damage to the reef from bombardment was seen. However, it is highly likely that the effects of island bombardment have combined with the natural effects of recurring tremors, earthquakes, and severe storms (*e.g.*, typhoon-strength wind, rain, and surf) to accelerate erosion of the island's shoreline cliffs, especially on the windward side. In several places, it appeared that the island used to be much wider than it was at the time of the survey.

The extensive areas of little or no coral development present in shallow water appeared to provide a relatively weak forage base for large reef fish, especially those species with fishery value. Either an obvious absence or an unusually low presence of many species of reef fishes commercially targeted in the Marianas were recorded. Only a few medium-sized and no large-sized predatory reef fish, other than stingrays and a single dogtooth tuna, were seen within any station, including those with the highest habitat value. These observations suggested that the fringing reef of FDM has been subjected to fishing pressure in the recent past. Nevertheless, the reef-fish community at FDM, especially within the best remaining habitat (stations S-4, S-6, and S-7), appeared to possess the

diversity needed to quickly recover greater numbers of commercially desirable species. Any such recovery, of course, would be limited by the amount of healthy reef habitat available to support reef-fish recruitment. Immediately surrounding FDM, most of this potential habitat appeared to be available only in deeper water approximately 150-300 ft away from the island's shoreline. Newly recruited algae and corals observed over large areas of shallow reef pavement suggested that this part of the fringing reef may be in a relatively constant state of recolonization. It would not be surprising if such new recruits did not persist very long due to the combined effects of storm wave assault and ongoing erosion and sedimentation.

Very few species of benthic macroinvertebrates that were seen on the fringing reef. Spiny lobsters were the most conspicuous crustaceans (although seen in low numbers), feather stars and sea cucumbers were the most ubiquitous echinoderms, and trochus and giant clams were the most visible molluscs. Other notable organisms seen during the survey were single green sea turtles within stations T-3 and T-8; dense concentrations of hydrocorals (*Stylaster* sp. and *Disticophora* sp.) within the cave complexes present within stations S-4 and S-7; a single dogtooth tuna (*Gymnosarda unicolor*) within Station S-4, a small school of squid within Station T-8; and a single, relatively rare Triton's trumpet (*C. tritonis*) within Station S-6.

Finally, the two existing beaches at FDM were assessed for their value as potential sea turtle nesting habitat. Although the survey team was prohibited from going ashore, both beaches appeared to be relatively narrow and likely to be regularly inundated by the ocean, especially the smaller beach on the windward side. The cliffs at the back of each beach appeared to be very unstable and constantly eroding fine sediments. Large piles of rocks and boulders were piled up at the base of the cliff behind the larger, leeward beach and the aftermath of a recent, large landslide was observed at the southern end of this beach. Based on these observations, neither beach was considered to represent valuable sea turtle nesting habitat.

Summary

1. With the exception of the relatively short shoreline section centered at Station S-4, the shallow, nearshore portion of the fringing reef (*i.e.*, shallower than 35 ft and less than 150 ft away from shore) surrounding FDM appears very disturbed.

2. On the basis of coral cover and substrate complexity, the best coral-reef habitat at FDM occurs within Stations S-4, S-6, and S-7.

3. The reef at FDM shows very little evidence of direct damage from bombardment, although the large amounts of slumped terrigenous material and depauperate marine life in shallow water suggests that bombardment has combined with natural forces to accelerate shoreline erosion.

4. Although the shallow reef community at FDM lacks abundant commercial reef-fish resources and shows signs of recent fishing pressure, the potential for recovery of important fishery species appears high but limited to the relatively good coral-reef habitats in deeper water.

5. Neither of the two existing beaches at FDM are considered to represent valuable potential sea turtle nesting habitat although green sea turtles occur in nearshore waters.

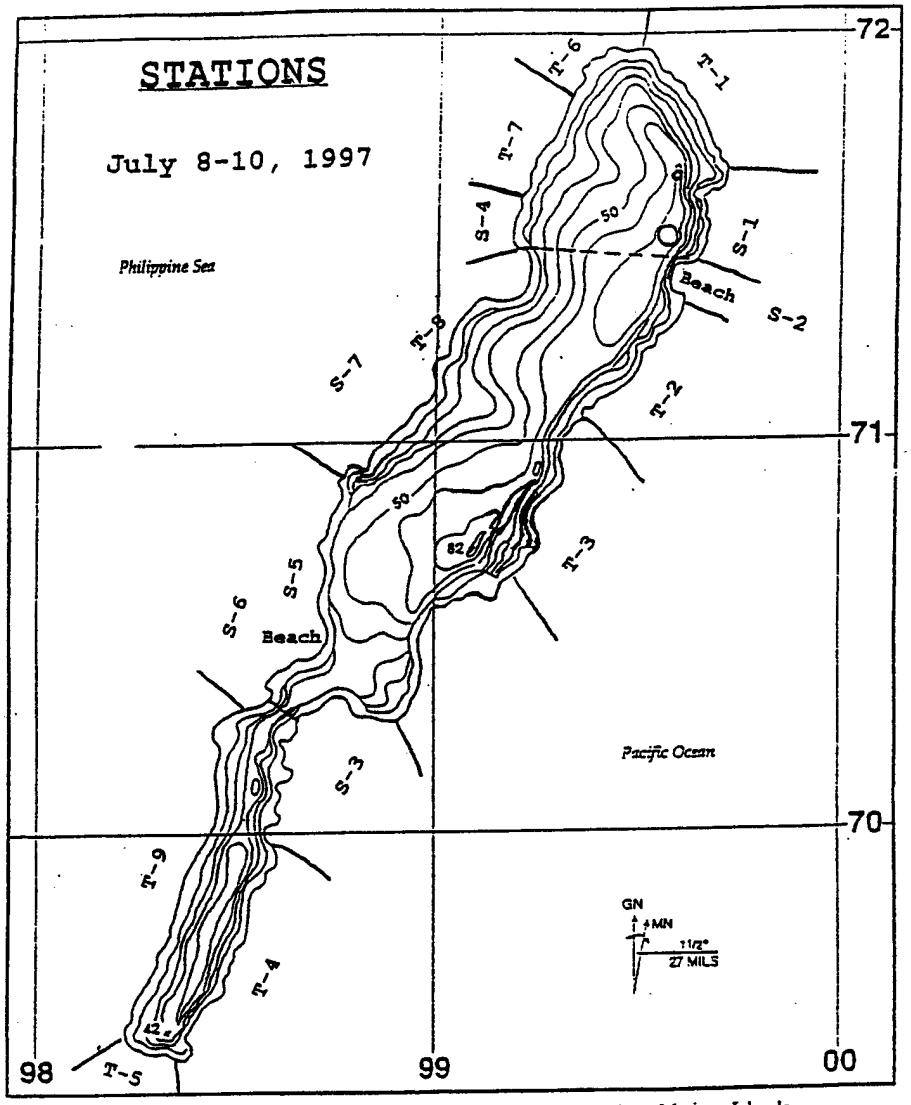


Figure 1. The island of Farallon de Medinilla, Commonwealth of the Northern Mariana Islands.

Table 1. Coral-reef fishes seen during snorkel or scuba dives at Farallon de Medinilla during July 8-10, 1997. Relative abundances of the species seen at each station are identified as follows: A = Abundant; C = Common; O = Occasional; R = Rare. Refer to text for station locations and survey methodology.

FAMILY / *Species*	DIVE STATIONS 1	2	3	4	5	6	7
ORECTOLOBIDAE (Nurse Sharks)							
Nebrius ferruginius			O				
HEMIGAELIDAE (Whitetip Reef Shark)							
Triaenodon obesus				R			
CARCHARHINIDAE (Requiem Sharks)							
Carcharhinus amblyrhynchos				C			R
DASYATIDIDAE (Stingrays)							
Taeniura melanospilos				R			R
HOLOCENTRIDAE (Squirrelfishes)							
Myripristis berndti				O			
M. murdjan				C			C
Sargocentron caudimaculatum							C
FISTULARIIDAE (Cornetfishes)							
Fistularia commersoni						R	
SCORPAENIDAE (Scorpionfishes)							
Pterois volitans				R			
SERRANIDAE (Groupers, Fairy Basslets)							
Cephalopholis argus			R	R		R	
C. urodeta	C		O	O		C	C
Epinephelus fasciatus				C			O
E. hexagontus			R	O			R
E. merra				O			
Pseudanthias pascalus						O	A
Variola louti	R		R			O	O

Table 1. Continued.

FAMILY / *Species*	DIVE STATIONS 1	2	3	4	5	6	7
CIRRHITIDAE (Hawkfishes)							
Cirrhitichthys falco						O	
Neocirrhitus armatus	O						
Paracirrhitus aractus	C			A		C	C
P. fosteri			O			O	O
CARANGIDAE (Jacks, Trevallys)							
Caranx ignobilis				O			
C. lugubris				C			
C. melampygus			O	O		C	
C. sexfasciatus						R	
Trachinotus blochii							
LUTJANIDAE (Snappers)							
Afareus furca			R	R			R
Aprion virescens			R				
Lutjanus bohar			O	O		O	A
L. fulvus		O	O				
L. gibbus			R	O			A
L. kasmira			O	A		C	O
Macolor macularis				O			C
M. niger	R						
CAESIONIDAE (Fusiliers)							
Pterocaesio marri	A						
P. tile	A			A			A
Caesio teres						A	
LETHRINIDAE (Emperors)							
Gnathodentex aurolineatus						O	O
Lethrinus harak	R						
L. olivaceus				R			
Monotaxis grandoculus				O		R	O
MULLIDAE (Goatfishes)							
Mulloides flavolineatus				C			
Parupeneus barberinus			O				
P. bifasciatus	O	O	A			O	R
P. ciliatus						O	
P. multifasciatus			C			A	A

Table 1. Continued.

FAMILY / Species	DIVE STATIONS 1	2	3	4	5	6	7
PEMPHERIDAE (Sweepers)							
Pempheris oualensis				A			C
KYPHOSIDAE (Rudderfishes, Chubs)							
Kyphosus bigibbus				C		A	
K. cinerascens		O		C		C	
CHAETODONTIDAE (Butterflyfishes)							
Chaetodon auriga	O						R
C. bennetti						R	O
C. citrinellus	O					O	
C. ephippium	O						O
C. kleinii				O		O	O
C. lunula							O
C. ornatissimus	O			O		R	
C. punctatofasciatus						O	
C. quadrimaculatus	O			O			O
C. reticulatus				O		O	
C. ulietensis	R			O			
Forcipiger flavissimus			R			R	O
F. longirostris							R
Heniochus chrysostomus							O
H. singularis			R				
POMACANTHIDAE (Angelfishes)							
Centropyge flavissimus				O		O	C
C. heraldi				O			O
Pomacanthus imperator				R			
POMACENTRIDAE (Damselfishes)							
Abudefduf sordidus				R			
A. vaigiensis				O			C
Chromis acares	A						C
C. margaritifer						R	
C. xanthura							O
Chrysiptera leucopoma						A	
C. traceyi				O		O	O
Dascyllus reticulatus	C			O		C	A
D. trimaculatus	C					C	O

Table 1. Continued.

FAMILY / Species	DIVE STATIONS 1	2	3	4	5	6	7
POMACENTRIDAE (Damselfishes) Cont.							
Pomachromis guamensis	A		A	A		A	A
Pomacentrus vaiuli				C		C	C
Plectroglyphidodon dickii	O			C		C	
P. imparipennis	R					R	
P. johnstonianus	C			A		C	C
Stegastes fasciolatus	O			C		C	O
LABRIDAE (Wrasses)							
Anampses caeruleopunctatus				R		R	O
Cheilinus fasciatus			R				
C. trilobatus	R						
C. undulatus	R						
Cirrhilabrus sp.			A			C	O
Coris aygula							R
C. gaimardi	O		R			O	O
Gomphosus varius						O	
Halichoeres hortulanus			O			C	O
H. margaritaceus			O				O
H. marginatus	O		R				
H. melanurus						O	
Hemigymnus melapterus	R						
Labrichthys unilineatus						R	
Labroides dimidiatus	R		R			O	O
Macropharyngodon meleagris	C		R				R
Pseudocheilinus evanidus						R	
Pseudojuloides atavai	O						
Stethojulis bandanensis						O	
S. strigiventer						O	
Thalassoma amblycephalum				A		O	A
T. lutescens	O		O	O		O	C
T. purpureum							O
T. quinquevittatum	A		A	A		A	
Xyrichtys sp.						C	

Table 1. Continued.

FAMILY / Species	DIVE STATIONS 1	2	3	4	5	6	7
SCARIDAE (Parrotfishes)							
Calotomus carolinus			R				
Scarus altipinnis	R						
S. bicolor	O						
S. microrhinos							O
S. oviceps							R
S. rubroviolaceus	R		O	C		C	C
PINGUIPEDIDAE (Sandperches)							
Parapercis clathrata							R
P. millipunctata				R			R
BLENNIIDAE (Blennies)							
Aspidontus taeniatus						R	
MICRODESMIDAE (Dartfishes)							
Ptereleotris evides						A	A
P. heteroptera						O	O
P. zebra						C	A
Nemateleotris magnifica						C	O
ACANTHURIDAE (Surgeonfishes)							
Acanthurus dussumieri				O			O
A. guttatus	A			C			
A. lineatus		R	O	A			O
A. guttatus		A	R	C			
A. nigricauda				O			C
A. nigrofuscus				C		C	A
A. olivaceus	A		O			A	A
A. pyroferus						O	O
A. triostegus		A				O	C
A. xanthopterus				O			O
Ctenochaetus striatus	C			C		C	A
Naso brevirostris	O		O				
N. hexacanthus				A			A
N. lituratus	C		C	C		C	A
N. tuberosus			R				
N. unicornis			O			O	

Table 1. Continued.

FAMILY / Species	DIVE STATIONS 1	2	3	4	5	6	7
ZANCLIDAE (Moorish Idols)							
Zanclus cornutus			C	O		O	C
SIGANIDAE (Rabbitfishes)							
Siganus spinus							O
SCOMBRIDAE (Tunas, Mackerels)							
Gymnosarda unicolor				R			
BALISTIDAE (Triggerfishes)							
Balistipus undulatus	O					R	O
Melichthys vidua				O		C	C
Rhinecanthus rectangulus	R			O		R	
Sufflamen bursa	C		R	O		O	
S. chrysoptera	O			O		O	R
TETRAODONTIDAE (Puffers)							
Arothron meleagris			R				
Canthigaster valentini						O	
Number of Families: 30							
Number of Species: 145							
Number of species/dive station:	44	6	41	66	0	74	80

Table 2. Coral-reef fishes seen during tows at Farallon de Medinilla during July 8-10, 1997. Relative abundances of the species seen at each station are identified as follows: A = Abundant; C = Common; O = Occasional; R = Rare. Refer to text for station locations and survey methodology.

FAMILY *Species*	TOW STATIONS 1	2	3	4	5	6	7	8	9
ORECTOLOBIDAE (Nurse Sharks)									
Nebrius ferruginius				R					
HEMIGALEIDAE (Reef Whitetip Sharks)									
Triaenodon obesus									R
CARCHARHINIDAE (Requiem Sharks)									
Carcharhinus amblyrhynchos				A					
C. melanopterus									R
DASYATIDAE (Stingrays)									
Taeniura melanospilos									R
CLUPEIDAE (Herrings, Sprats, Sardines)									
Spratelloides delicatulus							A	A	
SERRANIDAE (Groupers)									
Variola louti								O	
CARANGIDAE (Jacks, Trevallys)									
Caranx lugubris					O				
C. melampygus	O				R				
Eligatis bipinnulatus				C					
Scomberoides lysan					R				
Trachinotus blochii	C					A			
LUTJANIDAE (Snappers)									
Aphareus furca						O			
Lutjanus bohar		R				O	R		
CAESIONIDAE (Fusiliers)									
Caesio caerulaurea							C		
Pterocaesio tile					A			A	

Table 2. Continued.

FAMILY *Species*	TOW STATIONS 1	2	3	4	5	6	7	8	9
LETHRINIDAE (Emperors)									
Lethrinus rubrioperculatus			R						
Monotaxis grandoculis					C				
MULLIDAE (Goatfishes)									
Parupeneus multifasciatus			C						
KYPHOSIDAE (Rudderfishes)									
Kyphosus bigibbus								O	
LABRIDAE (Wrasses)									
Halichoeres hortulanus			C						
SCARIDAE (Parrotfishes)									
Scarus altipinnis						O			
S. microrhinos									C
S. oviceps					O				
S. rubroviolaceus		O	C			C			
S. sordidus					O				
ACANTHURIDAE (Surgeonfishes)									
Acanthurus dussumieri						O			
A. lineatus						A	A	A	
A. nigricauda			O						
A. olivaceus	C		O						
A. xanthopterus						O			
Ctenochaetus striatus						C			
Naso brevirostris									O
N. lituratus							C	C	
N. unicornis			C				C		
TETRAODONTIDAE (Puffers)									
Arothron nigropunctatus						R			
Number of Families: 16									
Number of Species: 36									
Number of species/tow station:	3	2	7	3	7	10	6	6	5

Appendix D-18
Preliminary Archaeological Reconnaissance and Assessment of Farallon de Medinilla, Mariana Islands (November 1997)

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE AND ASSESSMENT OF FARALLON DE MEDINILLA, MARIANA ISLANDS

by

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November 1997

Scope of Work

At the request of Belt Collins Hawaii, an archaeological survey was conducted on the island of Farallon de Medinilla as part of the assessment of military training activities in the Mariana Islands. Farallon de Medinilla is a small, low-lying island located north of Saipan in the Commonwealth of the Northern Mariana Islands (CNMI). The survey is a part of the background work being conducted by Belt Collins Hawaii and its subconsultants for an Environmental Impact Statement being prepared for the Navy assessing the effect of these activities. The survey was conducted as part of a general island research visit arranged by the Commander, Naval Forces, Marianas (COMNAVMAR) for assessment studies of the island. The archaeological research was conducted in conjunction with assessments of biological resources and the effects of human actions on these resources by an ornithologist, botanist, and marine biologists.

The project scope of work for the archaeological study consisted of the following:

1) Perform a reconnaissance archaeological survey of the island for evidence of prior human occupation or use of the island in historic or prehistoric times.

2) Summarize available literature concerning the history of the island.

3) Evaluate changes from natural conditions caused by military or other human activity.

4) Evaluate potential for significance of any sites observed on the island.

Investigations in the Marianas were conducted between 3 and 12 November 1996, with several interruptions due to typhoons and holidays. Tasks carried out during this period included fieldwork preparation, transport to the island, field survey, consultations with the CNMI Historic Preservation Office (HPO), and background research on Saipan and Guam. The actual field survey was conducted on one day, 5 November, by a single archaeologist, the project principal investigator, David J. Welch, Ph.D.

The principal investigator conducted background research of historic documents concerning Farallon de Medinilla and the northern islands of the Marianas in general. This included a review of documents and maps at the CNMI HPO, the Micronesian Area Research Center (MARC) at the University of Guam, and documents on file at the IARII offices in Honolulu and Guam. He was assisted by Myra Tomonari-Tuggle, who reviewed archival materials at Maxwell AFB, Alabama, during research for another project; Jolie Liston, who reviewed materials at the University of Hawaii Hamilton Library Pacific and Map Collections; and Richard Olmo, who researched additional materials at MARC.

Following the survey, the principal investigator met in Saipan with Scott Russell, the CNMI Deputy Historic Preservation Officer, and with Mike Fleming, former CNMI Historic Preservation Officer. Discussions with Russell concerned the scope of the survey, historic documents relating to the island, the survey results, and recent archaeological and archival research conducted on the other CNMI islands north of Saipan. Mr. Fleming provided local information concerning the island.

Setting

Farallon de Medinilla is located in the Mariana Islands within the jurisdiction of the Commonwealth of the Northern Mariana Islands. The sixth island from the south in this north-south chain of 15 islands, it is located at approximately 16°N latitude and 146°E longitude 40 km north of Saipan and 30 km southeast of Anatahan. The island is approximately 2,700 m long by 500 m wide. Covering an area of approximately 84 hectares (207 acres), it is the smallest of the Mariana islands (Fig. 1).

The island is an uplifted coralline reef platform, from which rocky cliff faces drop abruptly to the sea around the entire island coast. These are the source of the first part of the island's name: *farallon* is the Spanish word for cliff. The island rises to 50 to 80 m above sea level along the top of the east cliff face. The terrain then slopes gradually downward to the west, ending in cliffs about 20 to 40 m above sea level on the west side. A narrow peninsula of land, only about 200 m wide, extends south from the main portion of the island.

The prevailing winds are from the northeast and blow strongly across the exposed island most of the time. The island, especially on the windward side, is being eroded by strong waves and at many locations the cliffs have been severely undercut as a result of wave action. In some places openings from the surface extend down to sea level. The leeward coast is less exposed to severe wave action and a few small rocky beaches are sometimes present. A few isolated limestone cliffs rise from the land on the northern end of the island.

The soil is generally a wind-eroded, shallow, slightly gravelly, dusky red loam, exposed in many places along the high east ridge. Most of the island is covered with low vegetation, mainly grasses, *Capparis*, and *Ipomoea pes-caprae* (beach morning glory). The dominant plant in many areas, especially in low-lying pockets, is a lily (*Crinum asiaticum*) which reaches several feet in height. Sea birds and migratory birds, of which up to 18 species are present, nest throughout the island.

The project area consists of the entire island. However the terrain precludes survey in several places. The southern peninsula is cut off by steep, rocky, crumbly terrain that is impassable on foot. The edges of the cliffs are composed of loose, crumbly rock; and large openings in the surface constitute an additional survey hazard. Also, the presence of unexploded ordnance, from years of use of the island as a bombing target, make many areas of the island unsafe for pedestrian survey.

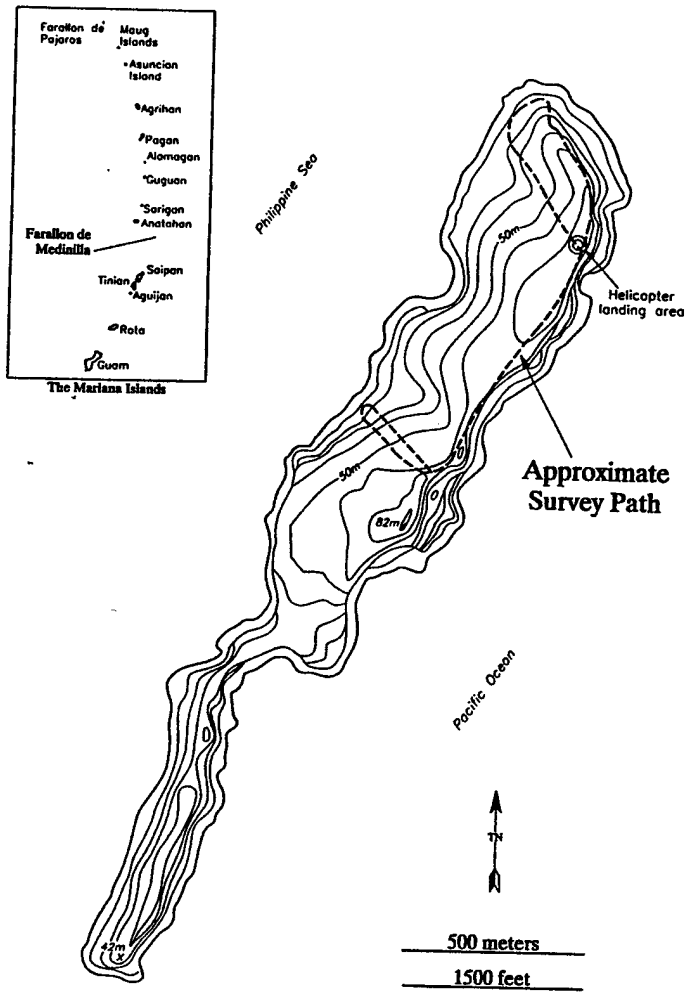


Figure 1. Map of Farallon de Medinilla showing location of reconnaissance survey path.

History of the Island

The first western landing in the Marianas was in 1521 by Magellan who probably sailed south of Farallon de Medinilla between Guam and Rota. One of the ships of Magellan's fleet, the *Trinidad*, attempted to return to Spain from the Moluccas in 1522 by sailing back across the Pacific. The ship, under the command of Captain Gomez de Espinosa, landed at Ascuncion and the Maug Islands at the northern end of the Marianas chain. Sailing south along the west side of the Marianas, Espinosa recorded 14 islands, which means that he probably did not see Farallon de Medinilla, the smallest and easternmost of the 15 islands in the archipelago.

Three sailors deserted from the *Trinidad* while in the Marianas. In 1526, a ship of the Loayasa expedition, the *Santa Maria de la Victoria* under the command of Alonso de Salazar, landed in Guam, where the one surviving deserter, Gonzalo de Vigo, was found. He too would have sailed past all the Mariana islands on his journey from the Maug Islands to Guam. He returned to Spain on the *Santa Maria*. A Portuguese map of the Marianas dating from approximately 1545 shows and names the 14 islands in the Marianas reported by Espinosa (Lévesque 1992: 332-333). Espinosa's names were confirmed by Gonzalo de Vigo.

The first reference to Farallon de Medinilla may be in the accounts of the Villalobos expedition, which reached the Marianas in 1543. On an attempted return to Mexico from the Philippine island of Mindanao, the *San Juan* under Bernard de la Torre reached the northern Marianas before turning around. Accounts state that several islands north of the *Ladrones* (Marianas) were passed. According to Juan Gaytan, one survivor of the voyage, an island was discovered at 16° N latitude. The small island, which they named Abriojos (Keep your eyes open), was almost level with the sea. The description and the location, as Andrew Sharp (1960:29-30) observes, suggest that the island seen was Farallon de Medinilla. Other islands were later seen to the north. The descriptions suggest that these were several of the northern Mariana and Bonin islands.

The next probable reference to the island is on the map of the Mariana Islands by Father Alonso Lopez, one of the early Jesuit missionaries, drawn in 1671 or early 1672. An islet labeled "Rocher" (Rock) is placed on the map in approximately the right location relative to Saipan to suggest that it is Farallon de Medinilla (Lévesque 1995: 382).

In 1742 Anson's ship, the *Centurion*, sailing along the Marianas on its way to Tinian, passed too far west of the island to spot it (Barratt 1988:11).

The first unambiguous reference to the island is found in the writings of Corte y Ruano Calderon (1875:39), who says that the island was named by Captain Louis de Freycinet in 1819. The island is however not mentioned in the primary account of Freycinet's voyage written by Arago (1823). This would suggest that the island was not seen on a two week journey that Arago and two others made to Rota and Tinian while their ships were docked in Guam. The island may then have been sighted by Freycinet on the

subsequent voyage from Guam to Hawai'i. Corte says that Freycinet named the island after Don Joseph Medinilla y Pineda who was the governor of Guam while he was there.

According to Corte the island was never used by the Chamorro or by the Spanish. He states (in translation):

> It does not seem possible to make any use whatever of this rock for not even the primitive inhabitants of the Marianas occupied it nor does Padre Sanvitores make mention of it.

Georg Fritz, the German governor of the Marianas in the early 1900s, wrote an account of his tenure as governor and includes the island in his list of Mariana islands (Fritz 1989). In contrast to Corte's statements, Fritz's description states that artifacts had been found on the island. An early translation of Fritz's work elaborated no further on this statement. However a recent publication in English of the governor's account provides a complete translation of his statement. Fritz (1997:27) writes, "Even on Mendinilla, which was unknown to the missionaries, I found smoke-blackened caves and as everywhere, fragments of burned clay".

No Japanese maps of the Marianas that show the island are known. A World War II U.S. military map entitled "Enemy Installations in the Western Carolines, the Marianas, and Related Areas" includes the island, but does not show any Japanese military installations on it.

An intensive search of the National Archives and military archives would presumably turn up evidence concerning the use of the island for target practice in the last year of World War II, but the author has not seen any records documenting this use of the island. A 1950 document of the 19th Bomb Wing (Wing Intelligence Office 1950) from the archives at Maxwell AFB mentions the dropping of two bomb bay tanks painted white on the island to provide visible targets. The U.S. military has continued to use Farallon de Medinilla for target practice until the present, resulting in the placement of numerous pick-up trucks on the island as targets and the dispersal of ordnance across the surface of the entire island.

Research Expectations and Design

The environmental and historical information concerning Farallon de Medinilla suggested that it is highly improbable that a permanent population has ever resided on the island. The lack of permanent sources of water most effectively prohibits long-term settlement on the island. In addition, the unprotected exposure of the island to high winds, the difficulty of landing on the island with its steep cliffs, and the general poverty and shallowness of the soil would have made difficult any permanent residence. Only the presence of a single small beach on the leeward side and the presence of a few low-lying wetland areas on the island suggest that any use was possible for the island.

The island did possess some resources which may have attracted temporary visitors. The waters around the island, which are placed above a submerged reef platform, could be expected to be rich in marine resources; present-day knowledge of the area indicates the presence of numerous species of fish and sharks. These resources may have attracted Chamorro populations from Saipan or other northern Mariana islands. The island is populated today by as many as 18 species of birds and expeditions to the island to hunt for birds or bird eggs might have occurred. In addition, the island may have provided a temporary refuge for boats lost at sea or caught in storms between Saipan and the inhabited islands to the north, or simply as a stopping off point on a voyage between islands.

While today access to the island's plateau from the ocean is almost impossible, informants on Saipan report that in the past a path led from the beach on the south leeward coast up to the plateau. Thus, while the possibility of long term residence on the island would seem to be precluded unless conditions were very different in the past from those today, the possibility of temporary camp sites or activity areas on the island cannot be ruled out. While none of the early European sailors who visited the northern Marianas report anybody living on or using the island, the German governor Fritz reports seeing fire-blackened cave walls on the island and observing "fragments of burned clay" (probably a better translation of the German would be "fragments of clay vessels"), fairly clearly a reference to pottery sherds.

On the basis of this information, the possibility of discovering some evidence of past human use of the island could not be completely discounted. The use would have been quite temporary, probably with no one staying on the island for more than a day or two (unless unable to leave), and therefore evidence of such occupation would be expected to be extremely scarce. Caves, which would have provided refuge and where evidence of human presence has been reported, would be the most likely locations where archaeological remains might be preserved. However, even if the island was occupied in the past, its recent use as a bombing target may have resulted in the destruction of some sites.

A survey strategy was therefore developed which involved three steps:

1) a preliminary reconnaissance of the island to obtain first-hand information of conditions, determine the potential for archaeological remains on various parts of the island, and identify areas for priority investigations.

2) more intensive survey of areas that might be expected to have the highest potential for archaeological remains, such as cliff lines, caves or rock shelters in cliff faces, the areas near wetlands, or locations protected from high winds.

3) sample survey of a few selected areas which could be covered intensively using transects.

All these strategies were of course limited by factors of safety, which precluded entry to certain portions of the island to conduct survey because of the danger from unexploded ordnance.

Field Survey

The preliminary reconnaissance survey was conducted by the author on the island on 5 November 1996. Accompanied by EOD specialists and other members of the survey team, a pedestrian survey of portions of the island was conducted over a 6 hour period (see Fig. 1).

The team first covered the area along the east edge of the island, following the coastline northward from the helicopter landing zone toward the northern tip of the island. The north end of the island includes some exposed limestone cliffs which rise up to 20 m above the surrounding landscape. Portions of these cliffs were explored and several sheltered areas and small caves were investigated for any possible cultural remains.

The team continued down to the northwest coast where the sea cliff rises only 20 m or so from the sea. The team then proceeded southeastward across the island on the south side of the limestone cliffs. This path passed near one of the wetlands, but the dense and relatively high vegetation dominated by lilies, precluded a careful check of this area. The team returned by this path to the helicopter landing area.

Survey was then conducted along the east edge of the island toward the south, a fairly open area with some areas of exposed red silt soil, others in low grass, and some in lilies. Just south of the middle of the island one transect was made across the island to the west coast. The team then returned to the helicopter zone by approximately the same route.

At this point the threat of an approaching typhoon resulted in the cessation of the survey.

Results and Evaluation

Of the three planned survey steps, only the first, the preliminary reconnaissance was conducted in the time available on the island. No archaeological sites or isolated non-modern artifact finds were recorded during the course of the survey. The only cultural materials observed were numerous pieces of ordnance, several pick-up trucks, and a collapsed tower near the north end of the island.

All items relate to the use of the island as a bombing target by the U.S. military since the last year of World War II. None of these remains constitute significant historic resources. Except for the first targets placed on the island (and what these may be and whether still extant is unknown), all are less than 50 years old and therefore not eligible for the National

Register of Historic Places. Neither do any possess integrity of place nor are they of any value for research purposes.

Recommendations

While the preliminary reconnaissance survey failed to turn up any evidence of prehistoric or early historic human activity on the island, the extent of the survey was far too limited to confirm that such evidence is not present or very unlikely to be present. The expected scarcity of any archaeological remains would make a more intensive survey necessary to confirm their presence or absence and the past and potential future impacts of the military use of the island.

The second two steps of the proposed survey would need to be completed to draw reasonably well-supported conclusions concerning past human use of the island. First, areas with the best potential to contain cultural materials, such as the cliff faces at the north end of the island and any caves, would need to be explored in more depth. Second, one or two areas elsewhere on the island that would be considered safe and representative of the island should be subject to more intensive transect survey to provide a sample from which inferences could be more safely drawn concerning the presence or absence of cultural remains. Without this information, it is difficult to evaluate the probability that the island was used in the past, whether any cultural remains are still present, and what impact military training on the island has had and may continue to have on the island's cultural resource base.

However, following removal of the survey team from the island because of the imminent threat of a typhoon, a Navy EOD team discovered the presence of dangerous submunitions on the island. No further survey in line with the recommendations above is possible, as access to the island is now prohibited for safety reasons.

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Appendix D-19
Farallon de Medinilla Survey Report (November 6, 1997)

Farallon de Medinilla Survey Report

Prepared by:

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[Submitted by Michael S. Trianni, Fishery Biologist III, on November 6, 1997.]

Introduction

The United States Navy has been conducting monthly bombing exercises at Farallon de Medinilla(FDM) since 1971, following a lease agreement with the Trust Territory of the Northern Mariana Islands. An environmental impact statement was never completed prior to the initiation of bombing exercises, and in late 1995 the Commonwealth of the Northern Mariana Islands(CNMI) Division of Fish and Wildlife and the United States Navy agreed to biological surveys of FDM to assess terrestrial species compositions and distributions, and to conduct a marine survey to qualitatively determine the degree of impact from bombing on the fringing coral reef community.

Survey

The original marine survey personnel included a marine biologist contracted to the Navy, a representative from the National Marine Fisheries Service(NMFS), and a biologist from the (CNMI)Division of Fish and Wildlife. The initial survey to FDM originally took place in November 1996. This survey was cut short due to pre-typhoon conditions, resulting in one day of terrestrial surveys, with the waters being too rough to conduct the marine survey. The marine survey was finally conducted from July 8-10, 1997, with survey personnel including the original marine biologist contracted to the Navy, the NMFS representative, a representative from the United States Fish and Wildlife Service, and a biologist from the CNMI Division of Fish and Wildlife.

It was understood at the beginning of the survey that the marine biologist contracted to the Navy would be assessing the benthic habitat and coral reef community, the USFWS representative would be focusing on fisheries observations, the NMFS representative would be observing all aspects of the habitat, and the CNMI biologist would be serving primarily as an 'observer'.

Methods

The goal of the marine survey team was to observe the fringing reef community around the entire island. A total of 16 stations were surveyed by three methods(Figure 1). Three survey methods were employed; manta tow, scuba diving, and free diving.

Stations T-1 to T-9 were surveyed by manta tow, with four to five snorkelers towed by an inflatable zodiac. During a tow snorkelers were pulled over a pre-determined area, obtaining a visual impression of the benthic habitat, the coral community and the fisheries diversity. The visual range of the snorkelers was from surface waters down to 60 feet, with the primary focus being on the habitat directly under them. No limits on range of visual observation were agreed to prior to towing.

Five scuba dives were conducted, two on the windward side of the island(S-1 and S-2), and three on the lee side(S-4, S-6 and S-7). Dive times ranged from 15 to 30 minutes, depending upon the depth, diver, and amount of tank air. As a condition set by the Navy, all survey divers were closely followed by Naval Explosive Ordinance Disposal personnel(EOD), and maximum dive depth was limited to 60 feet.

Two areas were surveyed by free diving(S-2 and S-5). As with the scuba dives, all snorkelers were closely followed by EOD personnel.

All dives were directional in nature, thus avoiding any re-tracking.

Results

The orientation of FDM is from NNE to SSW, the island being nearly a mile and a half long, and up to about one-eight of a mile wide. The surveys began on the windward NNE point, moving around the SSW point and back up the lee side NNE. A brief description of the survey areas follows. The observations which follow are based on qualitative observations, and should therefore be viewed as such. They are not presented as being all inclusive. They are organized in chronological order(Figure 1).

July 8

T-1

Four observers participated on this tow, the first in the FDM survey. The benthic habitat was composed of a 'reef pavement habitat', with very little relief. It was essentially homogenous in form, with very little coral cover. The habitat appeared to slope lightly away from the island. Tufts of *Pocillopora* sp. were observed on shallower rock slabs.

Mid-water schools of Trachinotus baillonl(approximately 40), and Pterocaesio tile(about 30) were conspicuous upon initial entry. Benthic and near bottom fish included Acanthurids(73%), which appeared to be the dominant family of fish in this area. Other families observed were Carangidae((2%), Siganidae(7%), Lutjanidae(7%), Pomacentridae, and Scaridae(11%). About 25% of the Scaridae observed were terminal phase males.

S-1

This was the first scuba dive. The maximum depth attained was 60 feet. This area was also described as a 'pavement habitat', though with a higher amount of coral cover than in T-1. Large patches of sand substrate strewn with rock were also present. Acanthurids(24%) and Pomacentrids(45%) appeared to be the dominant families in this area. *Chromis* sp. appeared to

be very abundant in this area. Also observed were Labridae(12%), Chactodontidae(12%), Lethrinidae(2%), Lutjanidae(2%), Balistidae(1%), and Serranidae(2%). Scarids were not observed.

S-2

This was a snorkel toward the exposed beach on the windward side. Visibility was very much reduced, to less than 15 feet in some areas. A high degree of suspended sediment was observed in this area, due primarily to the exposed nature of this beach to persistent physical disturbance by wind and waves. The appearance of the beach indicated that it would be covered by higher tides. From this factor, coupled with the high degree of physical disturbance, it was concluded that this beach was not suitable for turtle nesting.

From what could be observed, very little coral growth existed. The most abundant fish family was Acanturidae, which comprised over 98% of all fish observed. *Acanthurus trigosteus* was very dominant in this area, comprising over 75% of the Acanthurids. Kyphosids were observed for the first time in this area(*Kyphosus bigibbus*).

T-2

The CNMI biologist was stung by a man o' war at the commencement of this tow and was not able to continue to participate.

T-3

This habitat was also characterized by a pavement substrate, strewn with large boulders. Coral cover appeared low. Acanthurids were the dominant family of fish. From the Scaridae observed, 25% appeared to be terminal phase males.

A green sea turtle was observed following this tow(Figure 1).

S-5

The CNMI biologist did not dive in this area, but instead snorkeled. There appeared to be a high degree of coral cover in this habitat, which was characterized by large rock slabs and numerous crevices. The high degree of coral cover is attributed to the relative protected nature of this habitat(Figure 1).

T-4

This tow covered more of the pavement habitat which dominated the windward side of the island. Coral cover was low, as well as the abundance and diversity of fish species. Acanthurids were dominant, comprising over 90% of observed fish. Six *Cetoscarus bicolor*(all terminal phase males) were observed. At the end of the tow near a deep drop off, a school of approximately 30 Rainbow Runner(*Elegatis bipinnulatus*) were observed near the surface. Below the Rainbow Runners, a school of approximately 75 Grey Reef Sharks(*Carcharhinus amblyrhychos*) were observed down to about 70 feet. This appeared to be a school of 'pups', the size range being from 2 to 4 feet. Initially the school began to rise towards the observers, then sounded.

T-5

This was a tow over a shallow flat area at the SSW tip of the island, extending from the high relief area observed at the end of T-4. The current was very strong at about 4 knots. Coral cover appeared good on top of the flat area, where a crator appeared to be present from an exploded ordinance.

July 9

T-6

This tow began at the NNE lee side of island, towing SSE. The benthic habitat during this tow was bottom pavement with scattered boulders of varying size. Coral cover appeared to be medium, with the highest cover above 40 feet. The substrate in this area appeared to be steeper than in others observed. Of the observed fish, over 90% appeared to be Acanthurids. Two schools of *Trachinotus baillonl*(approximately 50 and 60) were observed during the tow. All Scarids observed were terminal phase males.

T-7

The benthic habitat at the beginning of this tow was similar to that in T-6. The tow length was shortened when a steep drop-off(from 20 to 80 feet) was observed. At that point it was decided to dive on the wall area. Acanthurids were observed to be the dominant family of fish. Kyphosids, Scarids(*Scarus rubrioviolaceus*, three terminal phase males) and Carangidae were also observed.

S-4

This was the third dive of the survey. The initial habitat was a near vertical wall, dropping from 20 to 80 feet. Near the bottom of the wall large boulders, numerous caves, overhangs, crevices and tunnels combined to provide a high degree of spatial heterogeneity, supporting a diverse assemblage of fauna. Coral cover was very high near the top of the wall, near 90%.

Over 45 species of fish from were observed. Fish families included Carangidae, Lutjanidae, Zanclidae, Scaridae, Carcharhinidae, Caesiondae, Balistidae, Pomacentridae, Pomacanthidae, Chaetodontidae, Lethrinidae, Labridae, Scombridae, Kyphosidae, Pempherididae, Serranidae, Mullidae, and Holocentridae. A large school *P. tile*(about 140) was observed, as well as 15 Grey Reef sharks in a cave at 50 feet, and a Dogtooth tuna(*Gymnosarda unicolor*).

Also observed were feather stars, wire coral, spiny lobsters, giant clams(*Tridacna maxima*), and sea cucumbers including *Bohadschia graffei*(about 100), *Thelanota ananas*, *Stichopus chloronotus*, *Holothura hilla*, *H. nobilis*(1), and *Actinopygna mauriantiana*(10). It was concluded that this habitat contains a very rich faunal assemblage.

T-8

This habitat consisted initially of a shelf area with numerous drop-offs, followed by pavement with large boulders near the end of the tow. There were 25 ordinance observed during this tow. Coral cover was approximately 50%. Acanthurids appeared to be dominant, followed by Labridae, Serranidae, and Scaridae. Another large school of *P. tile*(about 100) was observed. Approximately 25 *A. mauriantiana* were observed.

S-5

This area was observed using snorkel. It was the second of the two beaches found at FDM. The visibility in this area was much reduced as the beach was approached. There appeared to be a high amount of suspended sediment in the water. The cliff wall in back of the beach appeared to be highly eroded, probably from bombing exercises. This was the probable primary cause of suspended sediment. Acanthurids were the dominant species of fish, although Kyphosids were numerically very high, as numerous schools of 20-30 were encountered. Coral cover was low in this area.

As with the first beach, this beach was also probably covered during higher tidal events. It was also not deemed suitable as a sea turtle nesting site.

T-9

This area began near the 'window' or hole through FDM near the narrowest width of the island. The initial habitat was a rubble field near the hole. As the tow progressed south steeply sloping pavement habitat dominated. This area exhibited a low amount of coral cover(10-15%). There also existed large patches of alga growth, up to 70-70% coverage. One area was observed where the surface of a rise was fractured(approximately 50 feet). The cause of this fracture was not discernible. Anchor damage or detonation were speculated as possible causes, as well as tremors.

Acanthurids continued to be the dominant family of fish. Of the observed members of the family Scaridae, 50% were terminal phase males. Other notable observations included one Reef blacktip shark(*Carcharhinus melanopterus*), one Reef whitetip shark(*Triaenodon obesus*), and one blue spotted stingray(*Dasyatis kuhlii*).

Sea cucumber observed included *H. maurlantiana*(6T), *S. chloronotus*, *T. ananas*, and *B. graffei*..

S-6

This was the fourth dive of the survey. The CNMI observer dove for only 15 minutes due to low tank air. The area was an extensive gently sloping reef flat about 150 feet offshore from the 'window' or hole at the beginning of T-9. The dive depth ranged from 30-60 feet. This habitat exhibited a high degree of coral cover. It appeared very diverse biotically, with numerous species of fish, as well as sponges, tunicates, and algae. A Tritons trumpet was also observed(*Charonia tritonis*). This habitat was dominated by Labrids and Pomacentrids, the only habitat surveyed not dominated by Acanthurids. This was concluded to be very good reef habitat.

July 10

S-7

This dive closely followed T-8, and is an extension of the habitat surveyed in S-4. The habitat was characterized as a shelf with a steep drop-off, from approximately 40 to 80 feet. The coral cover on the shelf was about 90%, most consisting of *Poecillipora* sp., *Acropora* sp., and encrusting *Porites* sp. The surveyors descended onto the shelf, went over the wall and descended to 60 feet, following the wall in a southerly direction. The wall was followed until it gave way to a pavement bottom interspersed with varying sized boulders. The pavement was then followed up to shoreline(30-40 feet), which was subsequently followed.

Over 50 species of fish from 16 families were observed. A green sea turtle was also observed. Sea urchins were very common near the end of the wall, as well as giant clams(*T.*

maxima), ascidians, and algae. Sea cucumbers observed included; S. chloronotus, T. ananas, and B. graffei. This habitat contains a very rich faunal assemblage.

Discussion

It was observed that coral growth on the windward side of the island was very patchy, and in general coral cover very low. The windward habitat was primarily composed of a flat, 'pavement' type environment which gradually sloped away from the island. The habitat on this side of the island is subjected to a high degree of physical disturbance, resulting from open exposure to significant wave energy and wind force. These factors inhibit the establishment of juvenile coral, resulting in settlement events occurring only during periods of relative calm, thus explaining the patchy coral distribution.

Numerous bomb shells were observed scattered around the bottom down to 60-70 feet, usually singly, with no direct evidence of damage from bombing observed. EOD personnel who accompanied and provided support to the survey team stated that the types of shells observed were from bombs which were not packed with explosives, but rather only 'smoked' on impact. In generil, the spatial homogeneity of the windward side habitat, coupled with exposure to sever physical forces, is not a habitat which promotes significant coral growth and subsequently rich faunal assemblages.

As expected, the lee side of the island exhibited the highest degree of coral growth. The benthic habitat on this side and a much higher degree of spatial heterogeneity, and subsequently richer faunal assemblages. The most abundant growth was observed from the middle of the lee side to near the SSW tip of the lee side. In this area there existed a significant patches of coral growth, as well as numerous drop-offs or 'walls', from 20-30 feet down to 60-80 feet. This area receives the highest degree of protection from physical forces, and therefore ample coral recruitment. The surveyed sites which exhibited the richest faunal assemblages were S-4, S-6, and S-7. Not coincidental, these were also sites surveyed by scuba. Another area of note is the high relief area near the SSW tip of the windward side, near the end of T-4. It was here that a large number of juvenile grey reef sharks were observed. This area may in fact be a an important pupping ground for this species of shark. Although the survey was focused on the quality of coral reef habitat, survey findings should not be constrained as such. Because of the shark observation near the end of T-4; it is thus necessary to include this area as being of significant value ecologically. This is a good example of why richness and diversity alone do not necessarily serve as indicators of prime ecological habitat.

The highest densities of bomb shells were observed near the middle of the lee side, but again, no damage from bombing to the coral reef community was documented.

Near the SSW tip of the island a shallow flat area was observed to have been damaged from a bombing event(T-5).

Conclusion

The windward side of the island does not provide sufficient protection from physical forces to contribute to extensive coral settlement and growth. Although some nearshore areas were found to contain high degrees of suspended sediment(S-2), aerial bombing cannot be assumed to be the primary cause. In addition, no impact from bombing was observed. In contrast, the most protected parts of the lee side of the island supported the highest degree of coral growth. One observation of damage from bombing was observed at the SSW point of the island.

As expected, the lee side of the island contained the richest faunal assemblages of the surveyed areas. It was noted that certain nearshore areas contained considerable amounts of suspended sediment, usually coincident with eroding cliff lines(S-5). On this side bombing events can be considered to have a greater impact on the nearshore fringing reef community, but because FDM is a very narrow island and only one and a half miles long, the entire fringing reef community will be exposed to natural physical forces. This was very evident in November 1996, when the first marine survey was attempted, and FDM was being exposed to pre-typhoon conditions.

The major fishery around FDM targets the shallow water bottomfish complex, comprised mainly of Lethrinids, in particular *Lethrinus rubrioperculatus*, the Red-gilled emperor. The depths fished in this fishery range from 60 to 100 meters, well beyond the nearshore waters of FDM. No reef fish fishery exists at FDM, although the survey did encounter evidence of near shore bottomfishing. Because of the large population of sharks in the waters surrounding FDM, local fishermen avoid spear fishing there.

The survey would have benefited from a more inclusive plan. It is acknowledged that only 2.5 days were allotted by the Navy for this survey, and because of this only a qualitative impression was obtained. Regardless, the survey did cover all sides of FDM, and provided an excellent template if future investigations are deemed necessary.

It is concluded here that cessation of bombing at FDM would probably not contribute significantly to the enrichment of faunal assemblages already present. It can be suggested that certain areas, such as the lee side in general, be bombed less extensively that the windward side, and that the area of the 'window' or hole at the narrowest part of the island not be bombed at all.

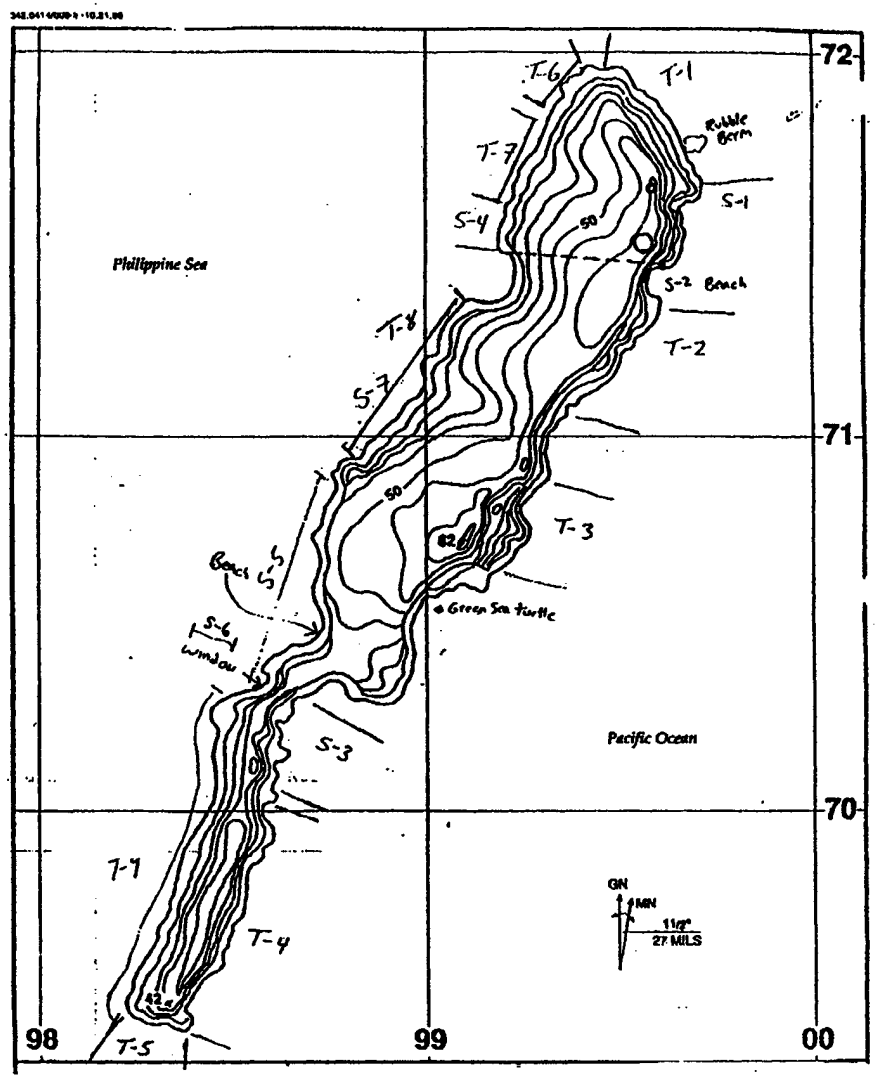


Figure 1. Farallon de Medinilla, with surveyed areas identified.

Appendix D-20
Forwarding Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 9 and 15 Sep 97 (December 1, 1997)

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

11015.4G23
Ser 232/ 4158
1 DEC 1997

From: Commander, Pacific Division, Naval Facilities Engineering Command
To: Commander in Chief, U.S. Pacific Fleet (N465)

Subj: FORWARDING RESULTS OF WILDLIFE SURVEYS OF FARALLON DE MEDINILLA (FDM) OF 9 AND 15 SEP 97

Ref: (a) Biological Opinion of the U.S. Fish and Wildlife Service for Gunnery and Aerial Bombardment Practice at FDM, Commonwealth of the Northern Mariana Islands of 11 Sep 97

Encl: (1) Map of Survey Routes and Stations
(2) COMNAVMARIANAS (N446) memo of 20 Nov 97

1. In accordance with reference (a), a helicopter survey was done at FDM prior to the aerial bombardment that took place on 12 to 13 September 1997. The pre-bombardement survey was performed on 9 September 1997. Enclosure (1) indicates the route taken during the marine survey, and stations censused during the seabird survey. The marine survey was performed by following the coastline 300 meters offshore at an altitude of 300 feet and the seabird survey was accomplished by flying just seaward of pre-established stations at an altitude of 300 feet or less. Larger nesting and loafing seabirds such as masked and red-footed boobies were counted at each of the stations. Weather conditions were excellent during the survey and seas were slight to moderate. COMNAVMARIANAS decided to forego the post bombing helicopter survey based on safety concerns expressed by HC-5 Helicopter Squadron concerning the hazards of flying Navy helicopter far from any airfield or support ship. The commercial helicopter based on Saipan that was previously used to do aerial surveys was not available at this time. A small commercial fixed wing aircraft was chartered out of Guam and the COMNAVMARIANAS biologist conducted a survey around the island on 15 September 1997.

2. Transportation for the pre-bombardement survey was provided by HC-5 flying out of Guam. Departure on 9 September 1997 from the Saipan International Airport was at 1315. Arrival at FDM was at 1350. As we approached the island a large flock of mixed species of seabirds departed to the north. The marine survey began at the southern end of the island and skirted the western and eastern shores until the island was circumnavigated. No turtles or marine mammals were seen in the waters around the island nor were any seen while in transit to or from FDM. No turtle tracks were seen on either of the two beaches on FDM. During marine surveys done in July 1997 the National Marine Fisheries Service determined that due to wave washing, the two beaches were not considered sea turtle nesting habitat. A total of 163 larger nesting seabirds were censused at 43 stations for an average of 8.25 seabirds per station. Departed FDM at 1440 and arrived Saipan at 1505.

3. The number of seabirds counted during this survey, 8.25 per station, was consistent with the previous counts done on 19 July 1997 and 2 August 1997 when 8.25 and 8.4 birds were counted per station, respectively. There appeared to be fewer noddies present flying around the island during this survey, a few brown boobies were nesting along the eastern cliff edges and a few red-tailled tropic birds were observed flying about.

4. One juvenile brown booby was killed near station 29 when it flew into the forward rotor blade. There did not appear to be any damage to the aircraft and no emergency landing to inspect for damages was required.

5. Enclosure (1) provides a report by Ms. Leslie Morton, Natural Resources Manager, COMNAVMARIANAS, on the post bombing survey conducted on 15 September 1997.

6. Should you require further information on this matter, point of contact is Mr. Timothy Sutterfield, Fish and Wildlife Biologist at (808) 471-9338 or by facsimile transmission at (808) 474-5909.

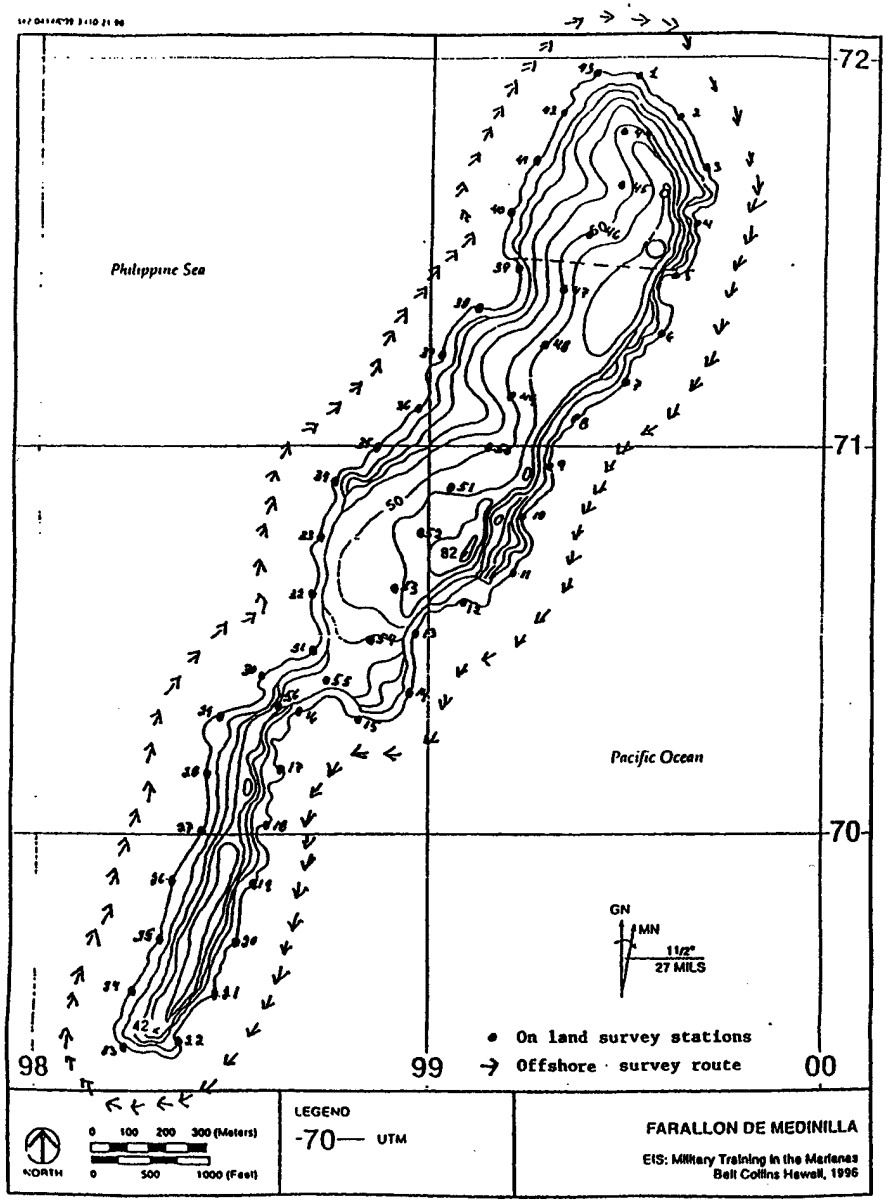
Melvin N. Kaku
MELVIN N. KAKU
By direction

Copy to:
COMNAVMARIANAS (N4)

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Belt Collins Hawaii
680 Ala Moana Boulevard, First Floor
Honolulu, HI 96813-5406



ENCLOSURE(1)

20 November 1997

Memorandum

From: Natural Resources Manager, COMNAVMARIANAS
To: Program Manager, Marianas Training EIS, PACDIV

Subj: 15 SEPTEMBER POST-BOMBING SURVEY OF FDM REPORT

Ms. Leslie S. Morton, Natural Resources Manager, and Mr. Anthony Hoover, Environmental Protection Specialist, departed Guam in a small fixed-wing aircraft at 0930 on 15 September 1997.

Arrived at Farallon de Medinilla (FDM) at 1040. Plane slowed to lowest safe traveling speed possible (any slower could have resulted in unplanned loss of altitude). Plane circumnavigated the island twice. Altitude was 200 feet above sea level for the first circle and 350 feet above sea level for the second circle. We were approximately 300-350 meters offshore.

No marine mammals or sea turtles, alive or dead, were seen on or around FDM.

Ms. Morton was unable to perform a sea bird nesting count. While fixed-wing aircraft are commonly used for surveys of birds on the wing or on the water and may be used for some nesting surveys, it was not feasible to perform a nesting survey using fixed-wing aircraft at FDM. For safety reasons, the plane could not fly slow enough or close enough to allow accurate identification of species, numbers, or nests. The brown boobies in particular tended to blend into the background.

Ms. Morton and Mr. Hoover did visually search the island for signs of any dead or injured Micronesian megapodes. None were seen.

Bomb craters were compared with photographs taken by Mr. Tim Satterfield in August. It appeared that there were no new bomb craters in the northern area. No new burn areas were seen.

Returned to Guam at 1215.

On 17 September 1997, Ms. Morton received the Lake Erie's spotters' report confirming that all bombs had landed on the south and central portions of the island. No bombs landed in the water or on the northern area of FDM.

ENCLOSURE(2)

Appendix D-21
Biological Opinion of the U.S. Fish and Wildlife Service for Aerial Bombardment and Small Arms Gunfire at Farallon de Medinilla, CNML (December 30, 1997)

BIOLOGICAL OPINION
of the
U.S. FISH AND WILDLIFE SERVICE
for
AERIAL BOMBARDMENT AND SMALL ARMS GUNFIRE
AT FARALLON DE MEDINILLA,
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

December 30, 1997

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To: mrl 1-2-98-F-02

DEC 30 1997

Melvin N. Kaku
Director, Environmental Planning Division
Department of the Navy
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

RE: Biological Opinion (Log Number 1-2-98-F-02), Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI).

Dear Mr. Kaku:

This represents the biological opinion of the U.S. Fish and Wildlife Service (Service) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544; Stat. 884), as amended, (Act) regarding potential impacts to the federally endangered Micronesian megapode, *Megapodius laperouse laperouse*, from proposed aerial bombardment and small arms gunfire. The Department of the Navy (Navy), as the range manager, proposes to use FDM for aerial bombardment and small arms gunfire during January/February 1998. Your request for formal consultation was received on December 12, 1997.

This biological opinion is based upon 1) information presented in your December 12, 1997, letter requesting formal consultation, 2) information provided in the Service's *Draft Recovery Plan for the Micronesian Megapode* (USFWS 1997), 3) information provided in the *Draft Recovery Plan for U.S. Pacific Populations of the Green Turtle* and in the *Draft Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle*, 4) information provided in the Service's *Status and Distribution of Marine Turtles on the Island of Tinian, Commonwealth of the Northern Mariana Islands - 1994 & 1995*, 5) literature published on megapodes, green sea turtles, and hawksbill sea turtles, 6) a site visit to FDM on November, 4, 1996, 7) a March 24, 1997, memorandum from Tim Sutterfield (Navy) assessing impacts to the fauna of FDM as a result of the training activities covered in the Service's January 29, 1997, biological opinion, 8) a July 8-10, 1997, marine resources survey of FDM, 9) an August 21, 1997, memorandum from Melvin Kaku assessing impacts to the fauna of FDM as a result of the training activities covered in the Service's May 16, 1997, biological opinion, and 10) a December 1, 1997, memorandum from Melvin Kaku assessing impacts to the fauna of FDM as a result of the training activities covered

in the Service's September 11, 1997, biological opinion.

The log number for this consultation is 1-2-98-F-02. A complete administrative record of this consultation is on file in the Service's Pacific Islands Office in Honolulu, Hawaii.

Consultation History

Farallon de Medinilla has been used as a bombardment range by the Navy and Air Force since at least 1971. An Environmental Assessment was completed for the use of FDM as a bombardment range by the Navy in 1975. The Navy initiated formal consultation with the Service for naval and aerial bombardment of FDM on December 6, 1996, April 4, 1997, and for ship to shore gunnery practice on August 27, 1997. The Service completed biological opinions for these actions on January 29, 1997, May 16, 1997, and September 11, 1997, respectively. In the January 29 biological opinion the Service authorized incidental take of ten adult or juvenile megapodes, four active megapode nests, one green sea turtle, one hawksbill sea turtle, and four active turtle nests. In the May 16 biological opinion, the Service determined that take of megapodes was indeterminate and anticipated the loss of all adult and juvenile megapodes and their nests. The sea turtle take remained the same. The September 11 biological opinion concluded that the take granted in the May 16 biological opinion had been met and anticipated the loss of any remaining or newly arrived adult and juvenile megapodes and their nests. The September 11 biological opinion did not authorize take for sea turtles because it was determined during a July 8-10, 1997, marine resources survey that the beaches on FDM were unsuitable for sea turtle nesting. In all three biological opinions the Service determined that the level of take was not likely to jeopardize the continued existence of the Micronesian megapode, the green sea turtle, or the hawksbill sea turtle.

Beginning with the first FDM training consultation initiated by the Navy on December 6, 1996, the Service has requested that the Navy apply for a programmatic consultation to cover all training activities on FDM. Completion of a programmatic consultation will alleviate the burden of addressing individual training exercises that are similar in nature. On December 12, 1997, the Service received a request from the Navy for a programmatic section 7 consultation that will cover all training exercises on FDM over the next three years. This programmatic consultation is associated with the Navy's analysis of all military training in the Mariana islands archipelago. Therefore, this consultation for aerial bombardment and small arms gunfire will be the last individual consultation for FDM training activities before completion of the programmatic consultation.

BIOLOGICAL OPINION

Description of the Proposed Action

The Navy proposes to engage in aerial bombardment and small arms gunfire practice during January/February 1998 on FDM, CNMI. Ammunition used during the practice will consist of

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MK-83 missiles, AH-1W missiles, and mortar rockets to be delivered by attack helicopters; small arms gunfire (including 7.62millimeter (mm) sniper rifle, 40mm grenade launcher, and anti-tank rockets) to be fired from helicopters and offshore raider boats; and a total net explosive weight of 4065 pounds of bombs to be delivered by aircraft. It is possible that aerial bombardment and small arms gunfire will occur at night. Overall this exercise uses smaller caliber arms and will deploy less bomb tonnage than those exercises covered under the three previous consultations. The Navy will conduct both pre- and post-exercise helicopter overflights to monitor training impacts and assess take of threatened and endangered species for this exercise.

Biology and Population Status of the Species

The Micronesian megapode was listed as endangered without critical habitat on June 2, 1970 (35 FR 8491-8498). This species formerly occurred on all of the islands in the Marianas archipelago (Figure 1) but declined to extinction on Guam, Rota, and Saipan in the 19th and early 20th centuries. It is currently found on 12 islands. Small remnant populations persist on Aguiguan, Tinian, and Farallon de Medinilla, along with a very small reintroduced population on Saipan. Relatively large numbers remain on the small, uninhabited northern islands of Anatahan, Sarigan, Guguan, Pagan, Maug, Alamagan, Asuncion, and possibly Agrihan.

The Micronesian megapode is a small, pigeon-sized bird in the family Megapodiidae, a family comprised of seven genera found only in the Australasian region. Members of this family are known as "incubator birds" because of their reliance on external heat sources, such as solar energy, volcanic activity, or microbial decay, to incubate their eggs (Clark 1964). Micronesian megapodes apparently use both burrow nesting and mound building in egg incubation (USFWS 1997), are believed to be monogamous, and may defend a territory of approximately one hectare (ha) on a year-round basis (Glass and Aldan 1988). Exact nesting seasons for this subspecies are not known; however, nesting probably occurs year-round on some of the Mariana Islands and seasonally on others, depending upon the heat sources used for incubation (USFWS 1997). These birds are omnivorous and have been observed to feed on seeds, beetles, ants, other insects, and plant matter (Glass and Aldan 1988, Stinson 1993).

Historical extinctions of Micronesian megapodes on Guam, Rota, Tinian, and Saipan were likely due to overexploitation by humans and habitat losses associated with agricultural practices and introduced ungulates. Loss of habitat through the effects of vulcanism is also known to have caused serious declines. Loss of habitat due to development projects and predation by introduced monitor lizards, feral dogs, cats, rats, and pigs are known current threats to this subspecies. Perhaps the most serious potential threat, however, is the possible establishment of the brown tree snake (*Boiga irregularis*) on islands other than Guam in the Marianas archipelago.

There are an estimated 10-15 Micronesian megapodes on the island of Aguiguan, less than 10 birds on Tinian, 10-25 on Saipan, less than 10 on Farallon de Medinilla, 200-300 on Anatahan, 545-810 on Sarigan, 500 on Guguan, less than 30 on Alamagan, 50-100 on Pagan, less than 25

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on Asuncion, 50-150 on Maug, and an unknown number on Agrihan. Recent estimates yield a total of about 1,440 to 1,975 birds (USFWS 1997) for the entire archipelago.

Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. The baseline includes State, local, and private actions that affect a species at the time the consultation begins. Unrelated Federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

A total of four megapodes were discovered on FDM during a site visit on November 4, 1996 (Lusk and Kessler 1996). Two megapodes were found on the island during a Navy site visit on December 17, 1996 (Figure 2) (Sutterfield *in lit.* 1997). The size of the island, 0.7 km^2, led the Service to estimate that at the time of the 1996 site visit there were likely no more than ten megapodes on the island. This number represents less than 1.0% of the total estimated population within the Marianas archipelago. Aerial and naval bombardment of the island since the 1996 site visit has likely decreased the numbers of megapodes on the island, but exact loss of megapodes is indeterminate due to inability to visit the island. No nesting has been recorded on the island, but the possibility for nesting does exist.

The Navy has conducted bombing exercises on FDM regularly over the past 20 years and intends to continue to do so in the future. Such exercises occurred in January, May, and September 1997. Before and after the January and May exercise, Tim Sutterfield, Fish and Wildlife Biologist for the Navy, conducted helicopter surveys in accordance with the Terms and Conditions of the January 29 and May 16 biological opinions. A helicopter survey was conducted by a Navy Fish and Wildlife Biologist before the September exercise in accordance with the September 11 biological opinion, but a fixed-wing aircraft survey was conducted by a Navy biologist after the exercise because the Navy could not make a helicopter available. None of the surveys revealed any direct evidence of death or injury to megapodes. However, observations of megapodes on FDM indicate that they are likely to remain underneath brushy cover and, therefore, deaths or injury from either direct strikes or indirectly from shrapnel would be difficult to detect from aerial surveys. On-the-ground surveys are not permitted due to the high incidence of unexploded ordnance distributed over the island.

Effects of the Action on Listed Species

The primary concerns of the Service with regard to the effects of aerial bombardment and small arms gunfire practice on the Micronesian megapode are (1) direct death of megapodes, (2) destruction or abandonment of active megapode nests, and (3) destruction of required foraging and nesting habitat. The potential for all of these effects was apparent when on August 2, 1997,

the Navy conducted post-bombardment surveys of FDM in accordance with the terms and conditions set forth in the Service's May 16, 1997, biological opinion. As detailed in the Navy's August 21, 1997, memorandum, 25 to 50 new bomb craters were observed and a large section of the central northern portion of the island, an area believed to represent megapode habitat, was "burned to bare earth" (Kaku *in lit.* 1997). Although the action covered under this biological opinion is not as likely to result in the degree of habitat impact as the actions covered under the May 16 biological opinion, the Service believes the August 2 surveys to be representative of the type of damage that can occur during aerial bombardment or even from small arms fire such as grenade launchers or anti-tank rockets.

The impact areas for gunnery practice cover the entire area of FDM. Therefore, the Service anticipates the possible direct death of remaining megapodes and destruction of nests occurring on the island at the time of the proposed training.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service has not identified any cumulative effects in the project area that may impact Micronesian megapodes.

Conclusion

After reviewing the current status of the Micronesian megapode, the environmental baseline of the species in the action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that aerial bombardment and small arms gunfire practice by the Navy in January/February 1998 is not likely to jeopardize the continued existence of the Micronesian megapode. No critical habitat has been designated for this subspecies; therefore, none will be affected.

INCIDENTAL TAKE

Sections 4(d) and 9 of the Act, as amended, prohibit the taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of a listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take

statement. The measures described below are non-discretionary and must be implemented by the Navy in order for the exemption in section 7(o)(2) to apply.

The Navy has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Navy fails to adhere to the terms and conditions of the incidental take statement the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

The Service believes that the last two bombing exercises, which occurred from July 21 to August 1, 1997, and from September 12 to 13, 1997, may have resulted in the taking of all the megapodes that occurred on FDM at the time of the bombing and gunnery practice. Such taking likely took the form of direct death or injury, harm and harassment. We, therefore, believe that the level of incidental take authorized in biological opinion #1-2-97-F-05 and biological opinion #1-2-97-F-08 has likely been met. We anticipate that any megapodes still present on FDM, or that may colonize the island prior to the onset of the September ship to shore gunnery practice, may also be incidentally taken during the aerial bombardment and small arms gunfire. However, because the inability to conduct on-the-ground surveys precludes exact analysis, the Service authorizes take at an indeterminate level.

Effect of the Take

The Service has determined that this level of impact is not likely to result in jeopardy to the Micronesian megapode because, even if all birds are extirpated from FDM, such losses do not represent a threat to the stability of the overall population in the Marianas archipelago.

Reasonable and Prudent Measure

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of this measure, the Service believes that take of Micronesian megapodes will be minimized.

The Navy will minimize take of adult and juvenile megapodes and minimize disruption to breeding activities (including destruction of any active nests) during project implementation.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, it is mandatory that the Navy comply with the following terms and conditions, which implement the reasonable and prudent measure described above:

RECEIVED TIME JAN. 3. 11:02AM PRINT TIME JAN. 3. 11:07AM

(1) The Navy shall restrict their impact zone to the central interior portion and/or southern tip of the island and cliff faces, to the extent possible.

(2) The Navy shall prohibit the use of cluster bombs in training on FDM.

(3) The Navy shall monitor the extent of take by conducting a helicopter overflight survey of FDM with a qualified biologist prior to bombardment and after the exercise is completed for the January/February training.

If, during the course of action, the amount or extent of the above-stated incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measure provided. The Navy must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Loss of even small numbers of megapodes and their nests slows the recovery of these species and represents an adverse effect. Further, destruction of nesting and foraging habitat for megapodes by shell impacts or by resulting fires may not represent a permanent loss, but it does slow the recovery process of this species by requiring time for the habitat to recover suitably and therefore, represents an adverse effect. In order to minimize the effect of these losses of individuals and habitat, the Service recommends that the Navy continue to assist the CNMI Division of Fish and Wildlife (DFW) in its efforts to eradicate feral ungulates on the island of Sarigan and that the Navy consider funding additional conservation and recovery projects for the megapode in the Marianas. Examples of conservation and recovery projects that should be considered for funding include: (1) efforts to eradicate feral ungulates on uninhabited northern islands, (2) surveys to assess status, distribution, and nesting areas of megapodes, (3) basic research into the life history and demography of the megapode, and (4) rat (*Rattus* spp.) eradication on FDM and/or other uninhabited northern islands.

In addition to providing habitat for and/or supporting populations of the Micronesian megapode, FDM also supports colonies of breeding seabirds, including masked boobies (*Sula dactylatra*), brown boobies (*Sula leucogaster*), red-footed boobies (*Sula sula*), great frigatebirds (*Fregata minor*), common noddies (*Anous stolidus*), black noddies (*Anous minutus*), and white terns (*Gygis alba*). FDM is particularly important for great frigatebirds as it is one of only two small breeding colonies known to exist in the Mariana Island chain (Stinson 1994) and for masked

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boobies because it represents the largest known nesting site for this species in the Mariana Islands (Reichel 1991). All of these birds are protected under the Migratory Bird Treaty Act of 1918 [16 U.S.C. 703-712; 40 Stat. 755], as amended. The Service recommends that the Navy concentrate impacts within the interior portion of the island to lessen harm to nesting and roosting seabirds and that the Navy establish a long-term monitoring program to evaluate the effects of aerial bombardment, naval gunnery, and small arms gunfire on seabird populations.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

This concludes formal section 7 consultation on this action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning any of the information contained in this biological opinion, please contact Interagency Program Leader Margo Stahl or Wildlife Biologist Michael Lusk (phone: 808/541-3441, fax: 808/541-3470, e-mail: Michael_Lusk@mail.fws.gov).

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: CNMI, DFW, Saipan
NMFS, Honolulu

REFERENCES CITED

Clark, G. A. 1964. Life histories and the evolution of megapodes. Living Bird 3:149-167.

Glass, P. O. and D. T. Aldan. 1988. Micronesian megapode surveys and research. Pp. 131-153, In Division of Fish and Wildlife Progress Report: 1982-1987. CNMI Division of Fish and Wildlife, Saipan.

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U.S. Fish and Wildlife Service. 1997. Technical/Agency Draft Recovery Plan for the Micronesian megapode. U.S. Fish and Wildlife Service, Portland, OR. 71 pp.

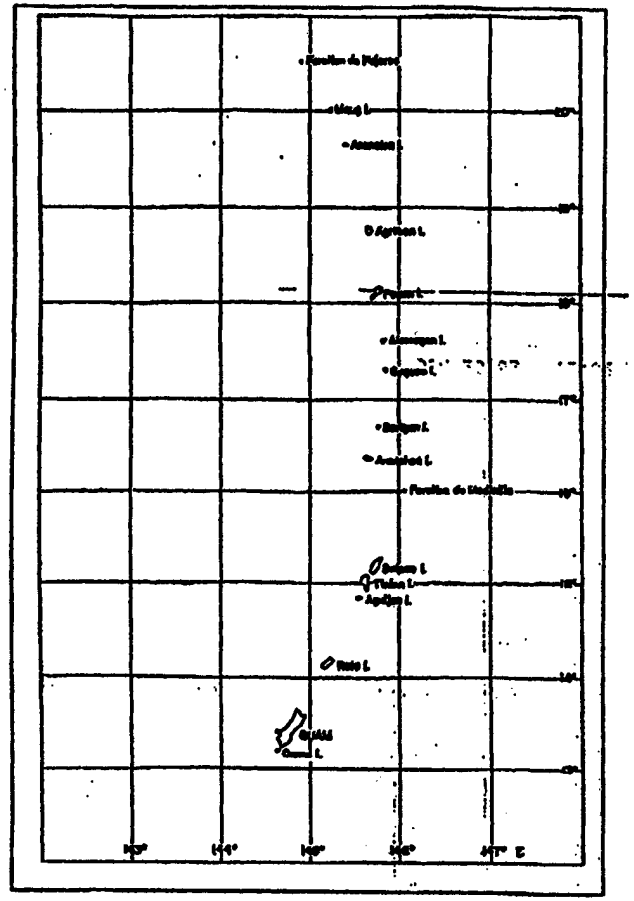


Figure 1. Mariana Islands archipelago.

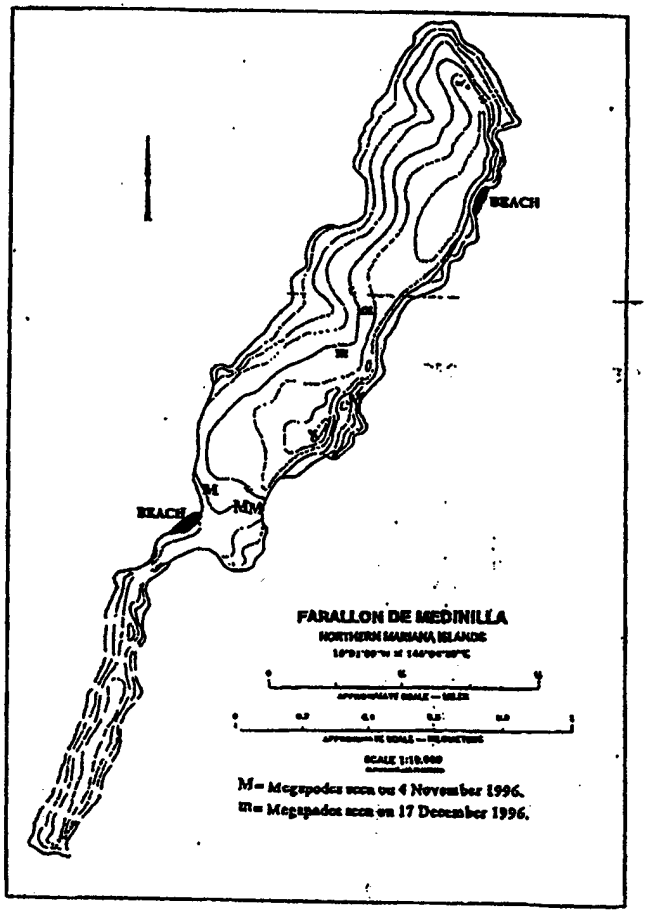


Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla (beaches not to scale).

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Appendix D-22
Forwarding Results of Wildlife Surveys of Farallon de Medinilla (FDM) of 19 and 23 February 1998 (March 2, 1998)

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA HI)
PEARL HARBOR HAWAII 96860-7300

11015.4G23
Ser 232/**1150**
6 MAR 1998

From: Commander, Pacific Division, Naval Facilities Engineering Command
To: Commander in Chief, U.S. Pacific Fleet (N465)

Subj: FORWARDING RESULTS OF WILDLIFE SURVEYS OF FARALLON DE MEDINILLA (FDM) OF 19 AND 23 FEBRUARY 1998

Ref: (a) National Marine Fisheries Service Informal Consultation ltr of 13 Jan 98
(b) U.S. Fish and Wildlife Service Biological Opinion of 30 Dec 97

Encl: (1) Map of Survey Routes and Stations

1. In accordance with references (a) and (b), sea turtle, marine mammal, and seabird surveys were performed before and after aerial bombardment training was conducted at FDM on 21 February 1998. The pre-bombardment survey was performed on 19 February 1998 and the post-bombardment survey was performed on 23 February 1998. Enclosure (1) indicates the route taken during the marine surveys, and stations censused during the seabird surveys. The marine survey was performed by following the coastline 1,000 feet offshore at an altitude of 300 feet and the seabird survey was accomplished by flying just seaward of pre-established stations at an altitude of 300 feet or less. Larger nesting and loafing seabirds such as masked and red-footed boobies were counted at each of the stations. Weather conditions were excellent during the survey and seas were slight to moderate.

2. Transportation for the surveys was provided by Macaw Helicopter flying out of the Coral Ocean Point Resort just southwest of the Saipan International Airport. Departure from the Coral Ocean Point helidrome on 19 February 1998 was at 0920 and arrival at FDM was at 1005. The marine survey began at the southern end of the island and skirted the western and eastern shores until the island was circumnavigated. No sea turtles or marine mammals were seen in the waters around the island nor were any seen while in transit to or from FDM. No turtle tracks were seen on either of the two beaches on FDM.

3. The seabird survey started at station 23 and continued north and then south until the island was circumnavigated ending with station 22. A total of 673 larger nesting seabirds were censused at 42 stations for an average of 16 seabirds per station. Other birds noted flying around the Island were: one red-tailed tropicbird, 100 plus white terns, several hundred noddy terns and four brown boobies. Red footed boobies were the most common nesting seabird and were either on eggs or small downy chicks, masked boobies were on larger downy chicks and seemed to be about three weeks ahead of the red-foots in their nesting cycle. The helicopter departed FDM at 1055 and arrived at Saipan at 1135.

3. The post-bombardment survey was conducted on 23 February 1998 and departure was from the Coral Ocean Point helidrome at 0925. No marine mammals or sea turtles were observed in the vicinity of the island nor were any seen while in transit to or from the island. Nine hundred and ninety one larger nesting seabirds were counted at 42 stations for an average of 23.59 birds per station. The larger number of birds counted in the post bombing survey was due to wind conditions that required flying more inland for stations 34 through 42 giving a better view of the red-foots that were nesting in the low trees and shrubs. In addition to the birds seen flying around the island during the pre-bombardment survey six frigatebirds were seen.

4. FDM was relatively green during this survey period and the areas that had burned during the August 1997 exercise were no longer noticeable. There was no apparent damage from typhoons Keith and Paka that passed in the vicinity of the island. During the post-bombardment survey, there was no noticeable damage to the southern end of FDM which was the required target area for this exercise. In an after action report from the Air Force they reported that all 52 of the 750 pound bombs dropped landed on the island. It should be noted that the SOCEX exercise that was to include small arms fire from offshore raider boats and aerial bombardment from Marine Corps fighter attack aircraft did not take place.

5. Should you require further information on this matter, point of contact is Mr. Timothy Sutterfield, Fish and Wildlife Biologist at (808) 471-9338 or by facsimile transmission at (808) 474-5909.

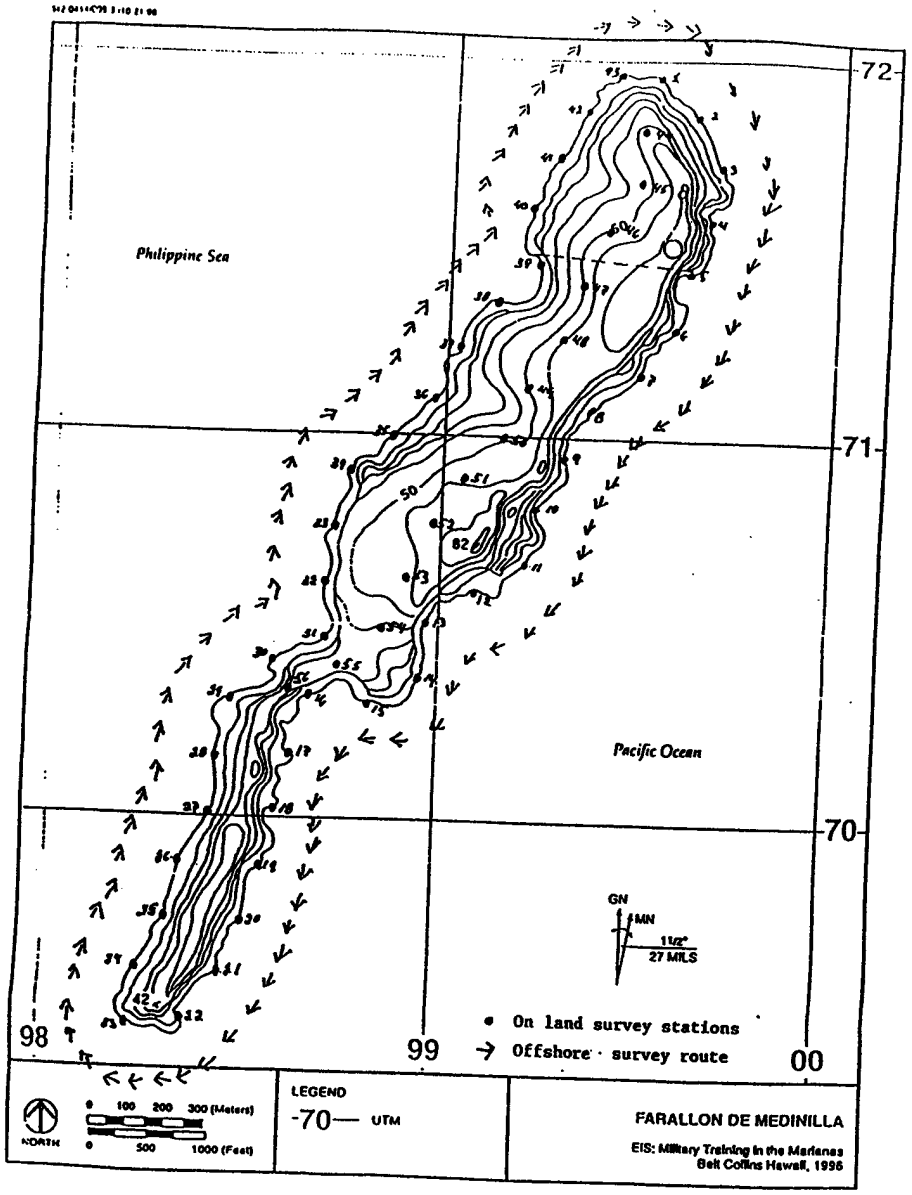
Melvin N. Kaku
MELVIN N. KAKU
By direction

Copy to:
COMNAVMARIANAS (N4)

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U.S. Fish and Wildlife Service
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Program Manager
National Marine Fisheries Service
2570 Dole Street
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Belt Collins Hawaii
680 Ala Moana Boulevard, First Floor
Honolulu, HI 96813-5406


Philippine Sea
Pacific Ocean
72
71
70
98
99
00
GN
MN
11/2°
27 MILS
• On land survey stations
→ Offshore survey route
LEGEND
-70— UTM
0 100 200 300 (Meters)
NORTH
0 500 1000 (Feet)
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

ENCLOSURE(1)

Appendix E
The Brown Tree Snake (BTS) Reports

E-1: **The Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises**

E-2: **USDA Wildlife Services Brown Tree Snake Control Procedures In Support of Scheduled Military Training Exercises**

Appendix E-1
The Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises

DEPARTMENT OF THE NAVY
U.S. PACIFIC FLEET
COMMANDER U.S. NAVAL FORCES MARIANAS
FPO AP 96536-0051

IN REPLY REFER TO:
5090
Ser N45/1906
31 OCT 1996

From: Commander U.S. Naval Forces Marianas

Subj: BROWN TREE SNAKE (BTS) CONTROL PROGRAM

Encl: (1) BTS Control/Interdiction Plan for Military Training Exercises

1. Enclosure (1) is forwarded for information.

2. Point of contact is LCDR Bryan K. Jagoe, Environmental Programs Officer, at (671) 349-5241/2.

J. M. LOFASO
By direction

Distribution:
USCINCPAC REP GUAM/CNMI/FSM/
ROP//COMNAVMARIANASINST 5216.1Q
List I, II, & III

Copy to:
PACNAVFACENGCOM, Pearl Harbor, HI
(Codes 23, 231)

Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises

Prepared by:
Commander U.S. Naval Forces Marianas
Facilities & Environment, N45

1 October 1996

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E. U.S. Department of Agriculture/Animal Damage Control (USDA/ADC)
F. National Biological Survey
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C. BTS Control Procedures at Tent City
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BROWN TREE SNAKE (BTS) CONTROL PLAN

1 October 1996

This plan provides brown tree snake (BTS) control requirements to those responsible for cargo handling, and inspection and cleaning of vehicles, equipment and supplies as well as ships and aircraft involved in military training exercises that emanate or transhipp through Guam

I. Introduction.

A. Purpose: The purpose of BTS inspection and control is to prevent the spread by inadvertent transportation of the BTS from Guam to other areas of the world. Emphasis is placed on those areas most at risk from Guam training activities, including the Commonwealth of the Northern Mariana Islands (CNMI), Hawaii and other snake-free Pacific Islands.

B. Background Information

1. The U.S. military trains routinely on Guam and the CNMI. Deployments for training on Guam and the CNMI can occur from virtually anywhere. Once on Guam, military units must take special precautions to prevent the inadvertent introduction of the BTS to other snake-free areas. This could result in an ecological disaster similar to that on Guam that has caused the loss of most of its native bird species. This could also hamper future training activities emanating or transiting through Guam.

2. Department of Defense (DoD) has supported BTS control efforts in a number of ways. In 1993, the DoD entered into a Memorandum of Agreement (MOA) with the U.S. Department of the Interior (DOI), U.S. Department of Agriculture (USDA), the Government of Guam (GovGuam) and the State of Hawaii, and developed cooperative efforts to participate and pursue BTS research, control, inspection and eradication efforts. A copy of the MOA is attached as enclosure (1).

II. Responsibilities.

The following categorized responsibilities provide a foundation for required action by certain agencies or individuals involved with the military training exercise and BTS control/interdiction program.

A. DoD: Enclosure (1) cites DoD's general responsibilities and commitment to BTS control.

B. Headquarters or Highest Operational Command: When lower echelon commands need upgraded manpower requirements for inspection and control requirements, this level of command should be consulted for support.

C. Shore Installation Commanders:

1. As land and facility managers and when deemed appropriate and necessary, establish snake sterile zones for staging of equipment and cargo. Assistance and support can be provided by the USDA, Animal Damage Control (ADC).

2. Coordinate all cargo handling procedures for cargo departing Guam with USDA/ADC personnel. Cargo handlers and/or managers will be required to work closely with USDA/ADC personnel to ensure an effective BTS control and inspection process is achieved.

D. Commander of On-Site Deployed Command:

1. Schedule BTS control briefings by USDA or Military Inspectors (MI) for members involved in the deployment. The MI may be those DoD members involved with cargo management, handling, and transportation at military shipping and aircraft ports on Guam.

2. Coordinate with on-site contacts to obtain wash down facilities and inspections. If no facilities available, exercise planners should plan for and provide for units wash down equipment.

3. Develop unit plans for wash down operations of equipment and vehicles.

4. Certify vehicles and equipment have been properly cleaned prior to transportation off Guam.

E. USDA/ADC:

1. Provide BTS qualified ADC specialists in appropriate numbers to cover military exercises.

2. Provide all pre- and post- training operations BTS trappings (includes required maintenance, placement, etc.).

3. Provide all pre- and post- training operations BTS fence line/jungle BTS spotlight searches.

4. Provide handling/scheduling of detector dog use at all identified shipping and aircraft ports on Guam.

5. Assist in establishment of cargo containment areas and sterile areas.

6. P e available detector dogs and handlers to assist military insp tions of surface and air cargo.

7. Identify and purchase (if unavailable for loan through military) necessary tools, materials and equipment.

F. National Biological Survey (NBS): Provide technical support for issues regarding BTS control.

G. Military Inspectors (MI): Local MI responsible for cargo transportation or inspection will be expected to work closely with ADC personnel to execute BTS control and interdiction with cargo. The inspection of cargo by the MI must coincide with ADC control measures, i.e., detector dog use. Documentation of inspections shall be maintained by the military transporters or inspectors at the shipping and aircraft ports on Guam.

III. <u>Control, Cleaning and Inspection Procedures</u>.

A. Risk: The possibility of the inadvertent importation of the BTS to other areas of the world is always present whenever military units emanate or transit through Guam. BTS is a heat sensitive nocturnal snake that will seek shelter during the heat of the day in any area that offers shade, including CONEX boxes, shipping crates, pallets, vehicles, personal gear, as well as aboard aircraft and naval vessels. The snakes's ability to go without food for extended periods of time allows them to survive long voyages or flights undetected. Cargo and material may be categorized into the following levels of risk in terms of containing or housing a BTS:

1. Low Risk. Material originating off island and on Guam only during daylight hours or within sterile areas during nighttime hours.

2. Moderate Risk. Material on island for several days or more and exposed to entry by snakes due to use or storage outside snake sterile areas.

3. High Risk. Material originating from Guam, stored for extended periods, or in regular use.

B. BTS Control Measures on Guam:

1. During a scheduled DoD training exercise involving the shipment of military personnel and associated cargo off island via ship (Apra Harbor) and/or aircraft (Andersen AFB), USDA/ADC will provide BTS control support to military. This support will include those arrangements associated with the identification and purchase of BTS control tools, materials, and equipment needs. ADC will provide available personnel and trained detector dogs throughout the exercise on Guam. To ensure BTS control continues, ADC will rely on a close working relationship with military cargo managers and appropriate Installation Commanders.

2. Prior to exercise, ADC will intensify BTS trapping in sterile areas and aircraft staging areas on Guam. These areas shall include up to 500 meters from the established sterile areas and transport crafts. Night spotlight searches will be conducted in the same areas to further reduce BTS when they are most

active.

C. BTS Control Procedures at Tent City:

1. USDA/ADC should be consulted in establishing the most favorable locations for tent facilities based on low risk areas.

2. Surrounding the immediate vicinity of temporary lodging quarters on Guam, ADC will activate and monitor BTS traps. Traps will be placed at strategic locations suspected of attracting snakes.

3. Particular caution shall be exercised during breakdown and re-packing of tent facilities.

D. BTS Control Procedures in Tinian or Other Off-Island Locations for Major Training Exercises:

1. Prior to the arrival of the first military cargo from Guam, ADC will have an established working relationship with the local wildlife and quarantine officers. As part of a BTS prevention operation, ADC will identify, purchase, and arrange for transport or BTS control tools and materials prior to the training exercise. ADC will coordinate and train assisting local wildlife and quarantine personnel to provide coverage during the exercise.

2. Additional traps will be made available by USDA/ADC and activated throughout the training exercise if deemed necessary. Traps will be deployed prior to arrival of inbound traffic from Guam and shall be maintained for an appropriate amount of time after the exercise. Some of the traps will be at drop zones and port of entry. Established take-off zone(s) will also have traps activated. Additional BTS traps shall be made available for contingency and in case a BTS is sighted.

E. Cleaning Procedures:

1. It is the responsibility of the training unit to clean vehicles and heavy equipment prior to staging in a designated sterile/containment area and prior to transportation off Guam. High pressure cleaning may facilitate the removal of BTS from vehicles and equipment.

2. The following commands may be contacted to provide cleaning facilities and staging support:

(a) Andersen AFB Vehicle Operations: 366-2239, 24 hours, 7 days per week.

(b) Naval Activities, Guam (NAVACTS GU), Staff Civil Engineer Office (SCE), Code N50, 339-7053; NAVACTS GU Ordnance Annex Transportation, 339-7210; and Camp Covington, Battalion Washrack, Operations Chief, 339-7171.

(c) Ship Repair Facility, Guam (SRF GU) SCE, Code 400: 339-2167/2066.

(d) USDA/ADC for information on snake sterile areas: Andersen AFB Office: 366-3261; Barrigada Heights District Office: 635-4400; and NAVACTS Office: 564-3900.

F. Inspection Procedures on Guam:

1. ADC will assist DoD personnel in the establishment of a loading zone where all outgoing cargo (including cargo off-loaded and then reloaded) can be staged and inspected. Working closely with the military, and when deemed appropriate, ADC will search all cargo using trained detector dogs. High-risk equipment/materials may be subject to detector dog inspections, breakdown, fumigation, or staging in sterile containment areas. Any containerized cargo suspected of housing a BTS will be opened by the military. Interior contents will be further inspected to verify and remove any discovered BTS. Personal gear and other hand-carried equipment and supplies will be staged in established sterile containment areas and inspected when appropriate. High-risk materials subject to thorough inspection may be adjusted to a lower risk category once inspected and staged in a sterile area.

2. For the purpose of maintaining open lines of communication, DoD will provide ADC names of military contacts at shipping/airport facilities. ADC will keep these DoD designated contacts abreast of BTS related activities. To assist with the scheduling of inspections, ADC would request within reason, that some form of notification be provided when unscheduled changes/delays occur.

G. Inspection Procedures at Tent City:

1. Detector dogs will be walked through the area periodically while troops are being stage before departure.

2. Prior to departure off-island, military personnel shall check all of their personnel belongings thoroughly for snakes. DoD will brief military personnel associated with the training exercise on the concerns of BTS as they arrive. As time allows, ADC will assist designated DoD personnel with BTS orientation.

H. Inspection Procedures on Tinian, CNMI or Other Off-Island Locations:

1. Temporary structures shall be erected in drop zone(s) and port of entry cargo off-load area(s) to enhance snake detection when deemed necessary. Floodlights will be provided by the military to assist ADC and wildlife and/or customs officer with night inspections while personnel/cargo off-loading is taking place.

2. Nights when inbound traffic is arriving, ADC and military will coordinate spotlight search of areas in close proximity to established off-load and breakdown locations. Visual checks of these areas should be conducted periodically. The military shall place emphasis on visual inspections during all cargo off-load and breakdowns.

IV. Guidelines for BTS Sighting During Military Operations.

A. BTS Sighting on Guam: During military operations on Guam, USDA/ADC will be the primary point of contact in the event of a BTS sighting. Do not attempt to capture and/or disturb the snake. If the presence of a BTS is suspected and/or visually sighted, immediately contact your local ADC office as follows:

- Andersen AFB K9 Office: 366-3261
- USDA/ADC Guam District Office Barrigada Heights: 635-4400
- USDA/ADC, NAVACTS Office: 564-3900

1. Any sighting of snakes by the military shall be reported immediately to the chain of command. Unit or Group Commanders will immediately notify ADC personnel and local wildlife and quarantine personnel.

2. DoD shall assist ADC and local officials in the interdiction of snakes when requested by USDA/ADC and local officials.

3. If a BTS is suspected of being housed in cargo or equipment, a military official shall open the container to allow thorough inspection by USDA/ADC personnel or detector dog(s).

4. Once notified, USDA/ADC will dispatch either personnel or BTS detector dogs to the vicinity of a sighting.

B. BTS Sighting on Tinian, CNMI or other Off-Island Location: During a military training exercise on Tinian, CNMI or other off-island location, the local natural resource agency shall be the primary point of contact:

- Tinian, CNMI: Division of Fish and Wildlife
  CNMI Government
  Saipan, MP 96950
  Telephone: (670) 322-9627/8
  FAX: (670) 322-9629

To obtain points of contact for other locations in the Pacific, call:

USDA/ADC
Guam District Office
Telephone: (671) 635-4400
FAX: (671) 635-4401

1. If a BTS is seen or suspected, the unit's chain of command shall be immediately notified. The Unit Commander or Officer in Charge shall immediately notify the local wildlife official, USDA/ADC Guam District Office and USCINCPAC REP Guam Command Center at (671) 349-5235/6.

2. If a snake is sighted, care should be taken not to be bitten. A BTS is only mildly toxic; however, a snake spotted on other Pacific Islands may be of the more dangerous, venomous species. If a person is bitten by a snake, the snake should be killed and, if possible, kept refrigerated, or frozen, or placed in alcohol, until it can be turned over to the proper natural resource agency or health official.

3. Notification procedures of a snake sighting should be considered an integral part of any training deployment plan.

4. If deemed necessary, USDA/ADC will make special arrangements to airlift a detector dog and handler to off-island location where the suspected BTS is sighed during a military training exercise.

5. USDA/ADC or local wildlife officials, when notified by military, of a BTS sighting, shall respond immediately by visual inspection and BTS traps, if deemed appropriate.

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3000

ACQUISITION

Honorable Allen Stayman
Deputy Assistant Secretary
Territorial and International Affairs
10th and C Streets, NW
Washington, DC 20240

17 AUG 1993

Dear Mr. Stayman:

Enclosed are four signed copies of the "Memorandum of Agreement (MOA) Among the U.S. Department of Interior, U.S. Department of Defense, U.S. Department of Agriculture, Government of Guam, and the State of Hawaii" regarding the Brown Tree Snake. We have retained one copy for our files.

The Director of the Armed Forces Pest Management Board is designated as the DoD Project officer to coordinate military obligations in the MOA. Captain Herbert Bolton, MAC, USN, currently holds that position.

We look forward to the continued progress that can be obtained through this MOA in containing and preventing the spread of the Brown Tree Snake. We also look forward to results that we can obtain with you through our Department's participation on the Brown tree Snake Control Committee under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 Task Force.

If you have questions, please call Captain Bolton at (301) 427-5191.

Very truly yours,

Sherri Wasserman Goodman
Deputy Under Secretary of Defense
(Environmental Security)

Enclosures: (4)

Environmental Security — Defending Our Future

002

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

JUL 19 1993

The Honorable Sherri Wasserman Goodman
Deputy Under Secretary of Defense
(For Environmental Security)
The Pentagon - 3D833
U.S. Department of Defense
Washington, D.C. 20301-4000

Dear Ms. Goodman:

Enclosed please find the modified "Memorandum of Agreement Among the U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Agriculture, Government of Guam, and the State of Hawaii" regarding the Brown Tree Snake.

As you are aware, this modification has been jointly development by the parties involved in the original agreement, with additional inputs from the U.S. Department of Agriculture and State of Hawaii. We sincerely appreciate the comments and suggestions provided by your office at the start of the process.

If you concur, please sign all five copies. Retain one copy for your files, and please return the remaining four signed copies to my office.

Please call me if you have any questions.

Sincerely,

Allen Stayman
Deputy Assistant Secretary
Territorial and International Affairs

Enclosures (5)

APHISAGMT. NO:
12-34-73-2241-MU

AMENDMENT TO
MEMORANDUM OF AGREEMENT
Among
U.S. Department of the Interior
U.S. Department of Defense
U.S. Department of Agriculture
Government of Guam
State of Hawaii
Commonwealth of the Northern Mariana Islands

Following page 12 of the Memorandum of Agreement executed in 1993, the following language shall be included:

The Commonwealth of the Northern Marianas (CNMI) shall assume the lead responsibility for specific on-island control and inspection research and other efforts required to establish desired levels of control and localized elimination of the brown tree snake within the CNMI.

Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating on-site activities with the designated project research or control personnel of the cooperating entities.

2. Developing specific plans for the use of funds provided for on-island control research and pilot control/ elimination programs.

3. Providing locally appropriated funds for research, control, and inspection efforts to augment other programs.

4. Facilitating access for responsible personnel of the cooperating entities to enter lands on the islands under the jurisdiction of the CNMI and when appropriate assist in obtaining permission for entry to private lands.

5. Exchanging information with cooperating entities on the incidents of snake movements in civilian aircraft, surface vessels, and cargo, and on other incidents involving snakes within the CNMI includir, snake bites to humans, predation on domestic, agricultural, introduced and native animal species, and other potential problems.

6. Developing of educational programs and materials for local citizens, businesses, and other interested parties.

For the Secretary of the Interior — Date: 4/18/96

For the Governor of the Commonwealth of the Northern Mariana Islands — Date: 5/24/96

APHIS AGMT. NO:
12-34-73-2241-MU

MEMORANDUM OF AGREEMENT
Among
U.S. Department of the Interior
U.S. Department of Defense
U.S. Department of Agriculture
Government of Guam
State of Hawaii

I. BACKGROUND:

The brown tree snake (Boiga irregularis), presumably introduced to Guam by post-World War II cargo movements, has produced a variety of ecological, technical, and socioeconomic problems on Guam. In the near future snakes colonizing other Pacific Islands as a result of military and civilian traffic from Guam may greatly magnify the problems caused by this snake.

To continue to address this problem an intensive and coordinated effort aimed at dealing with snakes in a broad spectrum of situations would:

- control and eradicate snakes in agricultural, port, and urban situations;
- prevent the spread of the snakes to any other area through strong airport and seaport inspection programs;
- protect endangered species on military and civilian lands.

II. PARTICIPANTS:

This AGREEMENT is hereby made and entered among: Department of the Interior, (hereinafter referred to as "Interior"); Department of Defense, (hereinafter referred to a "Defense"); Department of Agriculture, (hereinafter referred to as "Agriculture"); the Government of Guam, (hereinafter referred to as "Guam"); and the State of Hawaii (hereinafter referred to as "Hawaii").

III. FEDERAL AUTHORITY:

This AGREEMENT is written under the authority of Public Law 86-797, the Sikes Act (16 U.S.C. 670a-o); Public Law 97-304, the Endangered Species Act and amendments of 1982 (16 U.S.C. 1531, et seq); Public Law 85-624, the Fish and Wildlife Coordination Act as amended (16 U.S.C. 661); the Animal Damage Control Act of 1931 as amended (7 U.S.C. 426); the Law on Territorial and Insular Possessions (48 U.S.C.); the Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. 4701-4741); and the FY 1992 Farm Bill, as amended.

IV. PURPOSE AND OBJECTIVES OF AGREEMENT:

This AGREEMENT is made for the purpose of establishing a working relationship among Interior, Defense, Agriculture, Guam, and Hawaii to facilitate pilot inspection, control, and research programs and other activities allowing control or elimination of

brown tree snakes on Guam, and prevention of the transport of brown tree snakes to any other areas. All signatory parties have a vested interest in reducing the damages caused on Guam, minimizing the threat to endangered species, and protecting other U.S. insular areas from the harmful pest species.

V. TERMS OF AGREEMENT:

This AGREEMENT shall become effective upon signature by all parties. It shall remain in force for five (5) years at which time the cooperative program will be reviewed, and may be extended upon mutual consent.

VI. REIMBURSEMENTS AND COST CEILINGS:

By joining in this AGREEMENT all parties are acknowledging the importance of brown tree snake control in the Pacific Region and the need for cooperative efforts to solve the resultant problems. Signatory parties may provide and transfer funding to cover the costs of such research, control, inspection or eradication efforts between themselves without being subject to overhead or other indirect costs. Nothing in this Agreement commits any signatory to present or future funding amounts. To date all parties to the agreement have contributed research funds.

VII. ANNUAL MEETING:

The Project Officers of the cooperating parties will meet annually during the first quarter of each fiscal year to determine objectives for the coming year, the amount of funding needed for those and future efforts, and the appropriate sources of funding for conducting necessary work.

VIII. TRANSFER OF FUNDS:

Efficient and effective implementation of research and control efforts pursuant to this Agreement requires that funding for each Fiscal Year be identified and made available at the beginning of each year or as soon as possible to avoid any interruption of work.

IX. MUTUAL CONSENT:

Each party agrees to cooperate with the other parties and fulfill their obligations as herein provided. All parties agree to full cooperation in development, coordination and implementation of present and future plans regarding research and eradication of the brown tree snake in Guam. Any of the parties may fund or directly initiate necessary research and control efforts if funds and qualified personnel are available. Research results shall be disseminated when they become available and each party reserves the right to publish or distribute results in any manner deemed appropriate.

X. SPECIFIC OBLIGATIONS OF THE PARTIES:

A. INTERIOR OBLIGATIONS:

Interior, in cooperation with the other signatory parties, shall assume the lead responsibility for disseminating information and training of personnel within U.S. affiliated insular governments, and in encouraging the development of control and elimination techniques, including those necessary to prevent dispersal of snakes to other islands as a result of civilian and military traffic and commercial and non-commercial carriers. Specific obligations include, but are not limited to:

1. Designating a Project Officer from the Office of Territorial and International Affairs with responsibilities for coordinating activities associated with the snake program and representing Interior in coordination meetings.
2. Seeking future funds, as appropriate, to reduce the impact of snakes on Guam and control dispersal to the other areas, in keeping with past performance of providing funds for the pilot control and research program for Fiscal Years 1990, 1991 and 1992.
3. Distributing appropriated funds as needed to various agencies and governments. Guam will

receive no less than 15% of amounts appropriated for brown tree snake control and inspection during the period of this AGREEMENT.

4. Coordinating the annual meeting, described in paragraph VII above, and coordinating current program year reviews and meetings, as required.
5. Assisting in developing informational brochures, educational programs, and other instructional materials for use by Federal, state, insular and local governments.
6. Taking the lead in conducting the research needed to allow control or elimination of the brown tree snake on Guam by:
   a. Designating a Principal Investigator from Region 8 (Research), Fish and Wildlife Service, to lead research pursuant to this AGREEMENT and provide technical guidance, including technical meetings as required, for the cooperating entities.
   b. Designating a Project Officer from Region 1 (Pacific Islands Office), Fish and Wildlife Service (FWS), for coordinating activities on Guam and the Pacific Islands among FWS, Interior, Defense, Hawaii and Agriculture.

7. Making arrangements for FWS researchers and cooperating scientists to conduct field and laboratory studies pursuant to this AGREEMENT.

8. Providing annual progress and final reports on all research conducted in fulfillment of this AGREEMENT.

B. DEFENSE OBLIGATIONS:

Defense, in cooperation with the signatory parties, shall assume the lead in promoting and supporting studies to develop control techniques for the brown tree snake in military situations on Guam and to prevent dispersal in military traffic to other Pacific islands. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating with the designated project and research personnel of cooperating entities.

2. Providing financial or logistical support, subject to availability, for control and research or perform pilot control and research programs as necessary.

3. Continuing use of military customs inspection program to insure inspection of military cargo areas, military aircraft, cargo, and vessels to prevent import and export of the brown tree snake.

4. Facilitating access for responsible personnel of the cooperating parties to enter military lands on Guam to conduct control and research projects on the brown tree snake pursuant to this AGREEMENT.

5. Exchanging information with cooperating parties on the incidents of snake movements in military traffic and information appropriate to defining the risk of future movement within limits imposed by security and military information protocols.

6. Assist in producing informational brochures and other educational material for military and civilian personnel within Defense and providing training for controlling the brown tree snake in military situations on Guam and preventing its dispersal in military traffic to other areas.

C. AGRICULTURE OBLIGATIONS:

Agriculture shall assume lead responsibility for the development and implementation of appropriate brown tree snake control and develop an inspection program in cooperation with the other parties to this AGREEMENT. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating activities associated with the brown tree snake program.
2. Providing funds, subject to availability, for control research, inspection and other associated projects, as determined by Agriculture as necessary, for snake control.
3. Cooperating in planning and implementation of a brown tree snake control program on Guam in concert with Interior, Defense, Guam and Hawaii.
4. Making arrangements for Agriculture biologists, support technicians and collaborators, and cooperating scientists to conduct field work trials pursuant to this AGREEMENT.
5. Assisting in developing informational brochures, educational program, and other instruction materials for use by Federal, state, insular and local governments.

D. GUAM OBLIGATIONS:

Guam shall assume lead responsibility for specific on-island control and inspection research, and other efforts required to establish pilot control and localized elimination programs of the brown tree snake. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating on-site activities with the designed project and research personnel of the cooperating entities.
2. Developing specific plans for the use of funds provided for on-island control research, and pilot control and elimination programs, with concentration on the civilian airport and seaport areas.
3. Providing locally appropriated funds for research, control and inspection, and perform research, control and inspection efforts determined necessary by the entities.
4. Facilitating access for responsible personnel of the cooperating entities to enter lands on the islands under the jurisdiction of Guam, and when appropriate, assist in obtaining permission for entry to private lands.
5. Exchanging information with cooperating entities on the incidents of snake movements in civilian

aircraft, vessels and containers.

6. Exchanging information with cooperating entities on incidents of snake bites to humans, incidents and statistics regarding predation to domestic and non-domestic fowl, mammals and other species, and development of educational programs for local citizens, businesses and other interested parties.

E. HAWAII OBLIGATIONS:

Hawaii shall assume lead responsibility for specific on-island research, inspection and control program to reduce the potential for the import of the brown tree snake to the State of Hawaii. Specific obligations include but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating on-site activities with the designated project and research personnel of the cooperating entities.
2. Developing specific plans for use of funds provided for development and implementation of an on-island inspection program using detector dogs and pilot control and detection programs.
3. Facilitating access for responsible personnel of the cooperating entities to meet and work with

Hawaiian researchers, control, and inspections personnel.

4. Exchanging information with cooperating entities on incidents of snake movements in civilian and military aircraft, vessel and containers.

XI. SPECIAL TERMS AND CONDITIONS:

The obligation of the cooperating parties for performance of this AGREEMENT is contingent upon the availability of staff and funds.

XII. AMENDMENTS:

Amendments to the INTERAGENCY AGREEMENT may be proposed by any signatory party and shall become effective upon execution by all parties of a written instrument.

XIII. TERMINATION:

This INTERAGENCY AGREEMENT may be terminated by any party upon a 60-day written notice to the other cooperating parties.

IN WITNESS WHEREOF, each party hereto has caused this INTERAGENCY AGREEMENT to be executed by an authorized official on the day and year set forth opposite their signature.

For the Secretary of the Interior

Title: Assistant Secretary
Date: 31 Dec. 1992

For the Governor of Guam

Title: Governor
Date: 2-5-93

For the Secretary of Defense

Title: Deputy Under Secretary
Date: 8/12/93

For the Secretary of Agriculture

Title: Asst. Sec. NRE
Date: June 21, 1993

For the State of Hawaii

Title: Governor
Date: MAR 25 1993

Appendix E-2
USDA Wildlife Services Brown Tree Snake Control Procedures In Support of Scheduled Military Training Exercises

USDA Wildlife Services
Brown Tree Snake Control Procedures
In Support of Scheduled Military Training Exercises

INTRODUCTION

During a scheduled Department of Defense (DOD) training exercise involving the shipment of military personnel and associated cargo off island via ship and/or aircraft, USDA, Wildlife Services (WS) will provide brown tree snake control support. This support to DOD will include arrangements associated with the identification, purchase, operation, and maintenance of available brown tree snake control tools, including: brown tree snake traps, nightly spotlight search of accessible perimeter fence lines, and the installation of cargo containment areas/temporary snake barriers. In addition, WS will provide personnel and specially trained detector dogs 24 hours/7-day per week during deployment and post- exercise redeployment activities. To ensure effective communication with exercise participants, WS will rely on a close working relationship with military cargo managers and appropriate Installation Commanders.

SCOPE OF WORK- GUAM

Trapping/nightly fence line search: WS personnel will intensify brown tree snake trapping activities at or near identified cargo, ship, and aircraft staging areas on Guam. This shall include the removal of brown tree snakes up to 500 meters from identified staging areas. Traps will be placed on chain link fencing and/or along the perimeter of the jungle. Traps will be spaced at approximately 20 meter intervals and all associated maintenance, including care of the live mouse used as bait, cleaning, and repair, will be the responsibility of WS. Nightly spotlight searches with high-intensity flood lights will be conducted by WS in the same general areas to augment trapping of snakes.

Snake detector dogs: WS will use specially trained snake detector dogs (Jack Russell Terriers) to inspect staged cargo and accessible shipping vessels (ships/aircraft) from Apra Harbor and Andersen AFB. Up to 14 detector dog teams (team = 1 handler and 1 dog) will be made available as necessary. Detector dog teams will be scheduled into three work shifts including: day-shift (0700 - 1600); swing-shift (1600 - 0100), and grave-shift (0100 - 0900).

Use of temporary barriers: WS will assist DOD personnel in the establishment of a loading zone where all outgoing cargo including cargo off-loaded and then reloaded can be staged and inspected. WS will inspect 100% of cargo using snake detector dogs. Any containerized cargo suspected of housing a brown tree snake will be immediately "flagged" (marked with florescence ribbon) and a DOD authorized point of contact will be notified for opening the container. Once opened, the interior contents will be inspected with the dogs to verify and remove any brown tree snakes. WS detector dogs will also inspect accessible transport craft (ship, barge, and/or aircraft) prior to departure from Guam. Cargo, vehicles, and equipment held within established containment areas for more than two hours will be subject to additional inspection prior to loading for departure. Likewise, transport craft left stationary for more than two hours will also be inspected a second time by WS prior to departure.

To prevent brown tree snakes from entering the cargo containment area on Andersen AFB, WS personnel will install a temporary snake barrier system. The barrier will consist of erecting angled sections of a weather shade netting to prevent snake access to staged cargo. The netting will be supported by re-bar, PVC pipe, and sand bags. DOD will establish the approximate position of the barrier entrance and exit points.

All heavy equipment and vehicles will be thoroughly steam-cleaned by DOD designated personnel prior to entering the cargo containment areas. All heavy equipment and/or vehicles found not to have been steam-cleaned will not be inspected by the WS detector dog teams.

For tracking purposes, WS will identify inspected items within the Guam containment areas by affixing a stamp and/or tag to cargo or an available cargo manifest denoting the words: "Snake-Inspected" together with date and time the inspection occurred. Once a particular shipment of cargo reaches it's destination (i.e., Tinian) the stamp and/or tag must be removed from the cargo or manifest.

As an additional precaution, a number of brown tree snake traps will be activated and monitored in the vicinity of the cargo containment areas.

Tent City: Surrounding the immediate vicinity of temporary lodging quarters on Guam, WS will activate and monitor brown tree snake traps.

The WS detector dogs will be walked through the area periodically while troops are being staged prior to departure from Guam.

Prior to departure off-island, DOD personnel will thoroughly check all of their personnel belongings for snakes. DOD will brief military personnel associated with the training exercise on the concerns regarding brown tree snakes. As time permits, WS personnel will assist designated DOD personnel with brown tree snake orientation.

SCOPE OF WORK - TINIAN (or other off-island locations)

Prior to the arrival of the first DOD cargo from Guam, WS will have an established working relationship with the local wildlife and/or customs officials. WS personnel will identify, purchase, and make arrangements with DOD to air transport required brown tree snake control tools (i.e., traps) and materials (i.e., temporary barrier components) prior to the training exercise. Designated WS personnel will coordinate with and train volunteering wildlife and/or customs officials to assist with brown tree snake interdiction measures.

Brown tree snake traps will be made available throughout the duration of the training exercise by WS. Traps will be fully operational (live mouse, food, and water) one week prior to inbound cargo from Guam. Some traps will be installed near drop zones and port of entry. Traps will

also be installed near established take-off zones.

An anti-coagulant toxicant (contained within a tamper proof bait box) will be used in and around brown tree snake trapping areas and near cargo containment/temporary snake barriers to reduce local rat populations. Removal of rats reduces the potential damage they inflict to traps and barrier material.

Sections of angled weather shade netting, similar to Guam, will be erected to secure established cargo drop zones and port of entry cargo off-load areas. Flood lights provided by DOD will assist WS and local wildlife and/or customs officials with night inspections of cargo and the barrier while DOD personnel off-load cargo.

During the nighttime arrival of inbound traffic from Guam, WS will coordinate spotlight searches of existing fence lines and/or jungle areas in close proximity to established drop-zones. Although these areas will primarily be targeted during inbound and exiting traffic times, WS personnel will conduct regular visual checks of these areas to reinforce brown tree snake interdiction measures.

Appendix F
Fire Prevention and Response Plan

TINIAN FIRE PREVENTION AND RESPONSE PLAN

Grass fires are regular occurrences on Tinian, and there is a greater danger during the dry season (February to April) than in the wet season (July to October). Some fires have been caused by persons clearing forested land with inadequate controls, and by careless of use campfires and cigarettes. Military training activities with its use of blank or live fire, signal and smoke devices and other pyrotechnics creates the risk of fires occurring in the training area. Fires spreads rapidly through the grasslands; and depending on weather conditions may or may not burn out when they hit the tangantangan (haole koa). Fires appear to burn more readily in "pristine" forests on the limestone cliffs.

Fire prevention measures start by assessing the fire risk and controlling the use of pyrotechnics, signal and smoke accordingly. The area authorized for open fires and pyrotechnics is North Field only (less actual emergency signaling). North Field's existing runways and taxiways act as fire breaks and fire access roads, and the vegetation is primarily tangantangan. No cooking will be performed in the exercise area, less heating individual field rations with heat tabs, and heating prepackaged meals (Tray-Packs) in portable units.

Fire response will be directed using standard communication nets, established prior to the start of major exercises. The nets will be managed by the Joint Exercise Control Group (JECG) using common communication nets, including satellite uplinks and telephone line as required. A command post and reception center will be established at West Field by COMNAVMARIANAS to coordinate with fire response assets and supporting agencies on Guam, as requested by JECG. Fire response communications will be rehearsed prior to exercise commencement.

Aviation operations involving fixed-wing personnel and cargo landings at North Field will require a P-19 Crash Fire Rescue Truck with six-man crew to be airlifted to Tinian as an initial lift from Guam.[1] The P19 will also be used to respond to brush fires within a limited distance from access roads. The truck will be equipped with fire-fighting foam used for aircraft fire response. The assigned logistic support unit will provide a five-ton truck and 1,000 gallon water container, together with a fire fighting crew and shovels. During the exercise, additional fire response capability will be provided by two U.S. Marine Corps helicopters with fire buckets, stationed on an amphibious ship offshore of Tinian. Prior to the Marines' arrival, helicopter bucket support (and medevac support) will be provided by HC-5.

To augment military fire response efforts, the Tinian Fire Department maintains a 300-gallon pump truck and fire crew to respond to wildfires. The Fire Department also maintains a 750-gallon pumper truck and crew in San Jose to respond to and provide fire service for the southern, occupied, portion of the island, and backup CFR support to West Field. Request for the use of these assets will be made through the COMNAVMARIANAS command post at West Field.

Source: Belt Collins Hawaii (Nov 1994) *Environmental Assessment, Military Exercise, Island of Tinian: Tandem Thrust 95.*

[1] Smaller exercises such as weekend National Guard exercises will not require P19 support, but will require advance coordination with West Field, and West Field CFR assets.

Appendix G
Revised Prefinal Military Exercises and Historic Sites in Military Training Areas on the Island of Tinian: An Archaeological Assessment (December 1996)

— REVISED PREFINAL —

MILITARY EXERCISES AND HISTORIC SITES IN THE MILITARY LEASE AREA OF THE ISLAND OF TINIAN, CNMI: AN ARCHAEOLOGICAL ASSESSMENT

by

David J. Welch and H. David Tuggle

Note: This Report Should Be Used In Conjunction With

THE TINIAN HISTORIC SITE PROTECTION PLAN FOR THE MILITARY LEASE AREA, 1996

Prepared for:

Belt Collins Hawaii
680 Ala Moana Blvd.
Honolulu, Hawai'i 96813

Prepared by:

International Archaeological Research Institute, Inc.
949 McCully St., Suite 5
Honolulu, Hawai'i 96826

December 1996

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INTRODUCTION

Approximately 16,100 acres on the Island of Tinian in the Commonwealth of the Northern Mariana Islands (Fig. 1) are under lease to the United States Department of Defense, and are managed by the Commander, Naval Forces, Marianas (COMNAVMAR). This area is known as the Military Lease Area (MLA) and is divided into two sections, the northern half is the Exclusive Military Use Area (EMUA) and the southern half is referred to as the Leaseback Area (LBA). The EMUA is used for periodic military training exercises and is not sub-leased to the public. However, there is no permanent military installation or staffed facility in the EMUA, and it is open to the public for recreational purposes when it is not in use for military training. The LBA is a joint use area, where both military and non-military activities may take place.

A draft Environmental Impact Statement (DEIS) has been developed for military training in the MLA. The present document is an assessment of the historic resources (generally defined as archaeological sites and historic buildings) in the MLA, prepared as a background document for the DEIS. It provides recommendations for site eligibility to the National Register of Historic Places (NRHP), an evaluation of the potential impacts of military training, and a summary of actions related to the protection of sites from military actions. A companion document that should be consulted is *The Tinian Historic Site Protection Plan for the Military Lease Area* (Tuggle and Welch 1996), which includes detailed recommendations for site protection related to the potential impacts of military training, as well as recommendations for protection of sites from other threats. Some of the text in the present report is duplicated in the *Site Protection Plan*.

Background

Preparation of this assessment is based on (1) information derived from existing archaeological survey reports, (2) consultation with archaeological contractors who have conducted surveys in conjunction with specific military exercises, (3) previous archaeological assessments and interim site protection plans (Welch and Bodner 1993; Welch 1994a and 1994b), (4) consultation with representatives of the Historic Preservation Officer of the CNMI and of the Office of the Mayor of the Municipality of Tinian (see Acknowledgments), (5) information of military training plans provided by Belt Collins Hawaii, with background information obtained from military training personnel for Tandem Thrust 95, and (6) field assessments. Portions of the present report have been taken from Welch and Bodner (1993) and Welch (1994a).

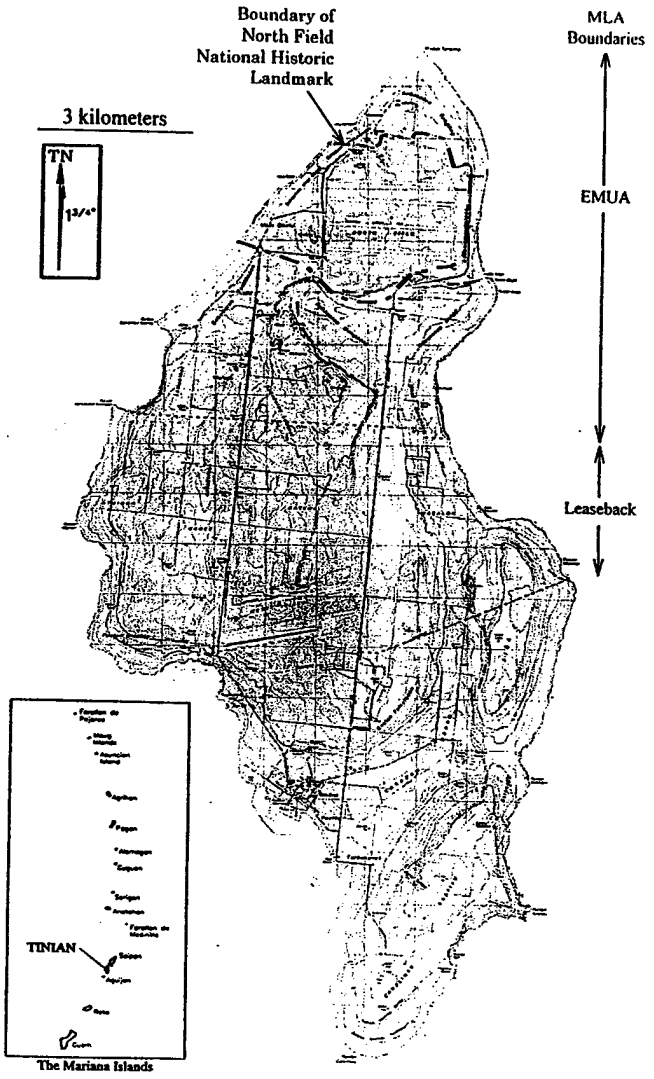


Figure 1. The Mariana Islands, showing Tinian and the project area.

Consultation and review have been effected through attendance at the Navy Tinian Cultural Resource Management Workshop in July 1994, several follow-up phone calls to the principal investigators for the archaeological surveys, review of reports provided by the Navy and/or the contractors, and by several meetings on Tinian and Saipan with staff of the CNMI Division of Historic Preservation.

Following the 1994 workshop, Welch and Tuggle undertook a one week in-field assessment of selected sites in the EMUA, focused on determining applicable and effective measures to protect sites in these areas from potential adverse impacts related to a military exercise planned for late 1994 (Welch 1994b). Subsequently, some site protective procedures were implemented by Tuggle and Jolie Liston in November 1994 and additional in-field site review and assessment were conducted at this time. Planning for public interpretation of selected sites as a part of site protection actions was also carried out during the two 1994 field trips.

For the present report, field assessment of historic resources was conducted by Welch and Tuggle from July 25 to August 2, 1996, with particular emphasis on evaluation of sites recorded by recent survey (Henry et al. 1996).

Two previous versions of the *Archaeological Assessment* have been prepared (Welch and Tuggle 1996a, 1996b). The present version includes a major change in site numbering, discussed below.

The Island of Tinian

The present document is limited in its purpose and does not include a description of the history and environment of the Island of Tinian. This information is summarized in the accompanying DEIS and may also be found in numerous recent publications (e.g., Farrell 1991; Henry et al. 1996; Bodner and Welch 1992).

The Undertaking and the Area of Potential Effect

Military training on Tinian may involve Guam-based elements of the U.S. Navy, U.S. Air Force, U.S. Army Reserve-Marianas, Guam Army National Guard, and Guam Air National Guard as well as U.S. Marine Corps elements from Okinawa and California, U.S. Army units from Okinawa, Hawai'i, and Alaska, U.S. Navy and USAF squadrons from Japan, and some allied forces (Belt Collins Hawaii 1995, 1996a). These exercises proposed for the EMUA (Fig. 2) include airfield operations by fixed-wing and helicopter-borne forces; ground maneuvers through much of the terrain, blank firing and pyrotechnic signals in certain areas; rapid runway repairs in one location at North Field; use of wheeled and tracked vehicles on paved taxiways, roads (and runways?); amphibious assault landings (and beach insertion/extraction) on beach sites; a permanent base camp; live fire weapons range;

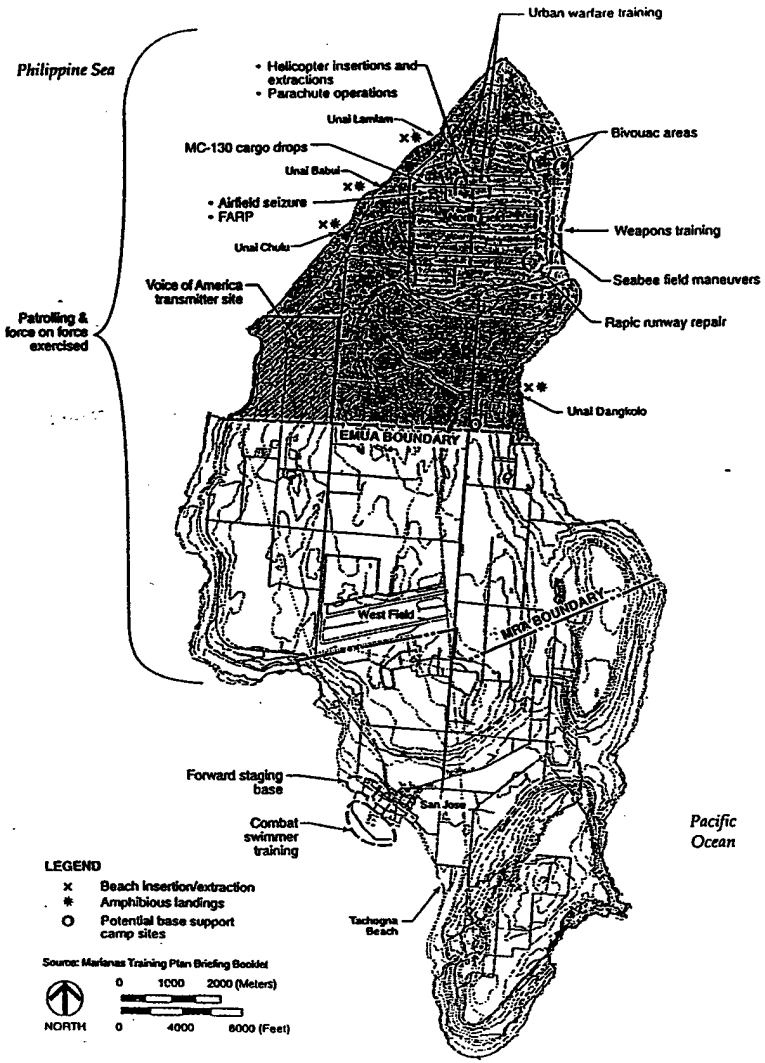


Figure 2. Proposed training areas, Tinian. (From Belt Collins Hawaii 1996a)

transmission of electromagnetic signals; use of demolitions and hand grenades; various logistic operations; bivouac areas; urban warfare training; cargo drops; and Seabee field maneuvers (Belt Collins Hawaii 1995: 13, Figure 7; 1996a: Figure 8; 1996b). In addition, in the LBA, West Field is a possible landing area for airmobile and airborne forces, with ground maneuvers from this area north into the EMUA.

Outside the MLA, it has also been proposed that San Jose Harbor be used for other force introductions, with adjacent forward staging bases, and for combat swimmer training (Belt Collins Hawaii 1995: 13 and Figure 7; 1996a). Kammer Beach has recently been proposed as an alternative landing beach for assault amphibious vehicles.

Based on this preliminary information, it can be concluded that the primary area of potential effect (defined as the area most heavily used) will be the EMUA (see Fig. 1), where most of the MLA archaeological surveys have been conducted. Because of these two factors, historic resources of the EMUA are emphasized in the following sections on inventory and significance. The LBA is discussed to some extent in these sections, but San Jose Harbor and Kammer Beach (outside the MLA) are considered only briefly because of the uncertainty of the proposed military activities in these areas.

HISTORIC RESOURCES INVENTORY

The historic resource inventory includes a listing of all of the historic sites recorded in the MLA, with recommendations regarding significance and eligibility to the National Register of Historic Places (Appendices A and B).

All of the historic resources in the MLA are archaeological sites. Some of these sites are the remains of buildings that have been afforded some inventory treatment as historic structures (e.g., Jones 1991, Bouthillier 1996). However, none of these structures have sufficient integrity as buildings to allow adequate evaluation and appropriate treatment according the guidelines of the U.S. Navy (Greenhorne & O'Mara, Inc. 1990) and thus in the present report are treated exclusively as archaeological sites, not as historic buildings.

Inventory Survey of the Military Lease Area

Prior to the early 1980s, only limited archaeological forays into north Tinian had been made (Thompson 1932; Spoehr 1957) and very few sites recorded. However, under federal historic preservation law and action, numerous archaeological surveys have now been carried out in the MLA (Fig. 3; Table 1), with the most recent survey conducted to complete coverage of most of the area planned for military use in the EMUA (Henry et al. 1996) (Fig. 4).

Inventory survey and selected test excavations have been conducted in most of the EMUA (Figs. 3 and 4), with the only incomplete coverage being in the area surveyed for Voice of America (VOA) (Fig. 3), although not all EMUA areas have been covered with the same intensity (Table 1 and Fig. 5) It is probable that the area west of 8th Avenue will be used by VOA and will not be used for military training. Thus, relevant to military training in the EMUA, only the VOA survey section east of 8th Avenue should be considered insufficiently inventoried for historic resources, if the variation in survey intensity of the EMUA is acceptable.

The Leaseback Area, in contrast, has had only selected survey and site specific search (Fig. 3). Only the 8th avenue corridor has been intensively survey, and as a result the historic resource inventory coverage of the region is incomplete.

The coastal strip behind San Jose Harbor and Kammer Beach was surveyed by Spoehr (1957) and later by Thomas (1980).

The sites identified in these surveys are listed in Appendices A and B.

Table 1. Archaeological Projects in the Military Lease Area.

Survey Report	Location	Intensity	Area
Bouthillier (1996)	sites in the EMUA	selected sites	NA
Craib (1993)	six parcels in North Field area	medium	800 acres
Craib (1994; in prep)	Unai Dangkulo, Banderon Nunu, portion of Mt. Lasu, (area north of House of Taga, outside present MLA)	low; limited test excavations	600 acres
Craib (1995)	(1) portion of North Field (2) northern roadways (3) Unai Chiget	medium low low	500 acres linear 28 acres
Denfeld (1983)	North Field	site specific search	NA
Donham (1986)	northern end of North Field	medium	312 acres
Eble et al. (1995)	proposed VOA areas, western area of MLA	low (sample reconnaissance)	small sample of 2,400 acre area
Franklin and Haun (1995a)	Hagoi area, Unai Dangkulo area	high	200 acres
Franklin and Haun (1995b)	8th Ave. road corridor	high, with emergency data recovery	ca. 18 km
Haun (1988)	north end of North Field	medium	40% sample of 80 acres
Haun et al. (1990)	north end of North Field	medium	37 acres
Henry and Haun (1995)	8th Ave. road corridor	testing Franklin and Haun (1995b) locales	ca 18 km
Henry et al. (1996)	major portion of EMUA	intensive	4,162 acres
Jimenez et al. (1996)	Unai Chulu (Site TN-073)	testing	NA
Jones (1991)	historic structures	site specific search	NA
Moore et al. (1986)	coastal zone and selected mountain areas	intensive	1,779 acres

Archaeological Research in the EMUA

Several cultural resource surveys have been conducted within the Exclusive Military Use Area (Figs. 3 and 4). These were designed with different objectives in mind, but together they provide survey at various levels of intensity for most of the EMUA. In addition to field surveys, extensive archival research, primarily of World War II documents, has been carried out. Test excavations have been conducted at several prehistoric sites.

Modern archaeological research in the area was initiated in the early 1980s (1980, 1983, and 1984) by D. Colt Denfeld (1983, 1992) for the CNMI Historic Preservation Office. This resulted in the identification of large, prominent features from the Japanese use of Ushi Airfield and the American use of North Field. Denfeld recorded 11 Japanese sites and 20 American sites (Appendix A). In addition, Denfeld noted the significance of Unai Chulu and nearby Unai Babui as the beaches on which the American invasion forces landed in 1944. He recorded several features in the vicinity of these beaches, including Japanese pillboxes, gun positions, and exits and service roads.

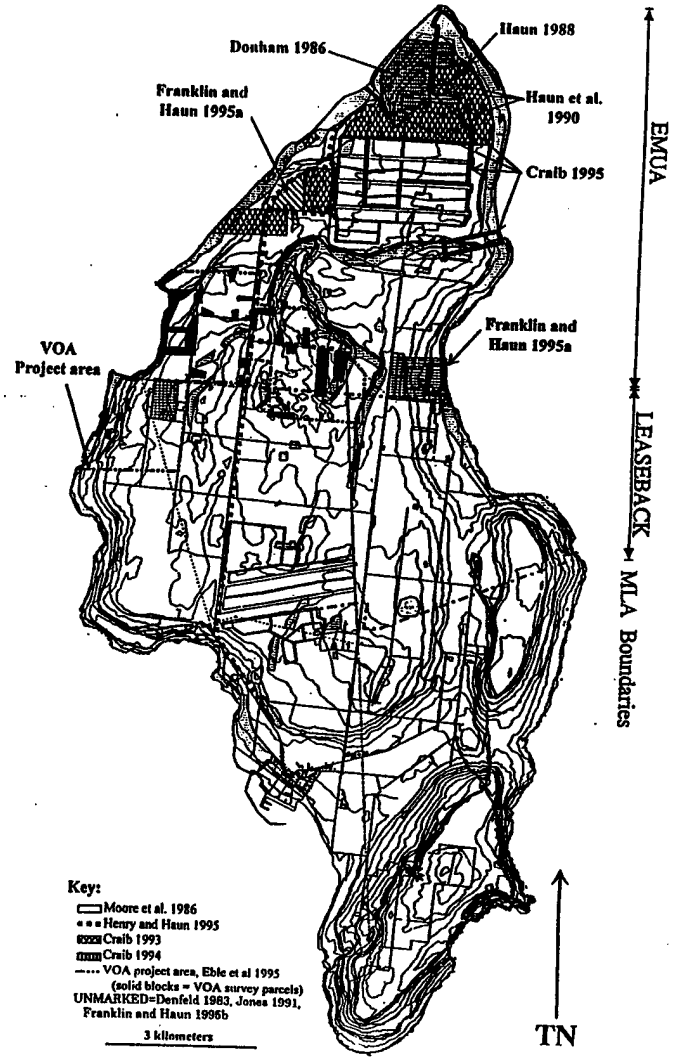


Figure 3. Map of Tinian showing the Military Lease Area and locales of archaeological surveys (pre-Henry et al. 1996).

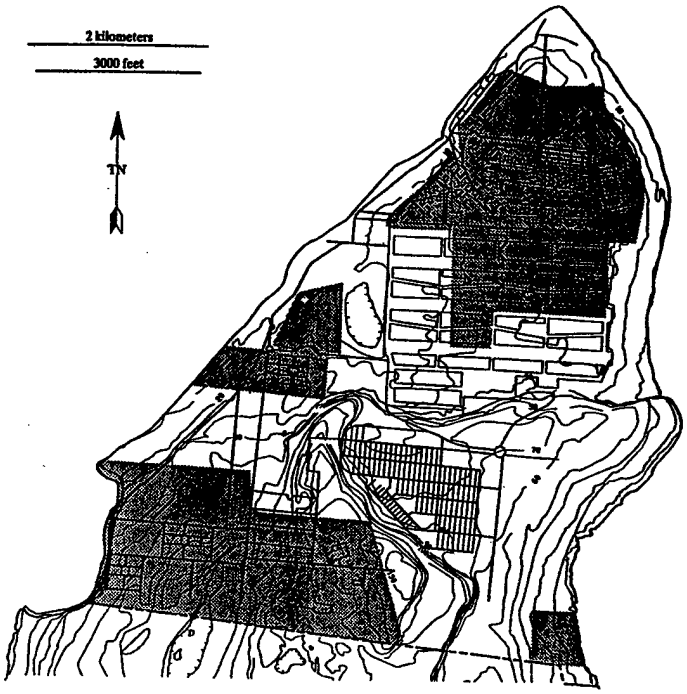


Figure 4. Survey area of Henry et al. (1996), shown in unscreened area (from Henry et al. 1996). Screened areas are other surveys, as shown in Figure 3.

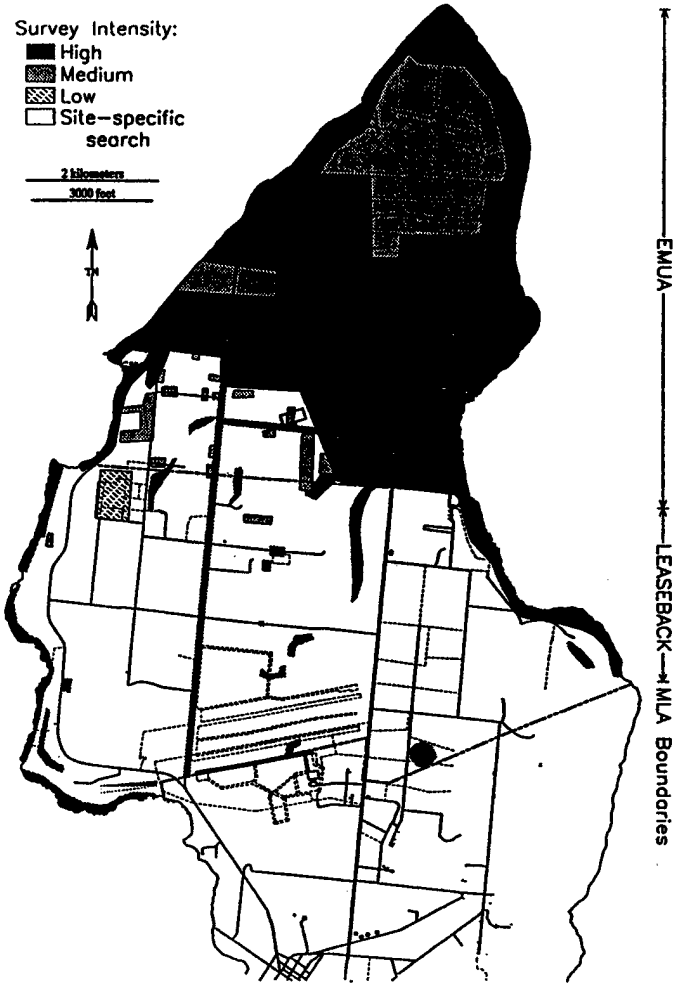


Figure 5. Survey intensity in the MLA.

Following Denfeld's work a National Register nomination form for North Field (Thompson 1984) was prepared, submitted, and revised, and in 1987 North Field was listed as a National Historic Landmark (see Fig. 1). Lying within the 1987 Landmark boundaries and included on the nomination form are five Japanese structures, a Japanese service apron, two American invasion landing beaches, and the North Field runways, taxiways, and service aprons. In 1985 Jack Jones (1991) conducted an investigation of non-indigenous resources on Tinian not included on the National Register form. In his inventory, Jones included Unai Chulu and Unai Babui. He documented 17 other significant Japanese pre-World War II, Japanese World War II, and American World War II sites in the general area of the EMUA, and a number of others in what is now the LBA.

In 1984 and 1985 American Resources Group (ARG) undertook the first major archaeological survey for indigenous sites on northern Tinian (Moore et al. 1986). Several relatively undisturbed parcels in the northern section of the island were selected for investigation (Fig. 3; Appendix A). ARG surveyed numerous parcels along both the west and east coasts, as well as several scattered inland parcels. Along the west shore, they recorded seven prehistoric sites, consisting of scatters of pottery and other indigenous artifacts and remnants of *latte* sets, including one site at Unai Chulu and one at Unai Babui. On the east coast they identified two *latte* set complexes, one made up of three sites at Unai Masalog and one of 10 sites at Unai Dangkulo. ARG prepared National Register nomination forms (1985) for the sites at Unai Dangkulo, nominating them as a complex, the Unai Dangkulo Archaeological District.

In the late 1980s, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted field surveys of three areas north of North Field in connection with the planned Relocatable-Over-the-Horizon Radar Project (ROTHR). A survey by Donham (1986) located 50 sites within a 312-acre parcel, a survey of approximately 40 percent of an 80-acre area by Haun (1988) identified features in the 358th and 359th US Service Group facilities area, and a survey of 3 separate parcels totaling 37 acres by Haun et al. (1990) located 41 American World War II features, which were grouped by Haun into one site. In connection with ROTHR, PHRI also conducted extensive background documentary research concerning North Field, assembling numerous documents, photographs, and other data, mostly related to the American invasion and use of the area during World War II (Dilli and Haun 1991). The report recommended expansion of the boundaries of the North Field Historic District to include the US North Service Group facility areas, the 18th Naval CB/509th Composite Group camp, and the Japanese Asahi Shrine.

Three recent surveys have been conducted by Ogden Environmental and Energy Services Co. The first, conducted in 1992 (Craib 1995), included the area between Runways 1 and 4 within North Field, a road running north from North Field, and Unai Chiget (Fig. 3), with the result that 48 prehistoric and historic period sites were identified (Appendix A).

A second Ogden survey, conducted in March 1993, included four survey areas (Craib 1993). Area 1 lay to the southwest of North Field, Area 2 at the northwest corner of

North Field, Area 3 at the northeast corner of North Field, and Area 4 near the north end of the island (Fig. 3). The survey team recorded 349 locations with evidence of former cultural activity (Appendices A and B). Subsurface testing of previously identified sites along the west coast was also conducted (Craib 1993).

The third Ogden survey was carried out by Craib in early 1994 (Fig. 3) and involved a low intensity coverage of about 540 acres in what is now the MLA (Craib 1994; in prep.; with additional work in the area of the House of Taga). At Unai Dangkulo, the area behind the coast within the ARG survey area was resurveyed and a sketch map of site locations prepared. Preliminary results suggested that five additional *latte* sets may have been found in addition to the 16 *latte* features previously recorded by ARG. Shovel tests were conducted within the *latte* complex. West of the *latte* site complex, extending to Broadway, the survey team recorded the remains of the 121st Naval Construction Battalion camp site. These remains included concrete pads and pavings, coral paved roads and walkways, and historic debris. South of the Unai Dangkulo *latte* sites at a cave site (Z-563), pictographs were observed on a rock face near the large cave's entrance. The survey area extended west from Broadway to the Lasu cliff face. Caves were concentrated along the lower face of the cliff, most exhibiting some form of modification, primarily rock walls constructed at the entrance. Historical material found inside the caves includes bottles, porcelain pottery, and metal fragments. Major use of these caves and construction of the modifications appear to date to the latter years of World War II. Two small areas were surveyed on the plateau above the Laderan Lasu cliff lines at the base of the Mount Lasu summit. The survey areas consist of cultivated fields. These contained a continuous scatter of pottery sherds. Evidence in the form of broken up limestone and high densities of pottery and pounder fragments are indicative of a prehistoric *latte* settlement. West of Mount Lasu on a plateau overlooking the west coast at Puntan Lamanibot Sanpapa a 150 acre survey area consisted of several cultivated fields contained continuous scatters of pottery sherds. A few basalt pestle fragments and marine shells were noted. The evidence suggested that this was an agricultural rather than a settlement area.

In the last three years, six surveys and related test excavations have been conducted in the MLA, five of these by PHRI and one by BioSystems Analysis, Inc. Four of the PHRI projects were conducted in relation to a military exercise that was planned for late 1994, and to site damage caused by unauthorized bulldozing along roads in the MLA (Fig. 3, Appendix A). The fifth PHRI project was intensive survey of a large portion of the EMUA, intended to largely complete the inventory of the area relevant to the EIS evaluation for military training (Henry et al. 1996). The BioSystems survey was a preliminary assessment of areas for possible location of Voice of America (VOA) Relay Stations.

As part of the PHRI work, intensive survey was carried out near Lake Hagoi and at Unai Dangkulo (Franklin and Haun 1995a). In the Hagoi area 18 sites were defined, primarily consisting of features relating to WWII Japanese military installations and to the edge of a Japanese village, the main portion of which was identified by Craib (1993) on the west side of Lake Hagoi. A sherd scatter related to the major prehistoric site complex at Unai Chulu was also located. At Unai Dangkulo, the numerous sets of *latte* in the area that had

been individually numbered as sites during previous surveys were combined into a single site (DS-21, or TN-078 in the CNMI numbering system; see Tuggle and Welch 1996, Table C-2), and a number of other sites were identified, including sherd scatters, a few remains indicating previous Japanese period occupation in the area, and American military features, primarily associated with the 121st Naval Seabee camp. Two caves may have been utilized prehistorically and by the Japanese, one as a World War II refuge cave. One basalt mortar and two artifact scatters were identified.

Related to the site damage assessment and data recovery project, survey and test excavation were conducted along the roadside of the western roadway stretching 14 km from San Jose to the northern end of the island (Franklin and Haun 1995b; Henry and Haun 1995), extending through the EMUA as well as the LBA. These two projects identified some 63 sites, the majority of which are sherd scatters, but which also included a WWII LVT and several pre-war Japanese habitation features or complexes.

A detailed survey and intensive test excavations were also conducted at Unai Chulu by PHRI as an effort to identify the boundaries of this important prehistoric site (Jimenez et al. 1996). This site (CNMI Site TN-073) is discussed below under Site Protection Area Q.

The VOA project area covered a large area of the EMUA and also extended into the LBA (Fig. 3), but the survey itself consisted of only a small sample of each of these three locales (Eble et al. 1995). Thirty-two sites were recorded (Appendices A and B), including prehistoric pottery scatters, Japanese civilian features, and several sites related to WWII.

The most recent archaeological project in the MLA is an intensive survey of over 4,000 acres (Fig. 4), with intensive testing of a number of prehistoric sites (Henry et al. 1996). The survey covered areas which had not been previously surveyed as well as areas that had previously been covered only by low intensity surveys. This survey completed the inventory coverage of the EMUA, except for a portion of the VOA survey area, and resulted in the identification of 520 sites, representing all periods of Tinian history (Appendices A and B).

Archaeological Research in the Leaseback Area

Very little archaeological work has been carried out in the Leaseback Area (Fig. 3). The ARG survey in the 1980s (Moore et al. 1986) was the first modern archaeological survey in this area. In the early part of the century, limited survey had been conducted by Hornbostel (Thompson 1932), followed by Spoehr's (1957) more intensive work along the coasts, resulting in the identification of archaeological areas defined by sherd scatters and several major *latte* sets. ARG surveyed nearly the entire east and west coastlines of the LBA, recording six sites along the west coast and three sites along the east coast. The east coast sites consist of three groups of *latte* sets that together form a cluster called the Unai Masalog Archaeological Complex. The west coast sites include a disturbed *latte* set, a complex of *latte* sets and a quarry, rock shelters, and three artifact scatters.

At the time of the ARG inventory, Jones' survey of non-indigenous resources on Tinian was carried out, resulting in the location of numerous sites in what is now the LBA (Jones 1991: Figure 19). Jones recorded significant pre-World War II Japanese structures, including a civilian camp police center, an administration building, the communications center, and a Shinto shrine. Japanese World War II features are less common in this area than in the EMUA with a large gun, antenna tower supports, and a small airfield recorded. Remains of the intensive American military occupation are more common and include foundations and remnant structures of the Quonset huts and revetments at the Masalog storage area, a bomb group camp, a bomb wing headquarters, a Seabee camp, and West Field.

Of the recent intensive surveys of the MLA, only the roadside damage assessment survey extended into the LBA (Franklin and Haun 1995b; Henry and Haun 1995), resulting in the identification of a number of sherd scatters, Japanese civilian structures, and features associated with West Field.

Approximately one-third of the VOA reconnaissance project (Eble et al. 1995) was located in the LBA, but the actual sample survey area in the LBA consisted of three small transects (Fig. 3), with the recording of three sites (Appendix A).

In order to take into account the numerous remnants of the WWII US sites in the areas, which have not been recorded due to the limited survey of the area (Jones 1991), aerial photographs have been used to define general site complex boundaries in the LBA (as described below)

Archaeological Site Numbering

Appendices A and B list the sites recorded within the boundaries of the EMUA and LBA. The problems with Tinian site numbers and the manner in which the problems have been temporarily resolved are discussed in the following.

Site Numbering Problems

Because of variation in the way researchers have identified and grouped sites, it is difficult to precisely enumerate the total number of sites in the area. It is common for each new survey to assign new (temporary) numbers to sites that have already been assigned (temporary) numbers by previous researchers. In some cases single sites have three or four temporary numbers. Thus combining the reported sites into a single list using the temporary site numbers assigned by the various researchers can result in a great deal of confusion in site labeling.

Because most researchers begin their temporary series with "1" and number sites in order, there is a great deal of repetition of these temporary numbers. In at least one case, one

phase of a project assigned numbers with a "T" for temporary, then in the second phase assigned the same series of numbers without the T to another set of sites. Further, what is counted as one site with several features in one report may be broken down into two or three sites in another report, then recombined and added to another site in yet a subsequent report. In several cases differences in the description or the indicated location between one report and another make it impossible to be certain if two descriptions refer to a single site or to two separate sites. In other instances, some previously recorded sites are given new numbers, others are referred to by old numbers, and yet others (in the survey area) are ignored altogether. These problems are compounded when maps of site locations are not provided, as is the case with some reports. There have been no limits to the ingenuity employed in creating site number chaos.

A complicating factor is that, to the best of our knowledge, none of the draft or final reports for northern Tinian have used the permanent CNMI site numbers that have been assigned by the HPO or have acquired permanent CNMI numbers for the sites recorded in new survey areas.

Site Re-numbering and Reorganization

In order to move toward clarity in site numbering and site identification, three actions have been taken in the *Archaeological Assessment*.

First, in cases where a permanent CNMI number can be identified with a specific survey site (see below), the CNMI number is used.

Second, an attempt has been made to identify all duplicate sites given various temporary numbers. When duplication has been found, the two are listed under a single number. The various numbers assigned sites are listed in Appendices A and B.

The third action has been to assign a new number to all sites that do not have a CNMI number.

CNMI Permanent Numbers (TN-sites)

A list of the previously assigned CNMI permanent numbers was obtained from the Tinian Historic Preservation Coordinator. Unfortunately, not all of the sites with permanent numbers on this list could be identified because of the loss of the original sites forms in a DHP building fire, and because of the limited information on the site number list. The permanent site numbers are shown in Appendix A (and tables and figures below), with the suffix "TN-" (for Tinian). However, the numerical prefix used by the CNMI HPO to indicate chronological placement of the site has not been included. This system has been changed recently and the chronological designation should be given by the CNMI DHP when the final

set of CNMI numbers is established for all of the sites in the MLA. This does not affect the primary site numbers, which are unique in the Tinian sequence.

It should be pointed out that the exact definition of the CNMI sites and their boundaries is unknown, given the loss of the site forms. Consequently, site boundary identification will have to be established when CNMI site forms are completed for all sites. However, some modification of the original site definition (and thus site form) would have been necessary in many cases because of the substantial amount of new information collected by the recent surveys.

Site Renumbering (Z-sites)

In previous reports, the multiplicity of site numbers was dealt with in various ways (Welch and Bodner 1993; Welch and Tuggle 1996b), all involving designations keyed to an original site survey and survey numbering. This has proved too cumbersome to use readily, and it was decided to apply a single sequence of site numbering to all of the sites without permanent CNMI numbers. However, in order to make this as efficient as possible, an unduplicated Tinian number sequence was obtained from the CNMI Division of Historic Preservation (letter of September 17, 1996). These numbers (from 353 to 614) are indicated with a "Z-" in the tables, figures, and appendices). The various temporary site numbers are indicated in Appendices A and B, and a table of concordance showing the conversion from old to new numbers is in the *Site Protection Plan* (Tuggle and Welch 1996:Appendix C)

One component of the permanent numbering of CNMI sits has not been used here. Ordinarily added to each site number is a prefix that indicates the cultural/chronological association of the site (e.g., 1- for the Prehistoric Period; 4- for Japanese Prewar Period). These prefixes are not assigned in the present report because of the problems offered by multi-component sites or sites of uncertain identification. The decision for this designation is left for the process of completing the CNMI site forms, when detailed consultation with the DHP can be carried out.

It has to be emphasized that the Z-numbers are not permanent CNMI numbers. The CNMI DHP requires that site forms be completed before permanent CNMI site numbers are assigned. However, when such forms are eventually completed, the working sequence can be easily converted to permanent numbers because they do not duplicate existing CNMI Tinian numbers.

In the process of assigning a consistent set of numbers to the Tinian sites, it was decided to organize the recorded sites and features, where possible, into spatial clusters of similar features under a single site designation. This was done for three reasons. First, there is a great deal of variation in how sites have been defined and in how features have been grouped; the present organization into feature clusters introduces some level of consistency (although this needs additional refinement). Second, features clustered under single site numbers provide more manageable units for planning than the much larger numbers of

individual site-feature designations. Third, when the final permanent CNMI site numbers are assigned (with some expected site reorganization), it will prove much easier to segregate features into separate sites and assign additional numbers, if necessary, than to combine existing sites and remove numbers.

In reorganizing site and feature numbers, the attempt was made to include all clustered features that appear to be part of a single "activity area" or occupation under individual site numbers. For example, clusters of defensive features are grouped as single sites, and individual US military camps are given singe site designations.

Every cluster of *latte* sets (with the associated sherd scatter and subsurface deposit) has been given a single site number. This follows the *de facto* CNMI practice as indicated by the fact that many of these clusters had been assigned CNMI permanent numbers. This eliminates the confusion created by giving a site number to each set in a cluster. The multiple numbering of clustered sets led to problems with site boundaries and uncertainty as to whether *latte* sets had or had not been recorded. For example, the *latte* complex at Unai Dangkulo has been formally surveyed at least four times in the last ten years (See Tuggle and Welch 1996:Table C-2), with the sets grouped, ungrouped, numbered and renumbered in a variety of ways in these surveys (with one of the last surveys recommending that the site be surveyed yet again), with some surveys finding "new" *latte* stones that were recorded in previous surveys.

Archaeological Site Locations

The large number of sites in the EMUA makes compilation of all of the sites on a single map unworkable. Locations of sites recommended as eligible to the National Register are shown in the present report on maps of individual protection areas, as defined below. These maps, however, have to be used with some caution. They are compiled from many different sources and the accuracy of site locations may vary considerably. These maps are for general planning purposes and should not be used to define exact locations.

The Archaeological Site Inventory

The total number of sites recorded for the MLA (as complied and edited for the present report) is 525, ranging from prehistoric sites to World War II buildings. Of these, 309 are recommended as eligible to the National Register of Historic Places (Appendix A), and 216 are recommended as not eligible to the National Register (Appendix B). Eligibility recommendations are discussed below.

SIGNIFICANCE EVALUATION AND POTENTIAL EFFECTS

Archaeological sites are evaluated for significance in terms of their ability to meet the criteria of eligibility for nomination to the National Register of Historic Places (NRHP). To be considered eligible, sites must possess integrity and meet at least one of the following four criteria of historic value:

A: The site is associated with events that have made a significant contribution to the broad patterns of our history.

B: The site is associated with the lives of persons significant in our past.

C: The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D: The site has yielded, or may be likely to yield, information important in prehistory or history.

Sites may be placed on the NRHP according to these criteria or they may be determined eligible for the NRHP according to these criteria, and in both instances are afforded the attention of appropriate historic preservation law.

The National Historic Landmark and Sites Listed on the National Register of Historic Places

One site complex that is listed on the NRHP and is also a National Historic Landmark is North Field, but there is considerable confusion regarding (1) the boundaries of the area (partly because several NR eligibility and nomination forms have been submitted) and (2) which properties are recognized as contributing elements (cf. Dilli and Haun 1991: 15; Spencer Mason Architects 1994). In Figure 1 the boundary of the North Field National Historic Landmark is derived from the landmark map in Dilli and Haun (1991: Figure 4), based on the 1986 nomination form. It is probable that at least included as contributing elements are the runways/taxiways, White Beaches 1 and 2, and the major Japanese buildings at Ushi Field.

However, a reconsideration of the boundaries of North Field has been undertaken by the U.S. Navy and the National Park Service, and it is assumed that a final determination on this will be made in the near future. It is recommended here that this boundary should at least include all of the features closely associated with the atomic bomb missions: these would

include not only North Field and the bomb loading pits, but also the service area for the 509th composite group (Site Z-362), the camp for the 509th composite group (Site TN-039) and the site identified as the location of the atomic bomb assembly (Site TN-041; see Appendix C).

Other sites on Tinian that are reported to be listed on the NR are "the NKK Administration Building, the NKK Ice Storage Plant, the NKK Laboratory, and a Japanese Structure near Red 2 Beach" (Spencer Mason Architects 1994:np). This listing has not been verified, but none are in the MLA.

Preliminary Significance Assessments

The recommendations concerning site significance and eligibility to the NRHP for all of the sites recorded in the MLA are presented in Appendix A. This is a summary with some modifications of previous eligibility recommendations, as indicated in the following.

In the majority of archaeological survey reports for the MLA, no recommendations for site significance or NRHP eligibility have been made. Welch and Bodner (1993) prepared a summary of sites recorded up to 1993 and provided such recommendations, later supplemented by Welch (1994). The Welch and Bodner (1993) recommendations were made for sites that had been recorded, but for which the original investigator had made no assessment or made an incomplete assessment. The evaluations of Welch and Bodner (1993) are based on a full assessment of all previous work conducted within the boundaries of the EMUA prior to 1993. None of the researchers who had conducted archaeological or historical investigations in the EMUA provided explicit evaluations of sites in terms of specific National Register criteria. Evaluations have consisted of general appraisals of site importance (e.g., Craib 1992, 1993), statements that particular sites are eligible for the National Register (e.g., Jones 1991: 345; Moore et al. 1986: 205), or evaluations of whether sties are significant for their information content or as excellent examples of a site type (e.g., Donham 1986: 102-103). The justification for these recommendations is in Welch and Bodner (1993) and Welch (1994). Subsequently one revision of an original survey report (Craib 1995) has adopted the Welch and Bodner (1993) recommendations for sites in its survey area.

With minor revisions, the present report maintains the recommendations for site significance for those sites included in Welch and Bodner (1993). The most recent survey report for the MLA (Henry et al. 1996) includes recommendations for site significance, largely covering sites not on the Welch and Bodner list. For the sites recorded by Henry et al. (1996), most of the significance recommendations are accepted in the present report (Appendix A), although there is some variation in the specific criteria on the basis of which sites are recommended for eligibility, and some variation due to the grouping of sites from Henry et al. (1996) in the present report.

Appendices A and B present sites in two categories, those recommended as not significant or not eligible for the NRHP and those recommended as eligible for the NRHP. In

the first category are sites that do not appear to meet eligibility criteria, primarily bulldozed debris piles, trash dumps, and isolated military features of no identifiable importance, such as pipelines. In addition, Appendix B includes sites considered eligible under Criterion D, but for which adequate information has been recovered, with no consideration for preservation, listed in Henry et al. (1996: Table 35) as NFW (No Further Work) with no preservation. However, some of the sites in this category in Henry et al. (1996) have been moved into the category of recommended eligible (Appendix A) because they have artifacts of historic importance (primarily WWII or Japanese era materials) that should be collected and preserved, constituting additional value based on need for data collection. Site evaluation is discussed in more detail in Tuggle and Welch (1996).

General Potential Adverse Effects

The military exercises proposed for Tinian could adversely impact sites in the area in a number of ways. The most serious threat would result from activities associated with any new construction; with area clearance (such as bulldozing for landing zones); with the use of vehicles off established roads (all-terrain vehicles, bulldozers, landing vehicles); with maneuvers that involve the digging of foxholes, latrines, and other subsurface excavations; and with the use of live fire. Other damage to the historic resources could come from the presence of large numbers of individuals and involve removal of historic artifacts and vandalism.

In Appendix A, one column is dedicated to the sensitivity to threats from the various potential actions. Military impact is also evaluated in Tuggle and Welch (1996).

SITE PROTECTION PLANNING

The following section provides the general plan recommended for the avoidance or mitigation of any potential adverse effects of the undertaking on the historic resources of the MLA. The framework for this is provided by reference to CNMI HPO priorities.

CNMI HPO Priorities

The staff of the CNMI Office of Historic Preservation provided the following information related to their priorities and concerns. This is, however, a summary prepared by the authors of the present report, based on consultation (see Acknowledgments), but has not been reviewed or approved as their position, and thus should be taken as general guidelines. The official position of the HPO in these matters will probably be addressed in a formal review of the EIS, the present *Assessment*, and the *Site Protection Plan*.

The highest priority of the HPO for site protection and preservation is intact prehistoric sites. The second priority for site protection and preservation is relatively unique and significant historic sites. There is particular concern with protection of sites at Unai Babui, Unai Chulu, Unai Dangkulo, and with the sites on the clifflines (which contain prehistoric deposits in shelters and caves, as well as numerous WWII features).

Regarding site management, concern was expressed regarding whether or not ground disturbing activities could be monitored during exercises, what sanctions might be available for violation of site protection measures during exercises, and what measures will be in place to clean up debris left on sites and in the vicinity of sites as a result of military exercises and encampments. The last item relates to experience following TT95 in which large quantities of trash were reported to have been left in the exercise areas, and had to be removed by Historic Preservation staff and others.

Concerning site recording, the staff of the HPO would like to see individual site significance statements presented in survey reports, and would like to see a consistent application of the CNMI site numbering system to sites within the MLA.

Recommended Protection Measures for the EMUA

The following measures are recommended for the mitigation of potential adverse impacts on the historic resources of Tinian as a result of military exercises.

This is a summary of the actions that are presented in the companion document *The Tinian Historic Site Protection Plan for the Military Lease Area* (Tuggle and Welch 1996), which should be consulted for more detail.

It should be emphasized that the recommendations below are specific to the military undertaking, and should be implemented within the more general site management framework recommended in Tuggle and Welch (1996), noting in particular, as described in the inventory section above, that the identification of resources at the level of inventory survey has not been completed for some areas of the EMUA or for most of the LBA.

The basic approach to site assessment and protection planning is the division of military lands into categories of constraint related to the significance and sensitivity of sites within those areas. This approach met with the general approval of the staff of the CNMI HPD and is also incorporated into the *Site Protection Plan* (Tuggle and Welch 1996).

Recommended protective measures are as follows:

I. Identification and marking of Site Protection Areas.

It is recommended that the EMUA be divided into Site Protection Areas (SPA), based on site sensitivity and importance. Proposed boundaries of Site Protection Areas are presented in Figure 6.

Following a final and accepted definition of these areas, they should be clearly marked on the ground and identified on appropriate operational military maps.

The categories of the protection areas are:

Category 1. Off-limits.

Restrictions: No military use of these areas would take place except for troop and vehicular movement on established roads. These roads would be marked on maps and identified on the ground with appropriate right-of-way signs.

Areas: Three areas are recommended for off-limits designation (Fig. 6): Unai Chulu complex, (SPA Q), the Lake Hagoi area (SPA S) and the Unai Dangkulo complex (SPA J).

Category 2. Moderate constraint.

Restrictions: These areas would be limited to pedestrian use; vehicles would be prohibited except for the use of established roads. No digging or other ground disturbance would be allowed. These areas would have permanent on-the-ground markers for identification. Individual sensitive sites in these areas should be marked as off-limits.

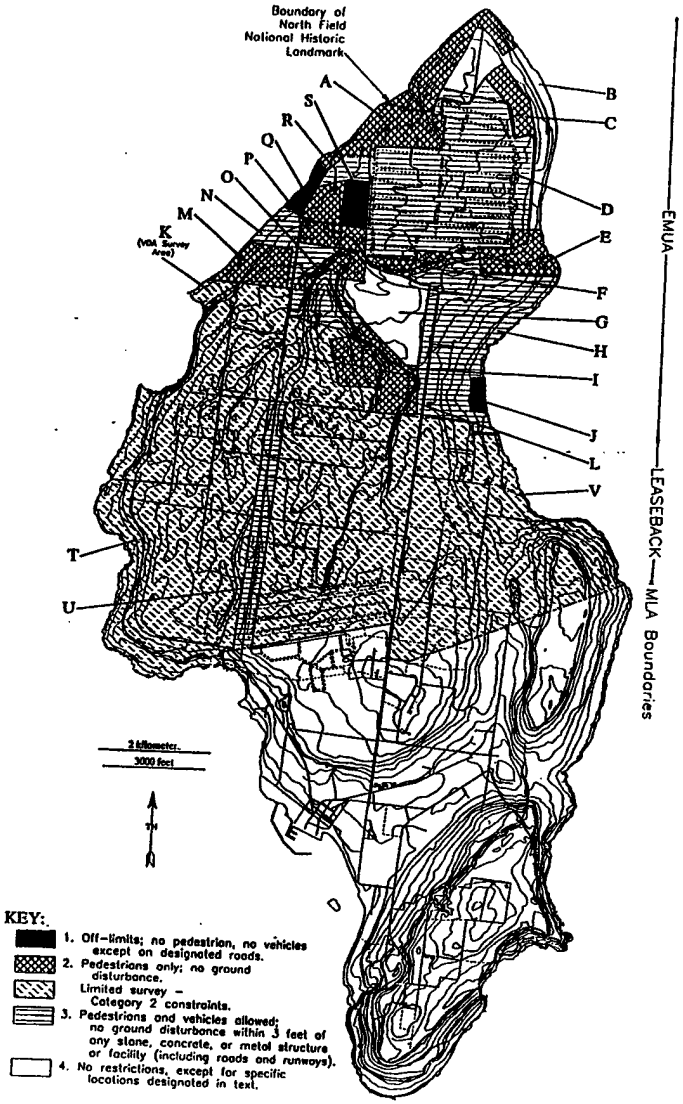


Figure 6. Site Protection Areas with National Landmark boundary.

EMUA—LEASEBACK—MLA Boundaries

-25-

Areas: The areas recommended for inclusion in this category are shown in Figure 6: Site Protection Areas A, C, E, F, L, I, M, O, and P. The VOA survey area (SPA K) has not had a complete inventory so it is also recommended for Category 2.

Category 3. Limited constraint.

Restrictions: Pedestrian and vehicular use of these areas would be permitted, but no ground disturbance would be allowed within three feet of any stone, concrete, or metal structures (including roads and runways). Restrictions would include general prohibition against collection of historic artifacts; prohibition against vandalism; and specific restrictions on digging within three feet of any structure or digging within any caves. Individual sensitive sites in these areas should be marked as off-limits.

Areas: Category 3 areas are shown in Figure 6: Site Protection Areas D, H, and N.

Category 4. Unconstrained.

Restrictions: Concerning cultural resources, there would be no restrictions on military activities in these areas. Individual sensitive sites in these areas should be marked as off-limits, or if appropriate, have data recovery conducted.

Areas: Category 4 areas (Fig. 6) include: Site Protection Areas C and G.

II. Identification of specific military project areas and development of special training locales.

The historic preservation actions and site protection planning place their emphasis on avoiding damage to historic sites. To accomplish this, it is recommended that, where possible, specifics of military exercises, specialized training areas, and any required facilities be identified regarding types of terrain, necessary total area, and recommended location. This information should be evaluated in terms of the distribution of historic resources to attempt to define the most appropriate areas for these actions with the least possible damage to any historic resources. Additionally, if specific military actions/projects as indicated above are most effectively placed in areas of historic resources, then appropriate data recovery should be undertaken to allow the action/project to take place.

For elaboration of planning concerns in this area, see the discussion of "Military Projects and Site Protection" in Tuggle and Welch (1996).

III. Information and instructions.

Information on the historic importance of Tinian and on the site protection areas, with identified restrictions, will be placed in all relevant instruction manuals and on operational maps, where possible. Written and oral instructions which will alert the troops

participating in exercises to the need to be careful to protect the cultural resources of the island. These instructions would involve the caution not to move, pick up, or in any way disturb artifacts or other historic properties on the island. Those participating in the exercises should be briefed on the significance of archaeological and historical resources on the island. Protective measures should be written into the instructions for the specific exercises. Prohibited and constrained areas should be clearly marked on all maps to be used during specific exercises. The military should provide sufficient oversight of the exercises to insure compliance with these mitigation measures.

IV. Program of monitoring and evaluation.

The U.S. Navy and the Historic Preservation Office of the CNMI should develop a monitoring plan for the evaluation of site protection actions after they have been implemented. This would involve, at a minimum, determining the extent to which the measures have been effectively implemented (for example, whether protection areas are marked effectively) and the extent to which the required actions and regulations are followed (for example, whether vehicles have respected the boundaries of prohibited areas). The Tinian Historic Preservation Coordinator has also suggested that in some instances, certain training activities might actually be monitored by representatives of the HPO. If this is not possible, then it is recommended that a post-exercise de-briefing take place in which the areas used during training are indicated to the CNMI HPO and may then be examined for possible damage to historic features or for violations of management or protection guidelines.

V. Interpretation.

A program of site interpretation in the MLA has been instituted by the U.S. Navy, and should be expanded. The existing program involves an interpretive brochure that is available to the public and a number of on-site interpretive signs. This program should be brought to the attention of all military users as a part of the briefing in appreciation of the history of the island and protection of its resources.

Recommended Protection Measures for the Leaseback Area and Kammer Beach

As presently defined, the use of the LBA for military exercises will be limited primarily to ground maneuvers from West Field north into the EMUA. If this remains the case, then all of the LBA (except the 8th Avenue corridor) should be considered a Category 2 constrained area; that is, pedestrian activity is allowed (with proper instructions as indicated above), but there is a prohibition on use of vehicles off established roads, and prohibition on any digging, ground disturbing activity, artifact collecting, or vandalism.

At the present time, with the exception of the 8th Avenue corridor, the area of the LBA is poorly known archaeologically, so more specific designations of site protection areas would depend on additional archaeological surveys. As shown in Figure 6, the 8th Avenue

corridor (SPA U) is recommended for Category 3 constraint, with the two other areas of the LBA (SPA T and V) recommended as Category 2.

Kammer Beach is recommended for Category 3 constraint for the area within 50 m (160 ft) of the coastline. The area from 50 to 200 m (160 to 650 ft) from the shoreline is part of the Taga site with a high potential that subsurface deposits are present and should be considered a Category 2 area in which no ground disturbance should occur and vehicle traffic should be restricted to established roads.

North Field National Historic Landmark

The boundaries of the North Field National Historic Landmark are shown in Figures 1 and 6, although, as indicated above, these boundaries and the contributing properties of the Landmark are under review.

For avoiding or mitigating any potential adverse effects of military training on the Landmark, it is recommended that the Landmark be managed according to the site protection actions proposed for each of the SPAs within which the Landmark falls.

Site Protection Areas

In the following discussion of site protection areas, only sites categorized as "significant" are listed on the tables and located on maps. These sites are listed in Appendix A, with a discussion of significance presented above.

Note that the locations of sites are shown based on the best information available, but the accuracy is limited by a number of problems, described in Tuggle and Welch (1996).

Site Protection Area A: Category 2, moderate constraint

The sites of Site Protection Area A (Fig. 7; Table 2) constitute some of the most important historic resources of the MLA. These include the atomic bomb loading area of North Field, the 509th service area (Site Z-362), the atomic bomb assembly area (Site TN-041), the Japanese Ushi Field complex (Sites TN-018, and Z-366, Z-369), numerous Japanese revetments, and the extensive prehistoric sites at Unai Babui and Puntan Tahgong (Sites TN-074 and TN-076).

The area is recommended for Category 2, with restriction of vehicles to established roads and restriction of troops to movement through the area only, with no camping or digging permitted. Unai Babui is proposed as a possible beach landing zone. Testing of the prehistoric site at Unai Babui (Fig. 8) has demonstrated that this site covers a very extensive

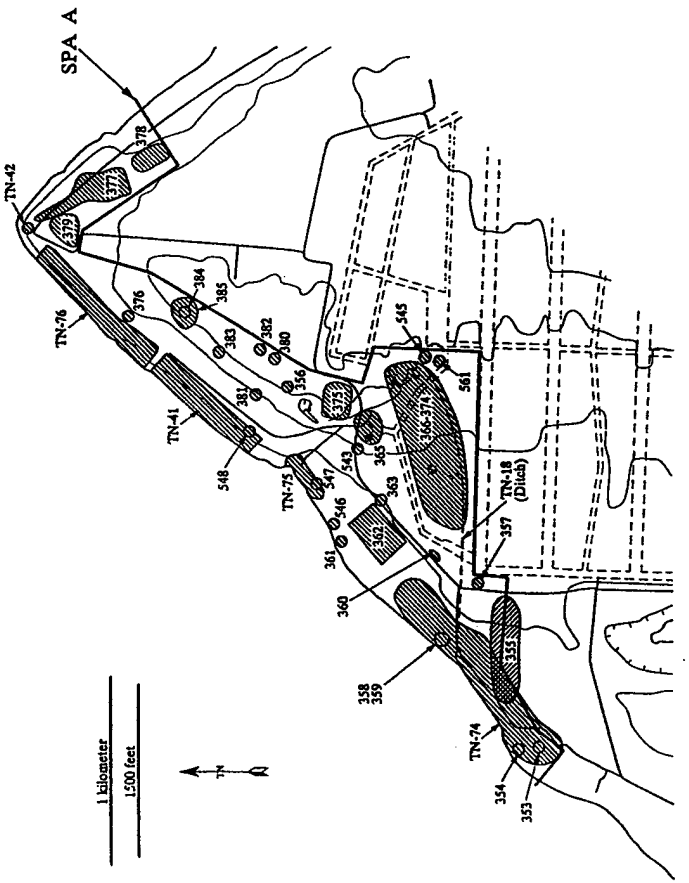


Figure 7. Significant archaeological sites, Site Protection Area A. (All site numbers without TN- prefix have Z- prefix.)

Table 2. Significant Sites of Site Protection Area A.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-018	A	JM	Drainage ditch (Ushi Field Complex)	A, C, D	1	Jones 1991; Henry and Haun 1995; Henry et al. 1996	
TN-041	A	US	A-bomb assembly areas; earthen enclosures, platforms	A, B, C, D	2	Jones 1991; Henry et al. 1996; Welch and Tuggle 1996	
TN-042	A	US	17th AAA recreational structure remnant	A, B, C, D	2	Denfeld 1983; Henry et al. 1996; Jones 1991:31, 297-303	
TN-074	A	P	Unai Babui latte set; large, stratified deposit, features, (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
TN-075	A	P	Unai Lamlam ceramic deposit	A, D	3	Moore et al. 1986; Craib 1995	
TN-076	A	P	P. Tahgong latte sets stratified deposits, features; (intensive, permanent occupation; Latte Phase ceramic)	A, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
Z-353	A	JC	Cistern	D	2	Henry et al. 1996	
Z-354	A	JM	Defensive enclosure, earthen	D	1	Henry et al. 1996	
Z-355	A	JM	Unai Babui defensive complex: fuel drum gun enclosures (JM, 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	3	Henry et al. 1996; Jones 1991	
Z-356	A	JM	Gun position, fuel drum revetment	A, D	2	Donham 1986:32, 68	
Z-357	A	US	Gun position, fuel drum revetments	A, D	2	Henry et al. 1996	
Z-358	A	US	Gun position, fuel drum revetment	A, D	2	Denfeld 1983; Henry et al. 1996	
Z-359	A	US	Landing craft, and craft fragments	A, D	1	Henry et al. 1996	Human remains
Z-360	A	P	Pottery scatter	D	3	Craib 1993:8, Fig. 1	
Z-361	A	J	Trash scatter	D	1	Henry et al. 1996	
Z-362	A	US	509th Composite Group service area	A, C, D	1	Henry et al. 1996	
Z-363	A	JM	Gun emplacement	A, C, D	1	Denfeld 1983; Henry and Haun 1995	
Z-365	A	US	Atomic bomb loading pits	A, B, C, D	2	Denfeld 1983:36	
Z-366	A	JM	Air Administration staff building (Ushi Field Complex)	A, B, C, D	1	Jones 1991:29, 204-210	
Z-367	A	JM	Air Operations building (Ushi Field Complex)	A, C, D	1	Jones 1991:29, 211-214	
Z-368	A	JM	Power plant (Ushi Field Complex)	A, C, D	2	Jones 1991:30, 215-221	
Z-369	A	JM	Air raid shelters (Ushi Field Complex)	A, C, D	1	Jones 1991:30, 222-225	
Z-370	A	JM	Aircraft parking area (Ushi Field Complex)	A, D	0		
Z-371	A	JM	Housing remains, cisterns, air raid shelters, etc., west of X-370 (Ushi Field Complex)	A, D	2		

Table 2. Significant Sites of Site Protection Area A. (cont.)

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
Z-372	A	JM	Housing remains, cisterns, air raid shelters, etc., east of X-370 (Ushi Field Complex)	A, D	2		
Z-373	A	JM	Storage bunker, fuel drum (Ushi Field Complex)	A, C, D	0	Donham 1986:33, 35; Denfeld 1983	
Z-374	A	JM	Storage bunker, ammo, demolished (Ushi Field Complex)	A, C, D	0	Donham 1986:34, 52; Denfeld 1983	
Z-375	A	JM	Gun positions, fuel drum enclosures, concrete storage bunker (Ushi field defensive complex)	A, C, D	1	Donham 1986:31, 34	
Z-376	A	US	Mound, dump	D	0	Henry et al. 1996	
Z-377	A	JM/US	Defensive complex, fuel drum enclosure, earthen enclosure., slabs (Ushi Point c complex 2; reused by US)	A, C, D	1	Henry et al. 1996	
Z-378	A	JM/US	Gun position, fuel drum, encl., slabs (Ushi Point complex 1; reused by US)	A, D	1	Henry et al. 1996	
Z-379	A	US	17 AAA camp remains	A, D	3		
Z-380	A	US	Debris, equipment	D	1	Donham 1986:32, 81	
Z-381	A	P	Sherd scatter	D	3	Donham 1986:32, 83	
Z-382	A	US	A Battery, 17th AAA; foundation piers, concrete pads	A, C, D	2	Donham 1986:33, 48	
Z-383	A	P	Sherd scatter, lithics	D	3	Donham 1986:33, 84	
Z-384	A	US/JM ?	Foundation, gun revetment, debris, foxhole	A, C, D	1	Donham 1986:33, 50	
Z-385	A	P	Sherd scatter	D	3	Donham 1986:33, 83	
Z-543	A	US?	Tower bases, radio station	A, C, D	0	Donham 1986:34, 59; Denfeld 1983	
Z-545	A	US	Quonset Hut	A, C, D	0	Denfeld 1983:34	
Z-546	A	?	Airplane wreck	D	1	Henry et al. 1996	
Z-547	A	US	Landing craft remains, invasion remnants	A, D	1	Henry et al. 1996	
Z-548	A	?	Gun enclosure, earthen	D	1	Henry et al. 1996	
Z-561	A	JC	Land boundary marker	D	1	Craib 1993:4, Fig. 2	

See Appendix A for Key to Tables.

area with intact prehistoric deposits and numerous human burials (Henry et al. 1996), and it is recommended that vehicular access be restricted above the beach area (Fig. 9). Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area B: Category 4, unconstrained

Although SPA B contains a number of sites (Fig. 10, Table 3), they generally fall into clusters or are of limited significance, and it is recommended that these clusters be identified and marked as off-limits. Alternatively, most of these sites could be subjected to data recovery and removed from protective consideration. Detailed site protection recommendations for development of this area as an unconstrained zone are presented in Tuggle and Welch (1996).

Site Protection Area C: Category 2, moderate constraint

SPA C (see Fig. 7) is a complex of the well-preserved foundations of the structures used by the 72nd, 77th, 338th, and 359th service groups. This entire complex is identified as Site Z-401 and the quality of its preservation, unusual features, and identification with several major bomb groups suggests that it be restricted from use by vehicles or for any pedestrian activities except movement through the area. Digging or encampment should be prohibited. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area D: Category 3, limited constraint

SPA D (Fig. 11; Table 4) is the main runway complex of North Field (Z-364) and several adjoining areas. There are numerous sites in the area, but most are structural features associated with the field and not readily susceptible to damage. Prohibition from damage to structures and from digging within the vicinity of structures will protect these types of features. Particularly sensitive sites within the area may be marked as off-limits. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area E: Category 2, moderate constraint

SPA E (Fig. 12; Table 5) is the Chiget area of beach, cliffline, and lowland. It contains several important complexes of sites, including a series of Japanese cliff defensive features and prehistoric complexes, some with *latte* sets and burials. The area is recommended as restricted to pedestrian movement only, with no encampments, digging or other ground disturbance, and no vehicles except on established roads, with clear prohibitions against digging, artifact collection, or other disturbance in caves. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

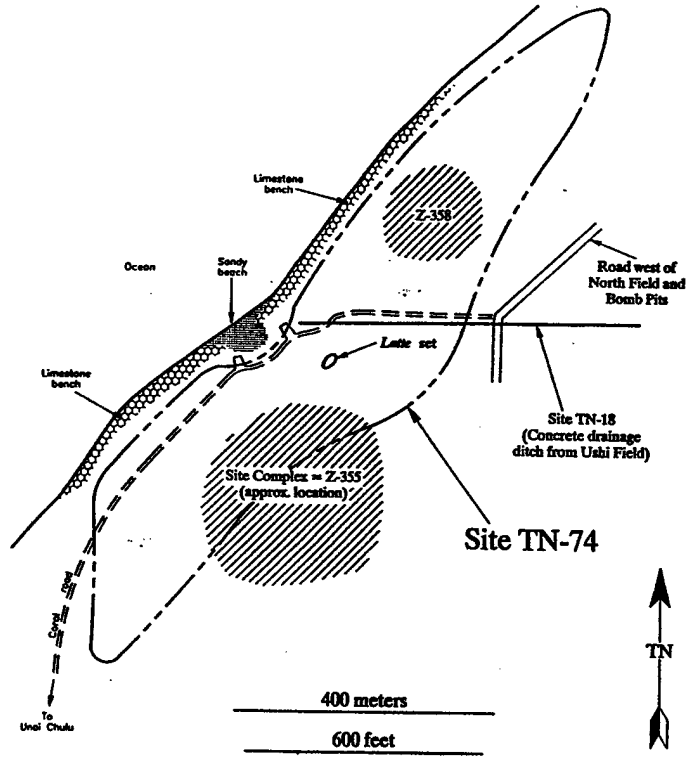


Figure 8. Detail of Unai Babui, in Site Protection Area A.

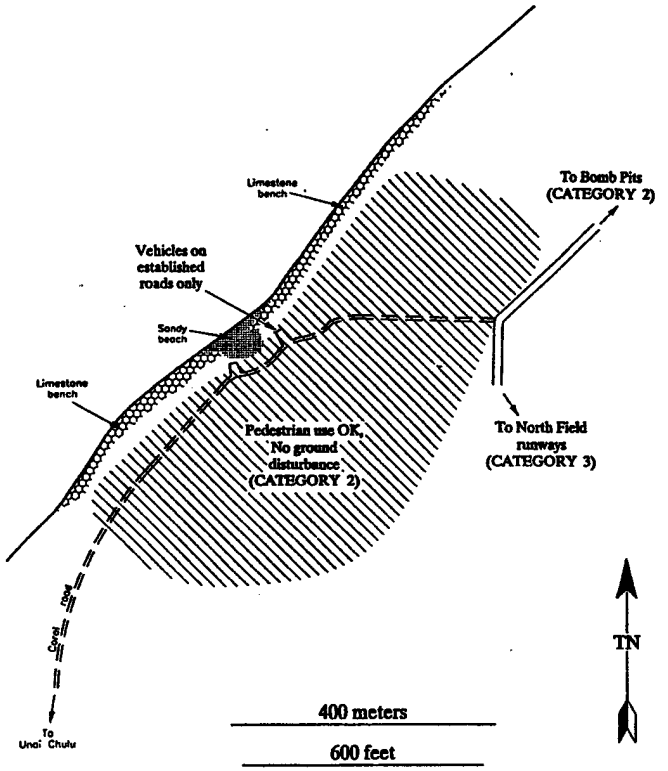


Figure 9. Constraints at Unai Babui, in Site Protection Area A.

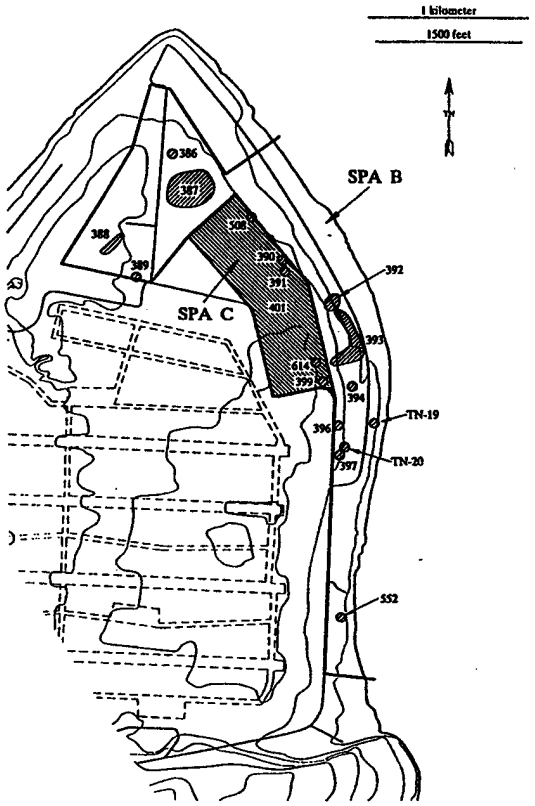


Figure 10. Archaeological sites, Site Protection Areas B and C. (All site numbers without TN- prefix have Z- prefix.)

Table 3. Significant Sites of Site Protection Area B.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-019	B	JM	Revetments, earthen; munitions storage	D	1	Henry et al. 1996
TN-020	B	JM	NE coast complex; defensive tunnels	A, D	2	Jones 1991; Henry et al. 1996
Z-386	B	P	Sherd scatter	D	3	Donham 1986:33, 86
Z-387	B	US	Rubble steps, structure remnants; trash, engine parts	D	1	Donham 1986:33, 71
Z-388	B	?	Berm, fence	D	1	Donham 1986:32, 73
Z-389	B	?	Revetment, mound	A, D	1	Donham 1986:32, 68
Z-392	B	P	Ceramics, shallow deposit, feature;	A, D	3	Henry et al. 1996
Z-393	B	US	B Battery, 17th AAA; Defensive mounds, earthen (radar/searchlights)	A, D	1	Henry et al. 1996
Z-394	B	P	Ceramics, small shallow deposit	D	33	Henry et al. 1996
Z-396	B	P	Ceramics, small shallow deposit	D	3	Henry et al. 1996
Z-397	B	JM	NE coast defensive complex, stone/earthen mounds (for radar/searchlights), trash	A, D	1	Henry et al. 1996
Z-552	B	US	Slab, dump	D	1	Henry et al. 1996

See Appendix A for Key to Tables.

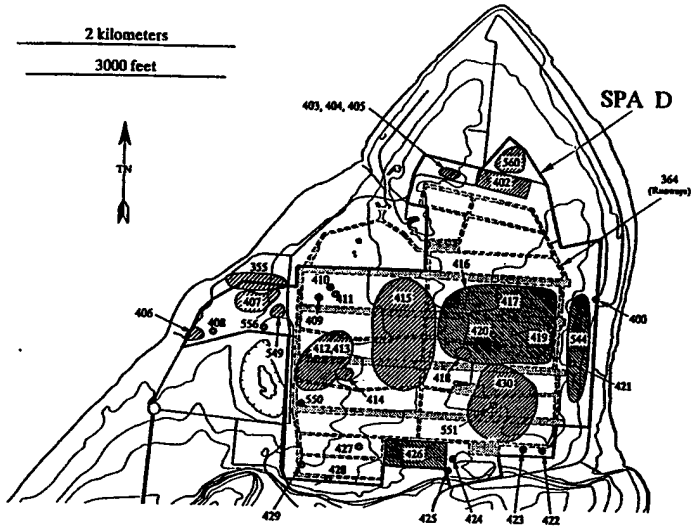


Figure 11. Significant archaeological sites, Site Protection Area D. (All site numbers without TN- prefix have Z- prefix.)

Table 4. Significant Sites of Site Protection Area D.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
Z-364	D	US	North Field runways, hardstands, and taxiways	A, B, C, D	0	Denfeld 1983:37
Z-400	D	?	Gun enclosure, earthen	D	1	Henry et al. 1996
Z-402	D	US	B-29 service apron shop	A, B, D	1	Donham 1986:34, 54; Denfeld 1983
Z-403	D	?	Aircraft debris, rubbish, secondary	D	1	Donham 1986:32, 82
Z-404	D	P	Sherd scatters	D		Donham 1986:32, 82
Z-405	D	JM	Gun position, fuel drum revetment	A, D	1	Donham 1986:33, 68
Z-406	D	JM	Unai Chulu defensive complex; gun positions, fuel drum revetments (JM 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	1	Henry et al. 1996
Z-407	D	JM	Unai Babui defensive complex; fuel drum revetments, earthen mounds (JM 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	3	Henry et al. 1996
Z-408	D	US	Amirak	A, C, D	1	Henry and Haun 1995
Z-409	D	JM	Water collection culverts for purification plant; structures	A, D	2	Denfeld 1983; Henry et al. 1996

Table 4. Significant Sites of Site Protection Area D. (cont.)

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
Z-410	D	M	Dump with Japanese boundary marker	D	1	Henry et al. 1996
Z-411	D	US	Airplane wreck	D	1	Henry et al. 1996
Z-412	D	US	Tower base, fuel drums, and culverts, with inscriptions by 110th NSB; inscriptions by 13th NCB	A, D	0	Henry et al. 1996
Z-413	D	JM/w US?	Gun position, fuel drum enclosures; tower bases	A, D	1	Henry et al. 1996
Z-414	D	JC	Japanese Civilian habitation complex; Homestead, partial; with RR bed	A, C, D	2	Henry et al. 1996
Z-415	D	US	Cluster of destroyed machinery and steel, iron, and aluminum fragments; concrete boxes, pads, culverts, iron structure, tire dump, crane section, fuel drums	D	0	Craib 1995:59, 63
Z-416	D	US	Drums, concrete boxes, culverts Baldwin-Lima-Hamilton crane and associated debris, machinery, tower remnants	D	1	Craib 1995:58-59
Z-417	D	P	*Latte* pillars, possible; limestone fragments; pottery scatter; (some concrete fragments)	D	3	Craib 1995:59, 62
Z-418	D	P	Sherd scatter	D	3	Craib 1995:60, 69, 72
Z-419	D	P	*Latte* stones, possible	D	3	Craib 1995:60, 72-73
Z-420	D	US/JC?	Building foundations, rock-lined path, metal troughs, trash dump or latrine area; also Japanese sugar village remnant?	A, D	1	Craib 1995:60, 74, 77-78
Z-421	D	P	Ceramics, small shallow deposit	D	3	Henry et al. 1996
Z-422	D	M	Bulldozed debris	D	0	Henry et al. 1996
Z-423	D	US	Enclosure, earthen, pit; storage	D	1	Henry et al. 1996
Z-424	D	US	Dump	D	0	Henry et al. 1996
Z-425	D	US	Dump	D	0	Henry et al. 1996
Z-426	D	US	Service area and assoc. encampment, of 121st NCB (first CBs on island)	A, B, C, D	2	Henry et al. 1996
Z-427	D	US	Defensive enclosure of metal boxes	A, D	1	Henry et al. 1996
Z-428	D	US	Enclosures, earthen, storage	D	1	Henry et al. 1996
Z-429	D	US	Encampment, original 67th NCB, (moved to Site 68)	A, D	2	Henry et al. 1996
Z-430	D	US/JM ?	Defensive complex, with gun positions, fuel drum; dump	A, D	1	Henry et al. 1996
Z-544	D	US?/P	B Battery of the 17th AAA; and ABCD Annex (?); fuel drum enclosures	A, C, D	1	Henry et al. 1996
Z-549	D	US	D Battery, 17th AAA; earthen enclosure, fuel drum enclosures, metal posts	A, C, D	1	Henry et al. 1996
Z-550	D	JC/JM	Homestead, intact, reused for defense	A, D	3	Henry et al. 1996
Z-551	D	JM	Gun enclosure, fuel drum	A, D	1	Henry et al. 1996
Z-556	D	US	Cistern	D	2	Henry et al. 1996
Z-560	D	JM/US	Mixed WWII Japanese and American sites	A, D	2	Craib 1993:4, Fig. 2

See Appendix A for Key to Tables.

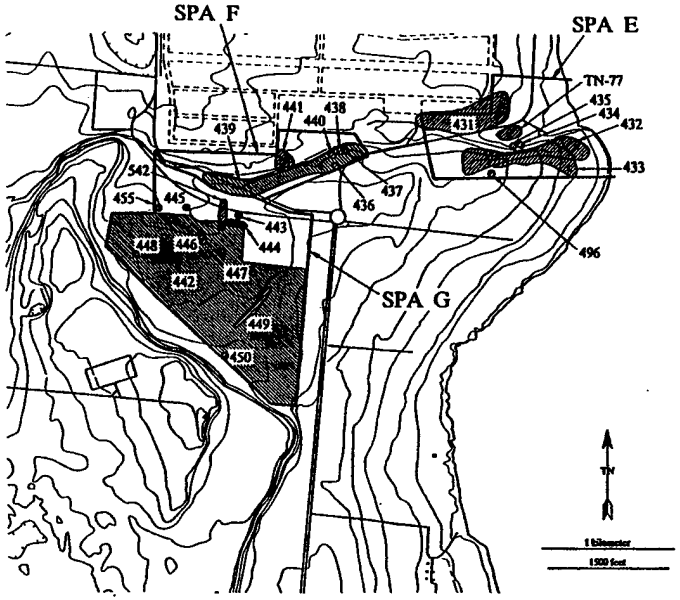


Figure 12. Significant archaeological sites, Site Protection Areas E, F, and G. (All site numbers without TN- prefix have Z- prefix.)

Table 5. Significant Sites of Site Protection Area E.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-077	E	P	Unai Chiget *latte* sets, deposit; (intensive, permanent occupation)	A, D	3	Moore et al. 1986; Henry et al. 1996; Craib 1995	
Z-431	E	P	Ceramic scatters; medium size, stratified deposit; large stratified deposit	D	3	Henry et al. 1996	Human remains
Z-432	E	JM/P	Laderan Chiget defensive cave complex, rifle positions, fuel drum enclosures (assoc. with JM 2nd Battalion 50th Infantry Div.) and Cave complex, with stratified prehistoric deposits, Pre-Latte and Latte Phase (intensive, permanent occupation)	A, C, D	3	Henry et al. 1996	
Z-433	E	P	Latte sets and stratified deposits, features; Pre-Latte and Latte Phase (intensive, permanent occupation); various deposits	A, D	3	Henry et al. 1996	Human remains
Z-434	E	JC	Homestead, partial	D	2	Henry et al. 1996	
Z-435	E	JC	Railroad bed, with rails, wooden ties; stacked facing	A, C, D	1	Henry et al. 1996	
Z-496	E	JC	House, concrete	D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area F: Category 2, moderate constraint

SPA F (Fig. 12; Table 6), the cliffline of Gatut, contains an extensive complex of Japanese defensive features and well-preserved Japanese plantation railroad berms with dry-laid stone facings. The area should be used only for pedestrian movement, with no ground disturbance or vehicular activity. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area G: Category 4, unconstrained

SPA G (Fig. 12; Table 7) contains some ruins of Japanese homesteads, but is primarily the area of the WWII US Central Bomb Dump (Site Z-442), which consists mainly of coral roads and large pits. The site has been mapped in detail (Henry et al. 1996) and it is recommended that that the area be considered as not significant, the detailed information having been collected. (Unlike other sites recommended as not significant, Site Z-442 is listed in the site table and identified on the map because it is the primary component of the SPA.) As such, the area is proposed for unconstrained military activity, following data recovery or set-asides for the Japanese homesteads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area H: Category 3, limited constraint

SPA H (Fig. 13; Table 8) is a large area of the eastern EMUA with numerous sites, but most of these are concrete structures, associated with Japanese plantation period occupation or World War U.S. occupation. There are also numerous open areas between sites, so that a substantial amount of activity could take place within the area if the structures are avoided and no ground disturbance takes place in their vicinity. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area I: Category 2, moderate constraint

SPA I (Fig. 14; Table 9) is the cliffline of Lasu and Mangpang and contains a large complex of Japanese defensive sites and features, as well as prehistoric deposits (Site TN-015). Like the other clifflines, this one deserves protection from disturbance, and thus should be limited to pedestrian movement only, with clear prohibitions against digging in caves, artifact collection, or other disturbance.

Table 6. Significant Sites of Site Protection Area F.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
Z-436	F	JC	Railroad bed, with rails; stacked facing	A, C, D	1	Henry et al. 1996
Z-437	F	J	Railroad bed, with rails; stacked facing	A, C, D	2	Henry et al. 1996
Z-438	F	J	Railroad bed, with rails; stacked facing	A, C, D	2	Henry et al. 1996
Z-439	F	JM	Gatot; Cliffline defensive complex; tunnels, enclosures	A, C, D	3	Henry et al. 1996
Z-440	F	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-441	F	P	Ceramics scatter, medium size, deposit	D	3	Henry et al. 1996

See Appendix A for Key to Tables.

Table 7. Significant Sites of Site Protection Area G.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
Z-442	G	US	Central Bomb Dump	-	1	Henry et al. 1996
Z-443	G	P	Ceramics; small, shallow deposit	D	3	Henry et al. 1996
Z-444	G	JM	Dump	D	0	Henry et al. 1996
Z-445	G	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-446	G	JC/P	Sinkhole with habitation debris; structure, destroyed	D	3	Henry et al. 1996
Z-447	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-448	G	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-449	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-450	G	JC	Homestead, partial; cisterns	D	1	Henry et al. 1996
Z-455	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-542	G	JC	Homestead, partial	D	1	Henry et al. 1996

See Appendix A for Key to Tables.

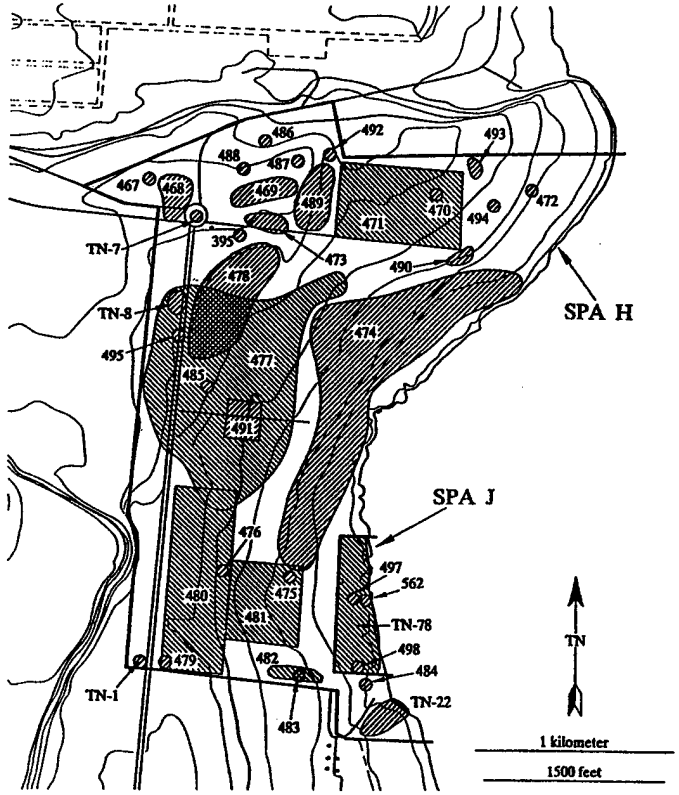


Figure 13. Significant archaeological sites, Site Protection Areas H and J. (All site numbers without TN- prefix have Z- prefix.)

Table 8. Significant Sites of Site Protection Area H.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-001	H	JC	Factories, remains	A, D	2	Jones 1991:36
TN-007	H	JC/US	Asahi (Sunrise) shrine	C, D	3	Jones 1991
TN-008	H	JC	NKK shrine	C, D	3	Jones 1991, Denfeld 1983
TN-022	H	JM	Unai Dangkulo defensive complex	A, C, D	1	Henry et al. 1996; Jones 1991; Franklin and Haun 1995
Z-395	H	JC	Bulldozed debris, demolished house	D	22	Henry et al. 1996
Z-467	H	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996
Z-468	H	JM	Laderan Gatot defensive complex (1); gun enclosures, fuel drum (machine gun position)	D	3	Henry et al. 1996
Z-469	H	JM	Laderan Gatot defensive complex (2); enclosure, stone; depressions, overhang; defensive depressions (Dual Purpose gun position), fuel drum enclosure (machine gun position)	A, C, D	3	Henry et al. 1996
Z-470	H	JM	Defensive modified depression	D	1	Henry et al. 1996
Z-471	H	US	67th NCB encampment, permanent; 1322 Engineering Regiment	A, B, C, D	1	Henry et al. 1996
Z-472	H	JM/US	Dump	?	0	Henry et al. 1996
Z-473	H	JC	Cisterns, slab, artifacts	D	1	Henry et al. 1996
Z-474	H	JM	JM Asiga Bay defense; concrete gun positioc, open; (held 80 mm Dual Purpose coastal gun); overhangs; combined Japanese and American use, rifle and gun positions; pillboxes, concrete gun pos., (held 6.5 mm-7.7 mm machine guns) prehistoric component with Pre-Latte and Latte Phase	A, C, D	1	Henry et al. 1996
Z-475	H	JC	Homestead, partial	D	2	Henry et al. 1996
Z-476	H	JC	Building, concrete	D	1	Henry et al. 1996
Z-477	H	JC	Homestead complexes	A, C, D	3	Henry et al. 1996
Z-478	H	US	East H-14-C N. Field, fuel tank farm	D	1	Henry et al. 1996
Z-479	H	JC	Slab, brick scatter	D	1	Henry et al. 1996
Z-480	H	US	9th NCB encampment	A, D	3	Henry et al. 1996
Z-481	H	US	509th Composite, temporary camp; 18th NCB; concrete slabs, trash	A, B, D	2	Franklin and Haun 1995: Tables 5 and 13
Z-482	H	JC	Homesteads, partial	D	3	Franklin and Haun 1995: Tables 5 and 13; 55
Z-483	H	P	Artifact scatter	D	3	Franklin and Haun 1995: Tables 5 and 13
Z-484	H	P	Artifact scatter	D	3	Franklin and Haun 1995: Tables 5 and 13
Z-485	H	JM	Gun position, fuel drum enclosure	D	1	Henry et al. 1996
Z-486	H	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996
Z-487	H	JC	Dump	D	0	Henry et al. 1996
Z-488	H	JM	Defensive, trench, fuel drum encl.	D	1	Henry et al. 1996
Z-489	H	US	C Battery, 17th AAA; (and 16th AAA?); road, mounds, posts, artifact scatters, earthen enclosures	A, D	3	Henry et al. 1996
Z-490	H	US	Dump	?	1	Henry et al. 1996
Z-491	H	US	Mine Depot No. 4; earthen structures, ARMCOs	D	1	Henry et al. 1996
Z-492	H	US	Survey marker and grill	D	0	Henry et al. 1996
Z-493	H	JM/US	Defensive complex with fuel drum enclosures	A, D	1	Henry et al. 1996
Z-494	H	US	Cave with historic artifacts	D	2	Henry et al. 1996
Z-495	H	US	Bunker, concrete	A, C, D	1	Henry et al. 1996
Z-563	H	P	Pictograph cave	A, C, D	3	Craib 1994

See Appendix A for Key to Tables.

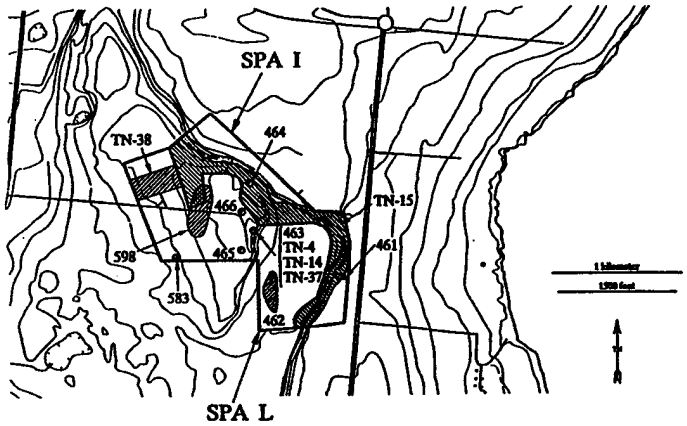


Figure 14. Significant archaeological sites, Site Protection Areas I and L. (All site numbers without TN- prefix have Z- prefix.)

Table 9. Significant Sites of Site Protection Area I.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
TN-015	I	JM/P	Caves, with prehistoric deposits and WWII defensive features; (probably contains headquarters of Colonel Ogata)	A, B, C, D	3	Henry et al. 1996; Jones 1991
Z-461	I	JC	Homestead, partial	D	2	Henry et al. 1996
Z-464	I	JC	Homestead, partial	D	2	Henry et al. 1996

See Appendix A for Key to Tables.

Site Protection Area J: Category 1, off-limits

SPA J (Fig. 12; Table 10) centers on the Unai Dangkulo prehistoric complex (Site TN-078) of *latte* sets and associated deposits and burials. Because these prehistoric features are so well-preserved, but easily damaged, the Unai Dangkulo area (inland of the sand beach) is recommend for a designation of off-limits. Any beach landings or activities on the beach have an access to the inland areas by a compacted road, allowing avoidance of the site area. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area K: Category 2, moderate constraint

SPA K (Fig. 15; Table 11) is recommended for temporary placement in Category 2 because of the limited archaeological survey. Most of area K is in the EMUA, but has only been surveyed by very small samples (Eble et al. 1995; see Figure 3), and was not covered in the survey of Henry et al. (1996). Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area L: Category 2, moderate constraint

SPA L (Fig. 14; Table 12) is the Mount Lasu area, containing a number of important sites, including a Japanese shrine and the remains of the U.S. Army hospital. The area is recommended for pedestrian activity only, except on the established roads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Table 10. Significant Sites of Site Protection Area J.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-078	J	P	Unai Dangkulo latte sets, deposit; (intensive, permanent occupation)	A, C, D	3	Craib 1994; Franklin and Haun 1995; Moore et al. 1986	
Z-497	J	JC	Concrete foundations, habitation complex	D	1	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-498	J	JM/P	Refuge cave; cave with water source	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13	Human remains
Z-562	J	JM	Gun emplacement, enclosure	D	1	Franklin and Haun 1995: Tables 5 and 13	

See Appendix A for Key to Tables.

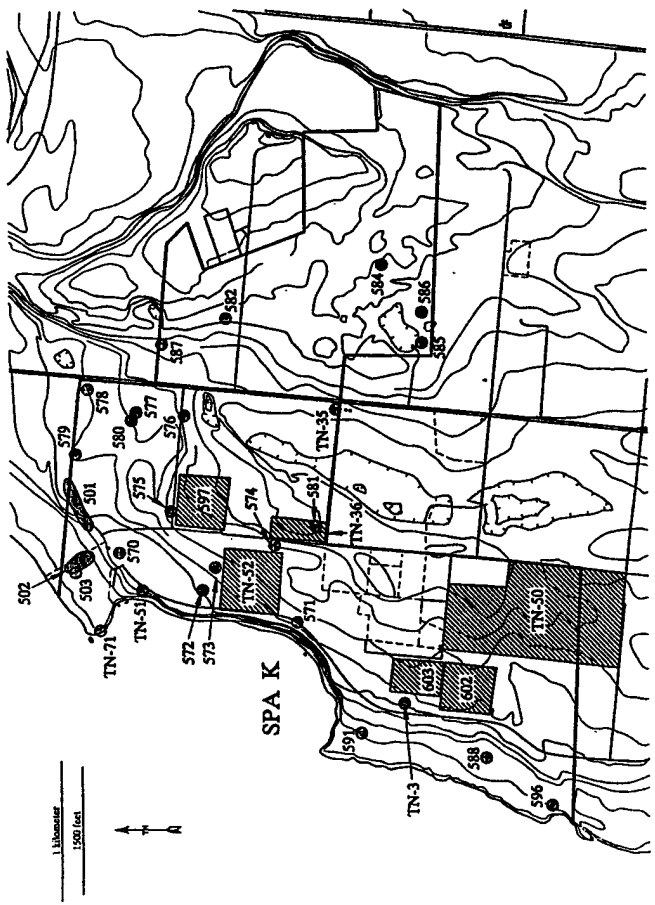


Figure 15. Significant archaeological sites, Site Protection Area K. (All site numbers without TN- prefix have Z- prefix.). The hatched site areas indicate site identification from aerial photos, without ground verification.

Table 11. Significant Sites of Site Protection Area K.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-002	K	JC	Civilian Camp	A, D	3	Jones 1991:40	
TN-003	K	JC	Administration Bldg	A, D	3	Jones 1991:47	
TN-034	K	US/C	Camp Churo Cemetery	A	3	Jones 1991:261	
TN-035	K	US	Stone headwalls, street intersection	A, D	1	Jones 1991:264	
TN-036	K	US	313th Bomb Wing HQ	A, B, D	3	Eble et al. 1995; Jones 1991	
TN-051	K	US	Guard rail	?	1	Eble et al. 1995; Jones 1991	
TN-052	K	US	504 Bomb Group Camp	A, B, D	3	Eble et al. 1995; Jones 1991	
TN-071	K	P	San Hilo pictographs	A, C, D	3	Eble et al. 1995; Moore et al. 1986	
Z-501	K	JM	San Hilo defensive cliffline complex; concrete gun position; overhangs, enclosures; tunnel	A, C, D	3	Henry et al. 1996	
Z-502	K	JC	Homesteads, intact	A, C, D	2	Henry et al. 1996	
Z-503	K	JM	San Hilo defensive complex; defensive enclosure, stone	A, D	1	Henry et al. 1996	
Z-564	K	JC	Cistern	D	1	Henry and Haun 1995	
Z-570	K	US	Refuse dump, and crash site	D	0	Eble et al. 1995	
Z-571	K	US	Camp	A, D	2	Eble et al. 1995	
Z-572	K	JM?	Concrete structure	A, D	1	Eble et al. 1995	
Z-573	K	JM?	Bunker; fuel drum	D	1	Eble et al. 1995	
Z-574	K	J	Concrete structure, unknown function	D	1	Eble et al. 1995	
Z-575	K	JC	Concrete stairway; shrine or residence	D	1	Eble et al. 1995	
Z-576	K	JC	Cistern	D	2	Eble et al. 1995	
Z-577	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-578	K	JC	Homestead	A, D	2	Eble et al. 1995	
Z-579	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-580	K	JC	Cistern	D	2	Eble et al. 1995	
Z-581	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-582	K	JC	Homestead	D	2	Eble et al. 1995	
Z-584	K	J/US	Massive concrete structure; US use	D	1	Eble et al. 1995	
Z-585	K	M	Dump, mixed US, Japanese	D	0	Eble et al. 1995	
Z-586	K	?	Cobble paving, small; unknown age	D	2	Eble et al. 1995	
Z-587	K	JC	Homesteads	A, C, D	2	Eble et al. 1995	
Z-588	K	P/JC	Rockshelter, *latte*, and cistern	A, D	3	Eble et al. 1995	Human remains
Z-591	K	P	Latte sets, quarry, mortars	A, D	3	Moore et al. 1986:175	
Z-596	K	P	Surface material	D	3	Moore et al. 1986:175	
Z-597*	K	US	505th Bomb Group	A, D	2	*	
Z-602*	K	US	6th Bomb Group	A, D	2	*	
Z-603*	K	US	9th Bomb Group	A, D	2	8	
Z-608*	K	US	Civilian Affairs	A, D	2	*	

See Appendix A for Key to Tables.

Table 12. Significant Sites of Site Protection Area L.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
TN-004	L	JC	Mt. Lasu shrine	C, D	3	Jones 1991; Henry and Haun 1995; Eble et al. 1995
TN-014	L	JM	Radar tower supports	D	3	Jones 1991
TN-037	L	US	B-29 homing tower	A, D	1	Jones 1991; Eble et al 1995
TN-038	L	US	Army hospital	A, D	2	Denfeld 1983; Jones 1991; Eble et al. 1995
Z-462	L	P	Ceramics, medium size scatter, deposit	D	3	Henry et al. 1996
Z-463	L	JM	JM Mt. Lasu observation post and defensive complex; platform, stone enclosures (for radar/searchlights; guns)	A, C, D	3	Henry et al. 1996
Z-465	L	JC	Homestead	A, D	2	Eble et al. 1995
Z-466	L	US	Mt. Lasu complex, military	A, D	2	Henry and Haun 1995
Z-583	L	P	Sherd scatter	D	3	Eble et al. 1995
Z-598*	L	US	Radio Transmission St.	D	2	*

See Appendix A for Key to Tables.

Site Protection Area M: Category 2, moderate constraint

SPA M (Fig. 16; Table 13), on the western side of the EMUA, contains a large prehistoric *latte* complex and associated deposits (Site TN-072) and an extensive distribution of well-preserved Okinawan farm houses. Activity in the area is recommended to pedestrian movement, with no ground disturbance and no vehicular use off established roads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area N: Category 3, limited constraint

SPA N (Fig. 16, Table 14) contains a variety of sites, but they are generally avoidable or not readily susceptible to damage. The area is recommended for Category 3 protection, allowing general activity in the area, with some individual site protection, and the avoidance of ground disturbance within three feet of structures. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area O: Category 2, moderate constraint

SPA O (Fig. 17, Table 15), the Laderan As Mahalang cliffline to the west of Gatut, contains several complexes of Japanese defensive sites, and is recommended for Category 2 protection, including the prohibition on digging in caves and artifact collection. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

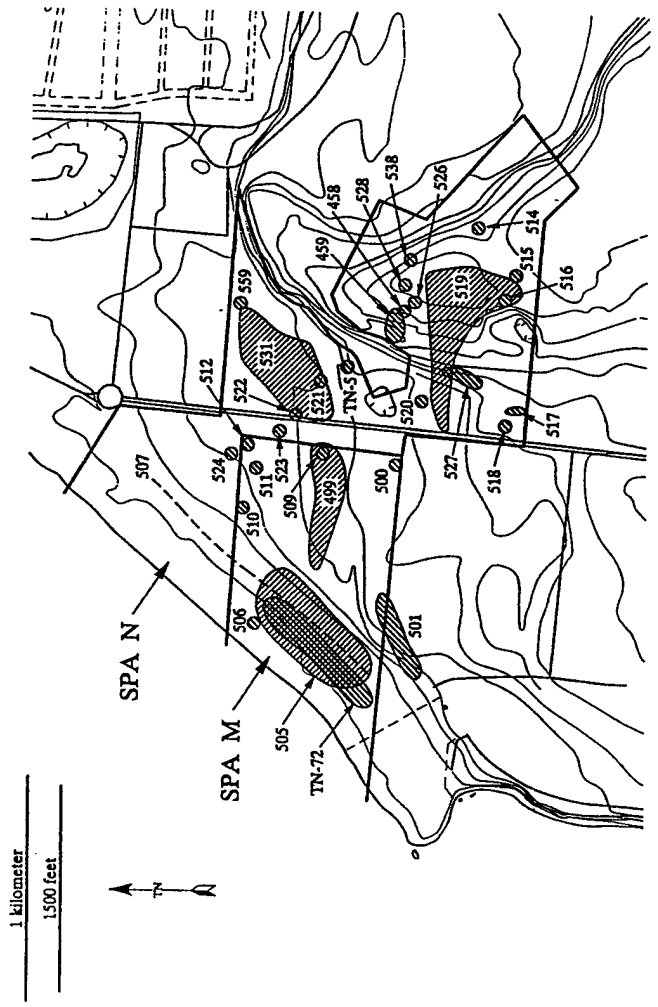


Figure 16. Significant archaeological sites, Site Protection Areas M and N. (All site numbers without TN- prefix have Z- prefix.)

Table 13. Significant Sites of Site Protection Area M.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References	Notes
TN-072	M	P	Latte sets at Sab. Farm, with stratified deposits; features; (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, C, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
Z-499	M	JC	Homestead complexes, intact	A, C, D	3	Henry et al. 1996	
Z-500	M	JM	Defensive stone platform	D	1	Henry et al. 1996	
Z-505	M	JM	Homestead complexes, intact	A, C, D	3	Henry et al. 1996	
Z-506	M	JM/P	Defensive modified depression	D	1	Henry et al. 1996	
Z-507	M	JC	Railroad bed; with rails; stacked facing	C, D	1	Henry et al. 1996	
Z-509	M	JM	Defensive modified depression	D	1	Henry et al. 1996	
Z-510	M	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-511	M	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-512	M	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	

See Appendix A for Key to Tables.

Table 14. Significant Sites of Site Protection Area N.

Site Number	SPA	Site Type	Site Description	NR eligible criteria	Threat	References	Notes
TN-005	N	US	Asphalt plant, wall foundation	A, D	1	Henry et al. 1996; Jones 1991	
Z-458	N	JM	JM Laderan Lasu defensive complex; stone enclosures; rifle pit/foxholes	A, C, D	1	Henry et al. 1996	
Z-459	N	JC	Habitation complex	D	2	Henry et al. 1996	
Z-514	N	JC	Homestead, partial	D	2	Henry et al. 1996	
Z-515	N	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-516	N	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996	
Z-517	N	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996	
Z-518	N	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	
Z-519	N	?	Defensive complex with fuel drum encl.	A, C, D	1	Henry et al. 1996	
Z-520	N	JC	Homestead, intact	C, D	2	Henry et al. 1996	
Z-521	N	JM/P	Sinkhole, with trash; Prehistoric compone...; Latte Phase ceramics	D	3	Henry et al. 1996	Human remains
Z-522	N	P?	Rock overhang	A, D	3	Henry and Haun 1995	Human remains
Z-523	N	JC	Cistern	D	1	Henry and Haun 1995	
Z-524	N	JM	Famalaoan defensive complex; modified depressions, rifle pit/foxholes	A, C, D	1	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform	D	1	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform	D	1	Henry et al. 1996	
Z-526	N	?	Gun position, fuel drum enclosure	A, D	1	Henry et al. 1996	
Z-527	N	JM	Cliffline defensive complex; caves, stone terraces	A, C, D	3	Henry et al. 1996	
Z-528	N	JM	Observation post, survey marker; platform	D	1	Henry et al. 1996	
Z-529	N	US	Bulldozed debris	D	0	Henry et al. 1996	
Z-530	N	?	Road on Maga	D	1	Henry et al. 1996	
Z-531	N	US	West H-14-C N Field, fuel tank farm; earthen enclosures	D	1	Henry et al. 1996	
Z-559	N	P	Pottery scatter	D	3	Craib 1993: Fig. 22	

See Appendix A for Key to Tables.

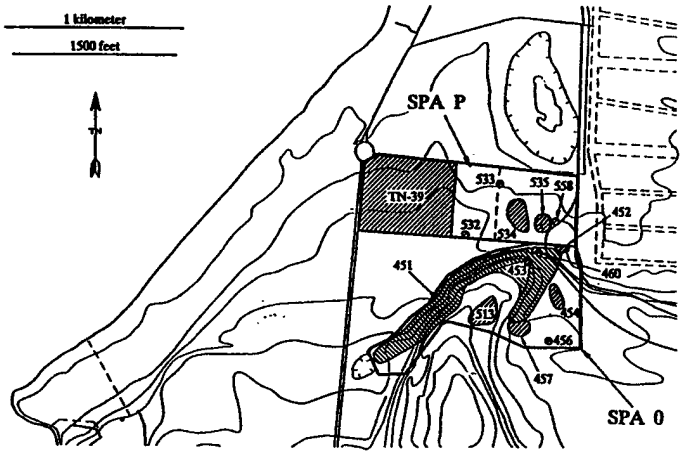


Figure 17. Significant archaeological sites, Site Protection Areas O and P. (All site numbers without TN- prefix have Z- prefix.)

Table 15. Significant Sites of Site Protection Area O.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
Z-451	O	JM/P	Cliffline defensive complex; gun enclosure, stone; depressions, rifle pits; with prehistoric deposits (Latte Phase ceramics)	A, C, D	3	Henry et al. 1996	
Z-452	O	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	
Z-453	O	US/P	Temporary encampment; slabs, depressions; prehistoric component	D	1	Henry et al. 1996	Human remains
Z-454	O	P	Ceramics, medium size, deposit	D	3	Henry et al. 1996	
Z-456	O	JC	Homestead, partial, cisterns	D	2	Henry et al. 1996	
Z-457	O	JC	Homestead complex, cave with trash	A, C, D	3	Henry et al. 1996	
Z-457	O	JC	Cistern	D	2	Henry et al. 1996	
Z-460	O	?	Road	D	1	Henry et al. 1996	
Z-513	O	US	Munitions storage? large earthen enclosures	D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area P: Category 2, moderate constraint

SPA P (Fig. 17) is the location of the camp of the 509th composite group (Site TN-039). The foundations of the camp are well-preserved and its significant historical association with the atomic bomb support a recommendation for Category 2 protection. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area Q: Category 1, off-limits

SPA Q (Figs. 18, 19, and 20; Table 16) focuses on Unai Chulu and the important prehistoric complex (Site TN-073), including *latte* remains, burials, and one of the earliest habitation sites in the Marianas (Jimenez et al. 1996). The importance of the location is also enhanced by the fact that this was one of the two primary U.S. invasion beaches of World War II.

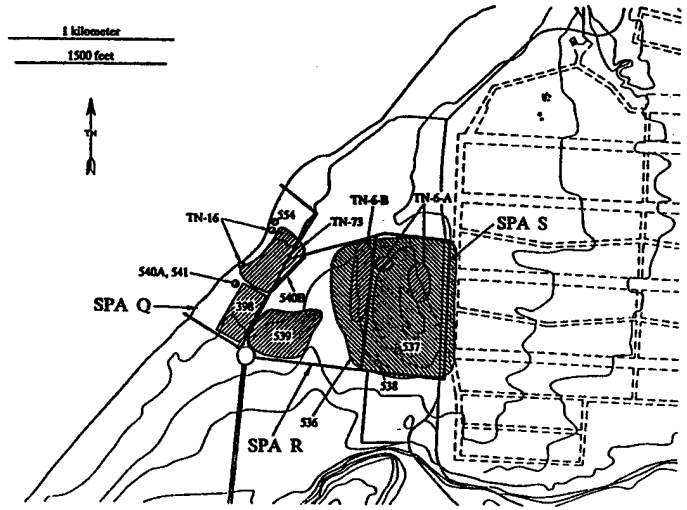


Figure 18. Significant archaeological sites, Site Protection Areas Q, R, and S. (All site numbers without TN- prefix have Z- prefix.)

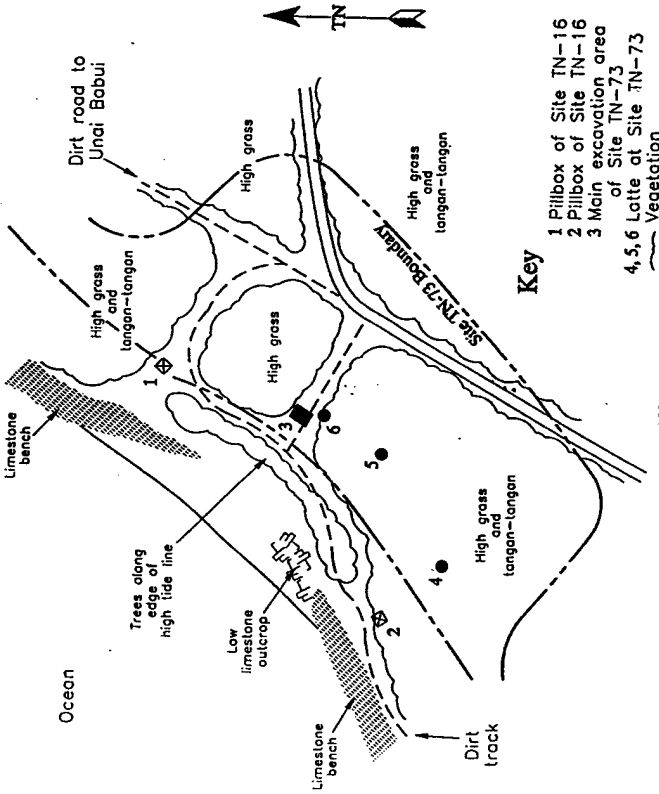


Figure 19. Detail of Unai Chulu, Site Protection Area Q.

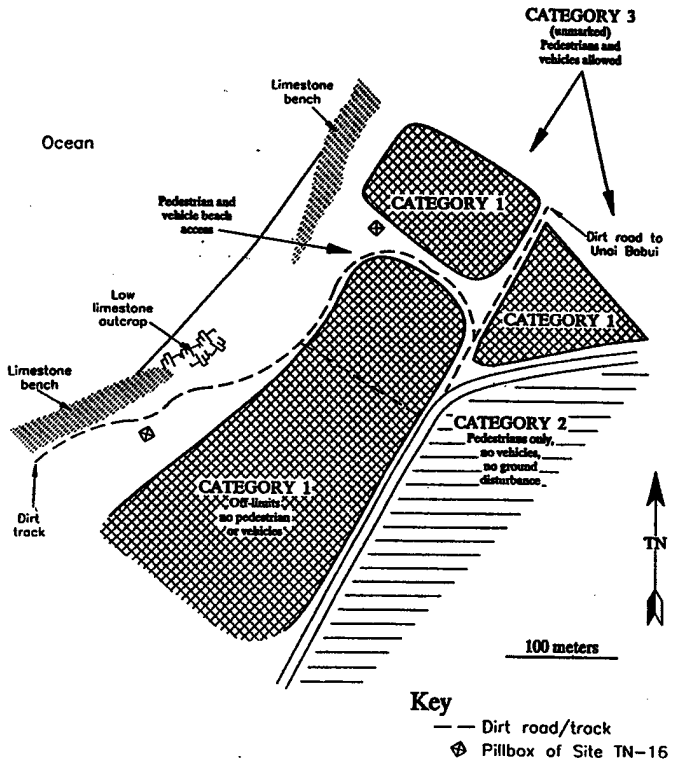


Figure 20. Constraints at Unai Chulu.

Table 16. Significant Sites of Site Protection Area Q.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-016	Q	JM	Unai Chulu pillboxes; (held 20 mm cannons); JM 3rd Co 1st Battalion, 50th Infantry	A, C, D	1	Jones, 1991; Denfeld 1983; Henry et al. 1996; Henry and Haun 1995	
TN-073	Q	P	Unai Chulu latte sets, disturbed; deposit; (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, C, D	3	Craib 1993:8-9; Jimenez et al. 1996; Moore et al. 1986; Henry et al. 1996	Human remains
Z-398	Q	US	American Military Cemetery, Former (2nd and 4th Marine Divisions)	A, C, D	1	Denfeld 1983, Jones 1991	
Z-540a	Q	?	Trench, military?	D	1	Henry et al. 1996	
Z-541	Q	?	Airplane wreck	D	1	Henry et al. 1996	
Z-554	Q	US	Landing craft fragments	A, D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

The July 1996 field inspection of Unai Chulu indicated that the previously cleared areas of the prehistoric site are now heavily overgrown with grasses, except for the east-west bulldozed track through the middle of the site. This is now being used as a road. Because of the significance of Unai Chulu, it is recommended that the entire area of site TN-073 west of the paved road be designated Category 1, off-limits, that the bulldozed track through the site, now in use as a road, be closed off, and that all activity in the area be restricted to the sandy beach and the access road to the north of the main beach (Fig. 20).

It is recommended that Site TN-073 be set aside for long-term preservation (with some restricted research allowed), with particular emphasis on protecting the areas of the site that contain the earliest components. If it is necessary for military purposes to contract the size of the area proposed as off-limits (see Fig. 19), then data recovery should be conducted in those areas taken out of "off-limits". It is proposed in the *Site Protection Plan* that the off-limits area be identified with fencing (Tuggle and Welch 1996). However, in no case should the off-limits area as defined by fencing be moved inside the areas of the earliest components.

Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area R: Category 2, moderate constraint

SPA R (Fig. 18; Table 17), between Unai Chulu and Lake Hagoi contains portions of the Unai Chulu prehistoric site (Site TN-073) and of the Japanese village that once existed at Hagoi (Site TN-006). It is recommended for Category 2, with prohibition on vehicles and ground disturbance. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area S: Category 1, off-limits

SPA S is the region of Lake Hagoi (Fig. 18; Table 18), the entire area of which has been found to contain prehistoric deposits (Site Z-536) and remnants of the Japanese village (Site TN-006) that existed here prior to World War II. It is recommended as off-limits. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Table 17. Significant Sites of Site Protection Area R.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References	Notes
TN-006b	R	JC	Village (Hagoi)	A, D	3	Franklin and Haun 1995; Jones 1991	
Z-536a	R	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	Human remains
Z-539	R	JM	Military complex; plus civilian features; railroad bed and roads	A, C, D	1	Franklin and Haun 1995: Tables 5 and 13	
Z-540b	R	?	Trench, military?	D	1	Franklin and Haun 1995: Tables 5 and 13	

Area R also contains a portion of Site TN-073 (the prehistoric Unai Chulu deposit). See Appendix A for Key to Tables.

Table 18. Significant Sites of Site Protection Area S.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-006a	S	JC	Village (Hagoi) w/Railroad line	A, D	3	Craib 1993; Henry et al. 1996; Jones 1991	
Z-536b	S	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	Human remains
Z-537	S	JC/US	Homestead, modified as pumping station; cisterns, slabs, concrete box	A, D	2	Henry et al. 1996	
Z-538	S	JC	Homestead, partial	D	2	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area T, U, and V: Categories 2 and 3

Of the three Site Protection Areas in the Leaseback Area (T, U, and V; Fig. 21; Table 19), T and V are recommended for temporary placement in Category 2 because of the lack of archaeological survey of the areas. In Figure 20, it should be noted that all of the sites marked with hatched lines are identified primarily from aerial photographs of the late 1940s and their current conditions are unknown. Future surveys in these areas would make the site information current and would allow a refined categorization of site protection areas.

One of the main roads through the Leaseback area (8th Avenue) has been surveyed (Area U) and is placed in Category 3, having only a limited number of features to avoid. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Specific Military Training Actions

Certain specific actions in the scoping documents are proposed for locations that may result in a direct impact on cultural resources. In particular these include locations for bivouacs, urban warfare, and weapons training (see Fig. 2). If locations for bivouacs and urban warfare impact on Category Areas 1 or 2, the activities should be relocated to Category Areas 3 or 4, if possible. If this is not feasible, then site protection and mitigation plans specific to each project should be developed. It should be emphasized that the level of detail on historic resources in a number of SPAs is not adequate for specific project planning. As described elsewhere in this *Assessment* and in the *Site Protection Plan*, not all areas have been surveyed at an inventory level, and many of the surveys that have been conducted have not been reported in detail.

Additional detail on proposed training facilities is provided in Figure 22. This includes a fire and maneuver range for small arms (which overlaps a proposed mortar range), two possible locations for construction of a shooting house (for urban training), the use of the WWII Japanese air administration staff building (not shown on Figure 22) for urban training, and development of two base support camp sites. The old mortar range (see Fig. 2; "weapons training") is to remain closed. Additional details are provided in Belt Collins Hawaii (1996b:2-32; Figures 2-12 and 2-13).

Fire and Maneuver Range; Mortar Range

The Fire and Maneuver Range will involve construction of a berm west of the public road and removal of tangantangan. The mortar range will require no construction or vegetation clearance, but will have target areas and an associated impact and safety zone.

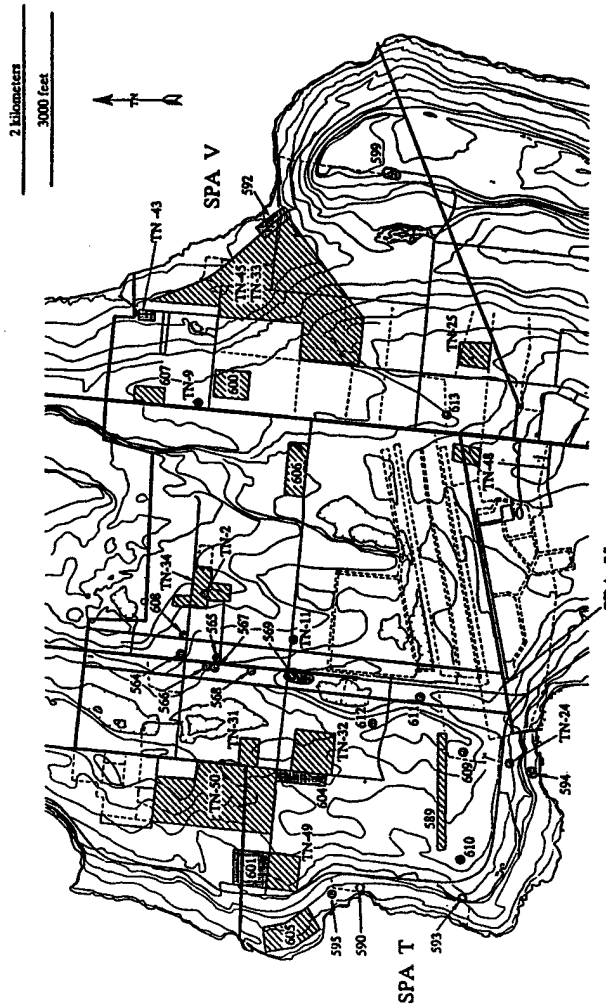


Figure 21. Significant archaeological sites, Site Protection Areas T, U, and V. (All site numbers without TN- prefix have Z- prefix.) The hatched site areas indicate site identification from aerial photos, without ground verification.

Table 19. Significant Sites of Site Protection Areas T, U, V.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-024	T	JM	Peipeinigul Gun	A, C, D	2	Jones 1991:192
TN-031	T	US	58th Wing HQ	A, B, D	3	Jones 1991: 246
TN-032	T	US	107th NCB Area	A, B, D	3	Jones 1991:251
TN-049	T	US	462nd Bomb Group Camp	A, B, C, D	3	Jones 1991:324
TN-050	T	US	Army Garrison Forces Depot	A, B, D	3	Jones 1991: 327
Z-589	T	JM	Gurguan Point Airfield	A, D	1	Jones 1991:201
Z-590	T	P	*Latte* sets (2), mortars	A, D	3	Moore et al. 1986:175
Z-593	T	P	Rock shelters (2) mortars, pottery	A, D	3	Moore et al. 1986:175
Z-594	T	P	Mortar, pottery	D	3	Moore et al. 1986:175
Z-595	T	P	Surface material	D	3	Moore et al. 1986:175
Z-601*	T	US	444th BG	A, D	2	*
Z-604*	T	US	468th BG	A, D	2	*
Z-605*	T	US	40th BG	A, D	2	*
Z-609*	T	US	C Battery, 18th AAA	A, D	2	*
Z-610*	T	US	A Battery, 180th SCA	A, D	2	*
Z-612*	T	US	Napalm Bomb Dump	A, D	0	*
TN-030	U	US	West Field (on-ramps)	C, D	1	Jones 1991: 240-245; Henry and Haun 1995
Z-565	U	P	Sherd scatter	D	3	Henry and Haun 1995
Z-566	U	PWC	Camp Churo ditch	A, D	1	Henry and Haun 1995
Z-567	U	US	Quarry	D	0	Henry and Haun 1995
Z-568	U	JC	Habitation complex	A, D	2	Henry and Haun 1995
Z-569	U	JC	Habitation complex	A, D	2	Henry and Haun 1995
Z-611*	U	US	HQ LAA 18th AAA	A, D	2	*
TN-009	V	J	Radio Communication Complex	A, D	2	Jones 1991: 98-110
TN-011	V	JC	86th St. Shinto Shrine	A, C, D	3	Jones 1991: 126
TN-025	V	JM	Antenna Tower Supports	D	1	Jones 1991:196
TN-033	V	US	Masalog Storage Quonset Huts	A, D	1	Jones 1991:258
TN-043	V	US	Munitions Storage Quonset Huts	A, D	1	Jones 1991: 304-307
TN-045	V	US	Masalog Storage Revetments	A, D	1	Jones 1991: 311
TN-048	V	US	Naval Air Base	A, B, C, D	1	Jones 1991
Z-592	V	P	*Latte* sets (5), mortars, quarry	A, D	3	Moore et al. 1986:175
Z-599*	V	US	696 Sig. AW Co	A, D	2	*
Z-600*	V	US	Hospital	A, D	2	*
Z-606*	V	US	87 & 25 Service Corps	A, D	2	*
Z-607*	V	US	240 Ord Ammo Co; 813, 827, 891 Chem. Co.	A, D	2	*
Z-613*	V	US	D Battery, 18th AAA	A, D	2	*

See Appendix A for Key to Tables.

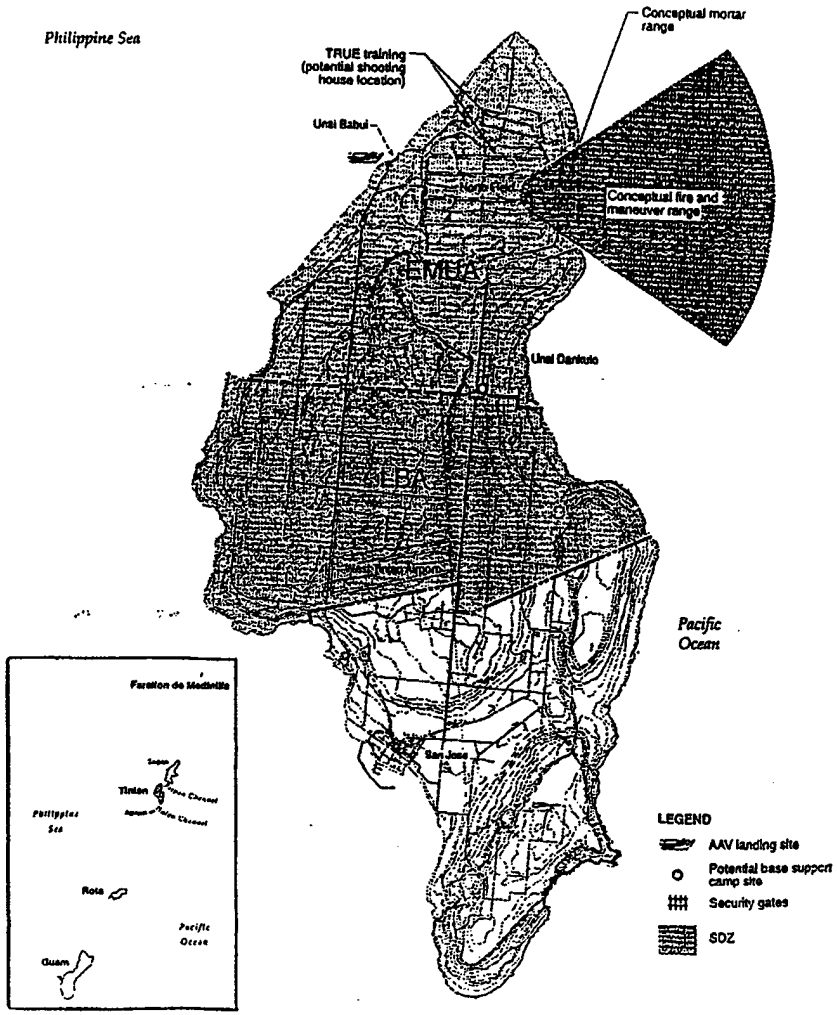


Figure 22. Proposed Tinian Training. (From Belt Collins Hawaii 1996b:Figure 2-10.)

These activities and facilities are proposed for an area in SPA D (see Fig. 11), with the safety fan for the Fire and Maneuver Range extending into SPA B (see Fig. 10). As indicated in the figures, there are several archaeological sites in the range area in SPA D (Category 3, limited constraint) including runways and taxiways (Site Z-364) of the North Field National Landmark, a variety of military debris (Site Z-416), a *latte* fragment (Site Z-419), a prehistoric sherd scatter (Site Z-421), and two WWII battery complexes (Sites Z-400 and Z-544). One important complex (Site Z-420) lies just to the west of the range. The portion of the range and safety fan that covers SPA B (Category 4, unconstrained, with protective actions implemented) is primarily in the old mortar range, which has no recorded sites, but the northeastern portion of the fan includes four sites in SPA B (see Fig. 10), WWII defensive complexes (Sites TN 19, TN-20, and Z-397) and one ceramic deposit (Site Z-396). All of these sites in the project area are recommended as eligible to the NRHP (Appendix A).

There are several sites in this area for which there would probably be little effect resulting from development and use of the firing ranges, including Sites Z-396, Z-397, Z-400, Z-419, TN-19, and TN-20. These sites all fall along the outer edge of the small arms safety fan for the Fire and Maneuver Range and are not in the Mortar Range.

Sites for which there could probably be an adverse impact resulting from berm construction and mortar firing include Z-364, Z-416, Z-421, and Z-544. The runways of Site Z-364 would be damaged by errant mortar fire. These is no way to avoid this threat, but damage should be mitigated by a program of runway repair. Sites Z-416 and Z-421 are recommended as significant for their information content, and suitable for mitigation of any adverse effect by means of data recovery (Appendix A). Appropriate data recovery of the military features of Site Z-416 would be detailed mapping and recording and collection of appropriate artifacts. Data recovery of Site Z-421, a prehistoric pottery scatter and partially disturbed deposit, should consist of a sample excavation (see Henry et al. 1996:38, B-10, field site no. 501). Site Z-544 is a large complex of US defensive features, probably including B Battery of the 17th AAA, and is recommended for preservation as a part of the North Field complex (Appendix A; also see Henry et al. 1996;B-135 and C-256, field site no. 332). However, if the location of the mortar range, which falls within the boundaries of Z-544, is deemed necessary, then the affected portion of Z-544 should be subject to data recovery. This should consist of detailed mapping and collection of appropriate artifacts.

Site Z-420 appears to be removed from the area of activity, but this well-preserved activity locale (see Craib 1995:Figure 16; field site no. 40) should be protected by some form of demarcation to avoid inadvertent damage and the area should be archaeologically monitored during berm construction.

Shooting Houses and Urban Training

The construction of a shooting house in one of two possible locations is proposed for North Field (Fig. 22), as well as the use of the Japanese Air Administration Staff Building

(Site Z-366) for urban training employing small arms fire. The shooting house would be a two-story concrete structure.

One of the proposed locations is immediately north of North Field runway number 1 and the second location is within a northern hardstand complex (Fig. 22), both within SPA D (Category 3, limited constraint), which is part of the North Field National Landmark. The first location is in an area surveyed by Craib (1995:93; survey area 3A) who reports a "low site density" with a total of six concrete structures in the entire survey area. However, the locations and descriptions of these sites are not indicated in the draft report and thus the sites have not been included in the assessment However, given the low site density, it would appear that the shooting house could be constructed without effect on historic properties in the area. It is recommended that if this locale is selected for construction that the shooting house be placed to avoid the existing structures.

The second location considered for the shooting house was surveyed by Donham (1986:Figure 4), with no sites identified in the area except hardstands (Donham 1986:Figure 6).

The Japanese Air Administration Staff Building, in the North Field National Landmark (and in SPA A, Category 2, moderate constraint), is proposed for use of live fire exercises in urban training. Protection of the structure is to be accomplished by the use of temporary bullet traps (Belt Collins Hawaii 1996b:2-32). However, this is one of the two most important standing structures in the North Field Landmark (along with the Air Operations Building), and heavy use of the building and potential failure of the bullet traps could result in serious damage. This structure is also recommended for long-term preservation and stabilization or rehabilitation (Tuggle and Welch 1996). It is recommended that construction of a shooting house or houses be chosen as the preferred alternative for urban warfare, and that the use of the Air Administration Staff Building (as well as the Air Operations Building) should be avoided if at all possible.

If it is decided to undertake the urban training using the Air Administration Staff Building or Air Operations Building, then appropriate mitigation measures should be implemented. These should include written and photographic documentation of the present condition of the building prepared by an architectural historian prior to initiation of the training exercises, followed by periodic monitoring of the building's condition to verify that live fire training is not damaging the building. If damage occurs, the training should be discontinued. The military should clean the area following each training exercise, but should not make any repairs of any damage they might cause. Repairs should be part of a historic rehabilitation program (see Tuggle and Welch 1996).

Base Support Camp Sites

One possible location for a base support camp is on the western side of the EMUA (Fig. 22), in SPA K. This area has not been archaeologically surveyed. It is recommended that such a survey be conducted prior to the development of the base camp.

A second possible location for a base support camp is in on the eastern side of the EMUA (Fig. 22) in SPA H (Category 3, limited constraint), in the vicinity of Sites Z-479 and Z-480, both of which are probably remnants of the 9th NCB encampment, with associated demolished pre-war Japanese structures. It is probable that the camp would have no effect on these remnants (which have been mapped) and it is recommended that no additional preservation action needs to take place in this locale related to the base camp development.

Management of Site Protection Areas

As noted above in the description of the Site Protection Areas, in general it is recommended that long-term protection be afforded areas by a variety of measures including permanent fencing for those areas that are eventually agreed to be designated as off-limits, and appropriate signage for selected portions of the Category 2 and Category 4 areas. Details on proposed management of site protection areas are provided in the *Site Protection Plan* (Tuggle and Welch 1996).

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APPENDIX A: SIGNIFICANT SITES (AS RECOMMENDED) IN THE MILITARY LEASE AREA OF TINIAN

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian.

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
?	?	P	Cave with sherds		D		?	3	H-035	Henry et al. 1996	
?	?	US	Truck, tanker		D		?	1	H-024	Henry et al. 1996	
TN-001	H	JC	Factories, remains		A, D		X	2	J-1001	Jones 1991:36	
TN-002	K	JC	Civilian Camp		A, D		X	3	J-1002	Jones 1991:40	
TN-003	K	JC	Administration Bldg		A, D		X	3	J-1003	Jones 1991:47	
TN-004	L	JC	Mt. Lasu shrine		C, D		X	3	J-1004; BS-T-25	Jones 1991; Henry and Haun 1995; Eble et al. 1995	
TN-005	N	US	Asphalt plant, wall foundation		A, D	X		1	J-1005; H-433	Henry et al. 1996; Jones 1991	
TN-006a	S	JC	Village (Hagoi)w/Railroad line		A, D		X	3	OG-J-7; J-1006; (H-367-369; HS-7)	Craib 1993; Henry et al. 1996; Jones 1991	
TN-006b	R	JC	Village (Hagoi)		A, D		X	3	HS-6; J-1006	Franklin and Haun 1995; Jones 1991	
TN-007	H	JC/US	Asahi (Sunrise) shrine		C, D		X	3	J-1007	Jones 1991	
TN-008	H	JC	NKK shrine		C, D		X	3	J-1008; D-11	Jones 1991, Denfeld 1983	
TN-009	V	J	Radio Communication Complex		A, D		X	2	J-1009	Jones 1991: 98-110	
TN-011	V	JC	86th St. Shinto Shrine		A, C, D		X	3	J-1011	Jones 1991: 126	
TN-014	L	JM	Radar tower supports		D	X		3	J-2003	Jones 1991	
TN-015	I	JM/P	Caves, with prehistoric deposits and WWII defensive features; (probably contains headquarters of Colonel Ogata)		A, B, C, D		X	3	(H-284,457, 512); J-2004	Henry et al. 1996; Jones 1991	
TN-016	Q	JM	Unai Chulu pillboxes; (held 20 mm cannons); JM 3rd Co 1st Battalion, 50th Infantry		A, C, D		X	1	D-26 J-2005; H-356; 1571-11	Jones, 1991; Denfeld 1983; Henry et al. 1996; Henry and Haun 1995	
TN-018	A	JM	Drainage ditch (Ushi Field Complex)		A, C, D		X	1	D-8; J-2007; H-155	Jones 1991; Henry and Haun 1995; Henry et al. 1996	
TN-019	B	JM	Revetments, earthen; munitions storage		D		X	1	J-2008; H-316	Henry et al. 1996	
TN-020	B	JM	NE coast complex; defensive tunnels		A, D		X	2	J-2008; H-314	Jones 1991; Henry et al. 1996	
TN-022	H	JM	Unai Dangkulo defensive complex		A, C, D		X	1	DS-25; J-2011; (H-330, 331)	Henry et al. 1996; Jones 1991; Franklin and Haun 1995	
TN-024	T	JM	Pelpelnigul Gun		A, C, D		X	2	J-2013	Jones 1991:192	
TN-025	V	JM	Antenna Tower Supports		D	X		1	J-2014	Jones 1991:196	
TN-030	U	US	West Field (on-ramps)		C, D		X	1	J-3005	Jones 1991: 240-245; Henry and Haun 1995	
TN-031	T	US	58th Wing HQ		A, B, D		X	3	J-3006	Jones 1991: 246	
TN-032	T	US	107th NCB Area		A, B, D	?	?	3	J-3007	Jones 1991:251	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
TN-033	V	US	Masalog Storage Quonset Huts		A, D	X		1	J-3008	Jones 1991:258	
TN-034	K	US/C	Camp Churo Cemetery		A		X	3	J-3009	Jones 1991:261	
TN-035	K	US	Stone headwalls, street intersection		A, D		X	1	J-3010	Jones 1991:264	
TN-036	K	US	313th Bomb Wing HQ		A, B,		X	3	J-3011; (BS-T-18,-20)	Eble et al. 1995; Jones 1991	
TN-037	L	US	B-29 homing tower		A, D		X	1	J-3012; BS-T-26	Jones 1991; Eble et al 1995	
TN-038	L	US	Army hospital		A, D		X	2	J-3013; (BS-T-21, 22)	Denfeld 1983; Jones 1991; Eble et al. 1995	
TN-039	P	US	509th Composite Group encampment (prev. 18th NCB)		A, B, C, D		X	3		Craib 1993; Jones 1991	
TN-041	A	US	A-bomb assembly areas; earthen enclosures, platforms		A, B, C, D		X	2	D-14; J-3016; H-497	Jones 1991; Henry et al. 1996; Welch and Tuggle 1996	
TN-042	A	US	17th AAA recreational structure remnant		A, B, C, D		X	2	D-13; J-3017;H-521	Denfeld 1983; Henry et al. 1996; Jones 1991:31, 297-303	
TN-043	V	US	Munitions Storage Quonset Huts		A, D	X		1	J-3018	Jones 1991: 304-307	
TN-045	V	US	Masalog Storage Revetments		A, D	X		1	J-3020	Jones 1991: 311	
TN-048	V	US	Naval Air Base		A, B, C, D		X	1	J-3023	Jones 1991	
TN-049	T	US	462nd Bomb Group Camp		A, B, C, D		X	3	J-3024	Jones 1991:324	
TN-050	T	US	Army Garrison Forces Depot		A, B, D		X	3	J-3025	Jones 1991: 327	
TN-051	K	US	Guard rail		?	X		1	J-3026, BS-T-02	Eble et al. 1995; Jones 1991	
TN-052	K	US	504 Bomb Group Camp		A, B, D		X	3	J-3027; BS-T-03; (part of 0052 TN)	Eble et al. 1995; Jones 1991	
TN-071	K	P	San Hilo pictographs		A, C, D		X	3	M-28; BS-T-05	Eble et al. 1995; Moore et al. 1986	
TN-072	M	P	Latte sets at Sab. Fam. with stratified deposits; features; (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, C, D		X	3	(M-27; H-417)	Moore et al. 1986; Henry et al. 1996	
TN-073	Q	P	Unai Chulu latte sets, disturbed; deposit; (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, C, D		X	3	(H-48, 354, 359; M-7)	Craib 1993:8-9; Jimenez et al. 1996; Moore et al. 1986; Henry et al. 1996	
TN-074	A	P	Unai Babui latte set; large, stratified deposit, features, (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, D		X	3	(M-23; H-486)	Moore et al. 1986; Henry et al. 1996	
TN-075	A	P	Unai Lamlam ceramic deposit		A, D		X	3	M-2; C-48	Moore et al. 1986; Craib 1995	
TN-076	A	P	P. Tahgong latte sets stratified deposits, features; (intensive, permanent occupation; Latte Phase ceramic)	X	A, D		X	3	(M-1; H-505)	Moore et al. 1986; Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
TN-077	E	P	Unai Chiget latte sets, deposit; (intensive, permanent occupation)		A, D		X	3	C-52, 53; H-252,253; M-29	Moore et al. 1986; Henry et al. 1996; Craib 1995	
TN-078	J	P	Unai Dangkulo latte sets, deposit; (intensive, permanent occupation)		A, C, D		X	3	DS-21; (M-11-21) H-278	Craib 1994; Franklin and Haun 1995; Moore et al. 1986	
Z-353	A	JC	Cistern		D		X	2	H-065	Henry et al. 1996	
Z-354	A	JM	Defensive enclosure, earthen		D		X	1	H-019	Henry et al. 1996	
Z-355	A	JM	Unai Babui defensive complex: fuel drum gun enclosures (JM, 3rd Co. 1st Battalion, 50th Infantry Div.)		A, C, D		X	3	(H-004, 005, 007-013, 015, 017, 018, 050)	Henry et al. 1996; Jones 1991	(1)
Z-356	A	JM	Gun position, fuel drum revetment		A, D		X	2	0218-T-22	Donham 1986:32, 68	
Z-357	A	US	Gun position, fuel drum revetments		A, D		X	2	(H-123, H-022)	Henry et al. 1996	
Z-358	A	US	Gun position, fuel drum revetment		A, D		X	2	D-22; H-021	Denfeld 1983; Henry et al. 1996	
Z-359	A	US	Landing craft, and craft fragments	X	A, D	X		1	(H-023, 028)	Henry et al. 1996	
Z-360	A	P	Pottery scatter		D	X		3	OG-P-03	Craib 1993:8, Fig. 1	
Z-361	A	J	Trash scatter		D	X		1	H-034	Henry et al. 1996	
Z-362	A	US	509th Composite Group service area		A, C, D		X	1	H-001	Henry et al. 1996	
Z-363	A	JM	Gun emplacement		A, C, D		X	1	D-1	Denfeld 1983; Henry and Haun 1995	
Z-364	D	US	North Field runways, hardstands, and taxiways		A, B, C, D		X	0	(D-20, H-210-214)	Denfeld 1983:37	(2)
Z-365	A	US	Atomic bomb loading pits		A, B, C, D		X	2	D-19	Denfeld 1983:36	
Z-366	A	JM	Air Administration staff building (Ushi Field Complex)		A, B, C, D		X	1	D-5, J-2016	Jones 1991:29, 204-210	
Z-367	A	JM	Air Operations building (Ushi Field Complex)		A, C, D		X	1	D-7; J-2017	Jones 1991:29, 211-214	
Z-368	A	JM	Power plant (Ushi Field Complex)		A, C, D		X	2	D-4; J-2018	Jones 1991:30, 215-221	
Z-369	A	JM	Air raid shelters (Ushi Field Complex)		A, C, D		X	1	D-6; J-2019	Jones 1991:30, 222-225	
Z-370	A	JM	Aircraft parking area (Ushi Field Complex)		A, D		X	0			
Z-371	A	JM	Housing remains, cisterns, air raid shelters, etc., west of X-370 (Ushi Field Complex)		A, D		X	2			
Z-372	A	JM	Housing remains, cisterns, air raid shelters, etc., east of X-370 (Ushi Field Complex)		A, D		X	2	OG-J-08		
Z-373	A	JM	Storage bunker, fuel drum (Ushi Field Complex)		A, C, D		X	0	D-3; 0218-T-45	Donham 1986:33, 35; Denfeld 1983	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-374	A	JM	Storage bunker, ammo, demolished (Ushi Field Complex)		A, C, D		X	0	D-3; 0218-T-46	Donham 1986:34, 52; Denfeld 1983	
Z-375	A	JM	Gun positions, fuel drum enclosures, concrete storage bunker (Ushi field defensive complex)		A, C, D		X	1	(0218-T-01, 0218-T-03-16)	Donham 1986:31, 34	
Z-376	A	US	Mound, dump		D	X		0	H-348	Henry et al. 1996	
Z-377	A	JM/US	Defensive complex, fuel drum enclosure, earthen enclosure., slabs (Ushi Point complex 2; reused by US)		A, C, D		X	1	(H-344, 350)	Henry et al. 1996	
Z-378	A	JM/US	Gun position, fuel drum, encl., slabs (Ushi Point complex 1; reused by US)		A, D		X	1	H-329	Henry et al. 1996	
Z-379	A	US	17 AAA camp remains		A, D	X		3	various IOs (isolated objects, see Henry et al. 1996:Figure 180)		
Z-380	A	US	Debris, equipment		D	X		1	0218-T-24	Donham 1986:32, 81	
Z-381	A	P	Sherd scatter		D	X		3	0218-T-23	Donham 1986:32, 83	
Z-382	A	US	A Battery, 17th AAA; foundation piers, concrete pads		A, C, D		X	2	(0218-T-31,32,34)	Donham 1986:33, 48	
Z-383	A	P	Sherd scatter, lithics		D	X		3	0218-T-36	Donham 1986:33, 84	
Z-384	A	US/JM ?	Foundation, gun revetment, debris, foxhole		A, C, D	X		1	(0218-T-33, 48, 49)	Donham 1986:33, 50	
Z-385	A	P	Sherd scatter		D	X		3	0218-T-35	Donham 1986:33, 83	
Z-386	B	P	Sherd scatter		D	X		3	0218-T-44	Donham 1986:33, 86	
Z-387	B	US	Rubble steps, structure remnants; trash, engine parts		D	X		1	(0218-T-38, 40-42)	Donham 1986:33, 71	
Z-388	B	?	Berm, fence		D	X		1	(0218-T-28, 30)	Donham 1986:32, 73	
Z-389	B	?	Revetment, mound		A, D	X		1	0218-T-29	Donham 1986:32, 68	
Z-390	C	US	Dump		D	X		0	H-325	Henry et al. 1996	(3)
Z-391	C	JM	Gun complex, fuel drum enclosures		D		X	1	H-326	Henry et al. 1996	
Z-392	B	P	Ceramics, shallow deposit, feature		A, D		X	3	H-504	Henry et al. 1996	
Z-393	B	US	B Battery, 17th AAA; Defensive mounds, earthen (radar/searchlights)		A, D		X	1	H-319	Henry et al. 1996	
Z-394	B	P	Ceramics, small shallow deposit		D	X		33	H-503	Henry et al. 1996	
Z-395	H	JC	Bd debris, demolished house		D	X		22	H-231	Henry et al. 1996	
Z-396	B	P	Ceramics, small shallow deposit		D	X		3	H-502	Henry et al. 1996	
Z-397	B	JM	NE coast defensive complex, stone/earthen mounds (for radar/searchlights), trash		A, D		X	1	(H-309, 313)	Henry et al. 1996	
Z-398	Q	US	American Military Cemetery, Former (2nd and 4th Marine Divisions)		A, C, D		X	1	D-21; J-3029	Denfeld 1983, Jones 1991	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-399	C	US	Dump		D	X		0	H-318	Henry et al. 1996	
Z-400	D	?	Gun enclosure, earthen		D		X	1	H-339	Henry et al. 1996	
Z-401	C	US	313th Wing Base Service Command, service group shop area (359th, 358th, 77th, and 72nd Service Groups)		A, B, D		X	3	D-18; P-1; OG-U-01	Denfeld 1983:35; Dilli and Haun 1991:16-17); Craib 1993	
Z-402	D	US	B-29 service apron shop		A, B, D		X	1	D-17; 0218-T-47	Donham 1986:34, 54; Denfeld 1983	
Z-403	D	?	Aircraft debris, rubbish, secondary		D	X		1	0218-T-17	Donham 1986:32, 82	
Z-404	D	P	Sherd scatters		D	X			(0218-T-18-21, 26)	Donham 1986:32, 82	
Z-405	D	JM	Gun position, fuel drum revetment		A, D		X	1	0218-T-25	Donham 1986:33, 68	
Z-406	D	JM	Unai Chulu defensive complex; gun positions, fuel drum revetments (JM 3rd Co. 1st Battalion, 50th Infantry Division)		A, C, D		X	1	(H-056-59)	Henry et al. 1996	
Z-407	D	JM	Unai Babui defensive complex; fuel drum revetments, earthen mounds (JM 3rd Co. 1st Battalion, 50th Infantry Division)		A, C, D		X	3	(H-040-42, 45, 48, 49, 51, 52, 54, 55)	Henry et al. 1996	
Z-408	D	US	Amtrak		A, C, D		X	1	1571-T-15	Henry and Haun 1995	
Z-409	D	JM	Water collection culverts for purification plant; structures		A, D		X	2	D-8, H-156	Denfeld 1983; Henry et al. 1996	
Z-410	D	M	Dump with Japanese boundary marker		D	X		1	H-154	Henry et al. 1996	
Z-411	D	US	Airplane wreck		D	X		1	H-153	Henry et al. 1996	
Z-412	D	US	Tower base, fuel drums, and culverts, with inscriptions by 110th NSB; inscriptions by 13th NCB		A, D		X	0	(H-126, 129)	Henry et al. 1996	
Z-413	D	JM/w US?	Gun position, fuel drum enclosures; tower bases		A, D		X	1	(H-130-134,136, 143)	Henry et al. 1996	
Z-414	D	JC	Japanese Civilian habitation complex; Homestead, partial; with RR bed		A, C, D		X	2	(H-139, 140, 145)	Henry et al. 1996	
Z-415	D	US	Cluster of destroyed machinery and steel, iron, and aluminum fragments; concrete boxes, pads, culverts, iron structure, tire dump, crane section, fuel drums		D	X		0	(C-08-11, 13,-23)	Craib 1995:59, 63	
Z-416	D	US	Drums, concrete boxes, culverts Baldwin-Lima-Hamilton crane and associated debris, machinery, tower remnants		D	X		1	(C-01, 02,05-06, 24-29, 31, 35-37, 39, 41-43)	Craib 1995:58-59	
Z-417	D	P	*Latte* pillars, possible; limestone fragments; pottery scatter; (some concrete fragments)		D	X		3	(C-03-04)	Craib 1995:59, 62	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-418	D	P	Sherd scatter		D	X		3	C-30	Craib 1995:60, 69, 72	
Z-419	D	P	*Latte* stones, possible		D	X		3	C-34	Craib 1995:60, 72-73	
Z-420	D	US/JC ?	Building foundations, rock-lined path, metal troughs, trash dump or latrine area; also Japanese sugar village remnant?		A, D	X		1	C-40	Craib 1995:60, 74, 77-78	
Z-421	D	P	Ceramics, small shallow deposit		D	X		3	H-501	Henry et al. 1996	
Z-422	D	M	Bd debris		D	X		0	H-215	Henry et al. 1996	
Z-423	D	US	Enclosure, earthen, pit; storage		D	X		1	H-247	Henry et al. 1996	
Z-424	D	US	Dump		D	X		0	H-209	Henry et al. 1996	
Z-425	D	US	Dump		D	X		0	H-219	Henry et al. 1996	
Z-426	D	US	Service area and assoc. encampment, of 121st NCB (first CBs on island)		A, B, C, D		X	2	H-245, D-28	Henry et al. 1996	
Z-427	D	US	Defensive enclosure of metal boxes		A, D	X		1	H-194	Henry et al. 1996	
Z-428	D	US	Enclosures, earthen, storage		D	X		1	H-296	Henry et al. 1996	
Z-429	D	US	Encampment, original 67th NCB, (moved to Site 68)		A, D		X	2	H-201	Henry et al. 1996	
Z-430	D	US/JM ?	Defensive complex, with gun positions, fuel drum; dump		A, D		X	1	(H-167, 176-178, 334)	Henry et al. 1996	
Z-431	E	P	Ceramic scatters; medium size, stratified deposit; large stratified deposit	X	D	X		3	(H-220, 482, 484)	Henry et al. 1996	
Z-432	E	JM/P	Laderan Chiget defensive cave complex, rifle positions, fuel drum enclosures (assoc. with JM 2nd Battalion 50th Infantry Div.) and Cave complex, with stratified prehistoric deposits; with Pre-Latte and Latte Phase (intensive, permanent occupation)		A, C, D		X	3	(H-88, 89, 91-94, 104-109, 116, 118-121, 250, 254), (C-49-51, 54-56)	Henry et al. 1996	
Z-433	E	P	Latte sets and stratified deposits, features; Pre-Latte and Latte Phase (intensive, permanent occupation); various deposits	X	A, D		X	3	(H-255, 479-481)	Henry et al. 1996	
Z-434	E	JC	Homestead, partial		D	X		2	H-251	Henry et al. 1996	
Z-435	E	JC	Railroad bed, with rails, wooden ties; stacked facing		A, C, D		X	1	H-090	Henry et al. 1996	
Z-436	F	JC	Railroad bed, with rails; stacked facing		A, C, D		X	1	H-083	Henry et al. 1996	
Z-437	F	J	Railroad bed, with rails; stacked facing		A, C, D		X	2	H-287	Henry et al. 1996	
Z-438	F	J	Railroad bed, with rails; stacked facing		A, C, D		X	2	H-289	Henry et al. 1996	
Z-439	F	JM	Gatot; Cliffline defensive complex; tunnels, enclosures		A, C, D		X	3	(H-286, 288, 290293, 297)	Henry et al. 1996	
Z-440	F	JC	Homestead, partial; cisterns		D	X		2	H-294	Henry et al. 1996	
Z-441	F	P	Ceramics scatter, medium size, deposit		D	X		3	H-488	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-442	G	US	Central Bomb Dump		-	?		1	H-509	Henry et al. 1996	
Z-443	G	P	Ceramics; small, shallow deposit		D	X		3	H-500	Henry et al. 1996	
Z-444	G	JM	Dump		D	X		0	(H-304, H-305)	Henry et al. 1996	
Z-445	G	JC	Homestead, partial; cisterns		D	X		2	H-525	Henry et al. 1996	
Z-446	G	JC/P	Sinkhole with habitation debris; structure, destroyed		D	X		3	(H-523, H-524)	Henry et al. 1996	
Z-447	G	JC	Homestead, partial		D	X		2	H-519	Henry et al. 1996	
Z-448	G	JC	Homestead, partial; cisterns		D	X		2	H-467	Henry et al. 1996	
Z-449	G	JC	Homestead, partial		D	X		2	H-520	Henry et al. 1996	
Z-450	G	JC	Homestead, partial; cisterns		D	X		1	H-510	Henry et al. 1996	
Z-451	O	JM/P	Cliffline defensive complex; gun enclosure, stone; depressions, rifle pits; with prehistoric deposits (Latte Phase ceramics)		A, C, D		X	3	(H-386, 388, 391-393, 432, 435,466)	Henry et al. 1996	
Z-452	O	JC	Homestead, intact		A, C, D		X	2	H-383	Henry et al. 1996	
Z-453	O	US/P	Temporary encampment; slabs, depressions; prehistoric component	X	D		X	1	H-437	Henry et al. 1996	
Z-454	O	P	Ceramics, medium size, deposit		D	X		3	H-496	Henry et al. 1996	
Z-455	G	JC	Homestead, partial		D	X		2	H-465	Henry et al. 1996	
Z-456	O	JC	Homestead, partial, cisterns		D	X		2	H-468	Henry et al. 1996	
Z-457	O	JC	Homestead complex, cave with trash		A, C, D		X	3	(H-427, 428, 470-472)	Henry et al. 1996	
Z-457	O	JC	Cistern		D	X		2	H-472	Henry et al. 1996	
Z-458	N	JM	JM Laderan Lasu defensive complex; stone enclosures; rifle pit/foxholes		A, C, D		X	1	H-447	Henry et al. 1996	
Z-459	N	JC	Habitation complex		D		X	2	(H-441, 444, 445)	Henry et al. 1996	
Z-460	O	?	Road		D	X		1	H-387	Henry et al. 1996	
Z-461	I	JC	Homestead, partial		D	X		2	H-285	Henry et al. 1996	
Z-462	L	P	Ceramics, medium size scatter, deposit		D	X		3	H-494	Henry et al. 1996	
Z-463	L	JM	JM Mt. Lasu observation post and defensive complex; platform, stone enclosures (for radar/searchlights; guns)		A, C, D		X	3	H-455	Henry et al. 1996	(4)
Z-464	I	JC	Homestead, partial		D	X		2	H-454	Henry et al. 1996	
Z-465	L	JC	Homestead		A, D		X	2	BS-T-24	Eble et al. 1995	
Z-466	L	US	Mt. Lasu complex, military		A, D		X	2	1571-09	Henry and Haun 1995	
Z-467	H	P	Ceramics, small, shallow deposit		D	X		3	H-489	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-468	H	JM	Laderan Gatot defensive complex (1); gun enclosures, fuel drum (machine gun position)		D		X	3	(H-079, 302, 303)	Henry et al. 1996	
Z-469	H	JM	Laderan Gatot defensive complex (2); enclosure, stone; depressions, overhang; defensive depressions (Dual Purpose gun position), fuel drum enclosure (machine gun position)		A, C, D		X	3	(H-070, 74, 75, 82)	Henry et al. 1996	
Z-470	H	JM	Defensive modified depression		D		X	1	H-111	Henry et al. 1996	
Z-471	H	US	67th NCB encampment, permanent; 1322 Engineering Regiment		A, B, C, D		X	1	(H-068, 71, 95, 98, 112)	Henry et al. 1996	
Z-472	H	JM/US	Dump		?	X		0	H-256	Henry et al. 1996	
Z-473	H	JC	Cisterns, slab, artifacts		D	X		1	H-077	Henry et al. 1996	
Z-474	H	JM	JM Asiga Bay defense; concrete gun position, open; (held 80 mm Dual Purpose coastal gun); overhangs; combined Japanese and American use, rifle and gun positions; pillboxes, concrete gun pos., (held 6.5 mm-7.7 mm machine guns)prehistoric component with Pre-Latte and Latte Phase		A, C, D		X	1	(H-243, 244, 258, 262, 263, 265, 268	Henry et al. 1996	
Z-475	H	JC	Homestead, partial		D	X		2	H-276	Henry et al. 1996	
Z-476	H	JC	Building, concrete		D	X		1	H-279	Henry et al. 1996	
Z-477	H	JC	Homestead complexes		A, C, D		X	3	(H-233-225, 227,228, 230,234-237, 241,242, 261, 267, 270, 307, 513, 514, 516, 517)	Henry et al. 1996	
Z-478	H	US	East H-14-C N. Field, fuel tank farm		D	X		1	H-229	Henry et al. 1996	
Z-479	H	JC	Slab, brick scatter		D	X		1	H-281	Henry et al. 1996	
Z-480	H	US	9th NCB encampment		A, D		X	3	H-271	Henry et al. 1996	
Z-481	H	US	509th Composite, temporary camp; 18th NCB; concrete slabs, trash		A, B, D		X	2	(DS-09, 10, 12-14, 17, 22-24, H-269, 272, 274, 277, 283)	Franklin and Haun 1995: Tables 5 and 13	
Z-482	H	JC	Homesteads, partial		D	X		3	(DS-01, 03)	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-483	H	P	Artifact scatter		D	X		3	DS-02	Franklin and Haun 1995: Tables 5 and 13	
Z-484	H	P	Artifact scatter		D	X		3	DS-05	Franklin and Haun 1995: Tables 5 and 13	
Z-485	H	JM	Gun position, fuel drum enclosure		D	X		1	H-515	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-486	H	P	Ceramics, small, shallow deposit		D	X		3	H-483	Henry et al. 1996	
Z-487	H	JC	Dump		D	X		0	H-076	Henry et al. 1996	
Z-488	H	JM	Defensive, trench, fuel drum encl.		D	X		1	H-081	Henry et al. 1996	
Z-489	H	US	C Battery, 17th AAA; (and 16th AAA?); road, mounds, posts, artifact scatters, earthen enclosures		A, D		X	3	(H-069,73, 84, 86, and 87)	Henry et al. 1996	
Z-490	H	US	Dump		?	X		1	(H-115, 264), J-3022	Henry et al. 1996	
Z-491	H	US	Mine Depot No. 4; earthen structures, ARMCOs		D	X		1	(H-239, 240, 259, 260)	Henry et al. 1996	
Z-492	H	US	Survey marker and grill		D	X		0	H-072	Henry et al. 1996	
Z-493	H	JM/US	Defensive complex with fuel drum enclosures		A, D		X	1	(H-096, 113)	Henry et al. 1996	
Z-494	H	US	Cave with historic artifacts		D	X		2	H-114	Henry et al. 1996	
Z-495	H	US	Bunker, concrete		A, C, D		X	1	H-495	Henry et al. 1996	
Z-496	E	JC	House, concrete		D	X		1	H-099	Henry et al. 1996	
Z-497	J	JC	Concrete foundations, habitation complex		D	X		1	DS-19	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-498	J	JM/P	Refuge cave; cave with water source	X	A, C, D		X	3	(DS-07, 08)	Franklin and Haun 1995: Tables 5 and 13	
Z-499	M	JC	Homestead complexes, intact		A, C, D		X	3	(H-404, 419-422)	Henry et al. 1996	
Z-500	M	JM	Defensive stone platform		D		X	1	H-460	Henry et al. 1996	
Z-501	K	JM	San Hilo defensive cliffline complex; concrete gun position; overhangs, enclosures; tunnel		A, C, D		X	3	(H-418, 458, 462)	Henry et al. 1996	
Z-502	K	JC	Homesteads, intact		A, C, D		X	2	(H-415, 459)	Henry et al. 1996	
Z-503	K	JM	San Hilo defensive complex; defensive enclosure, stone		A, D		X	1	H-416	Henry et al. 1996	
Z-505	M	JM	Homestead complexes, intact		A, C, D		X	3	(H-405-408, 410, 411, 414)	Henry et al. 1996	
Z-506	M	JM/P	Defensive modified depression		D	X		1	H-413	Henry et al. 1996	
Z-507	M	JC	Railroad bed; with rails; stacked facing		C, D		X	1	(H-412, 425)	Henry et al. 1996	(5)
Z-508	C	JC	Village remains		A, D	X		3	?	Haun 1988	
Z-509	M	JM	Defensive modified depression		D	X		1	H-424	Henry et al. 1996	
Z-510	M	JC	Homestead, intact		A, D		X	2	H-400	Henry et al. 1996	
Z-511	M	JC	Homestead, intact		A, D		X	2	H-401	Henry et al. 1996	
Z-512	M	JC	Homestead, intact		A, C, D		X	2	H-402	Henry et al. 1996	
Z-513	O	US	Munitions storage? large earthen enclosures		D		X	1	H-442	Henry et al. 1996	
Z-514	N	JC	Homestead, partial		D	X		2	H-507	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-515	N	JC	Homestead, intact		A, D		X	2	H-491	Henry et al. 1996	
Z-516	N	JC	Homestead, partial; cisterns		D	X		2	H-490	Henry et al. 1996	
Z-517	N	P	Ceramics, small, shallow deposit		D	X		3	H-485	Henry et al. 1996	
Z-518	N	JC	Homestead, intact		A, C, D		X	2	H-478	Henry et al. 1996	
Z-519	N	?	Defensive complex with fuel drum encl.		A, C, D		X	1	H-449	Henry et al. 1996	
Z-520	N	JC	Homestead, intact		C, D		X	2	H-446	Henry et al. 1996	
Z-521	N	JM/P	Sinkhole, with trash; Prehistoric component; Latte Phase ceramics	X	D	X		3	H-399	Henry et al. 1996	
Z-522	N	P?	Rock overhang	X	A, D	X		3	1571-06	Henry and Haun 1995	
Z-523	N	JC	Cistern		D	X		1	1571-T-22	Henry and Haun 1995	
Z-524	N	JM	Famalaonn defensive complex; modified depressions, rifle pit/foxholes		A, C, D		X	1	H-403	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform		D	X		1	H-364	Henry et al. 1996	(3)
Z-525	N	US	Defensive earthen platform		D	X		1	H-365	Henry et al. 1996	
Z-526	N	?	Gun position, fuel drum enclosure		A, D		X	1	H-450	Henry et al. 1996	
Z-527	N	JM	Cliffline defensive complex; caves, stone terraces		A, C, D		X	3	(H-476, H-477)	Henry et al. 1996	
Z-528	N	JM	Observation post, survey marker; platform		D		X	1	H-429	Henry et al. 1996	
Z-529	N	US	Bd debris		D	X		0	H-430	Henry et al. 1996	
Z-530	N	?	Road on Maga		D		X	1	H-493	Henry et al. 1996	
Z-531	N	US	West H-14-C N. Field, fuel tank farm; earthen enclosures		D	X		1	H-395	Henry et al. 1996	
Z-532	P	JM	Gun enclosure, earthen		D	X		1	H-389	Henry et al. 1996	
Z-533	P	JC	Cisterns		D	X		2	(H-373, 375)	Henry et al. 1996	
Z-534	P	P	Ceramics, medium size scatter, deposit		D	X		3	H-487	Henry et al. 1996	
Z-535	P	JC/US	Homestead, partial, modified		D		X	2	H-381	Henry et al. 1996	
Z-536a	R	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	X	A, C, D		X	3	(HS-01, 15, 19, 20, 31, 36. 41; H-506) Og-P-06	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	
Z-536b	S	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	X	A, C, D		X	3	(HS-01, 15, 19, 20, 31, 36. 41; H-506) Og-P-06	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	
Z-537	S	JC/US	Homestead, modified as pumping station; cisterns, slabs, concrete box		A, D	X		2	(H-370. 374)	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-538	S	JC	Homestead, partial		D	X		2	H-371	Henry et al. 1996	
Z-539	R	JM	Military complex; plus civilian features; railroad bed and roads		A, C, D		X	1	(H-027, 30, 49, 51, 52, 54)	Franklin and Haun 1995: Tables 5 and 13	
Z-540a	Q	?	Trench, military?		D	X		1	H-358	Henry et al. 1996	
Z-540b	R	?	Trench, military?		D	X		1	HS-34	Franklin and Haun 1995: Tables 5 and 13	
Z-541	Q	?	Airplane wreck		D	X		1	H-357	Henry et al. 1996	
Z-542	G	JC	Homestead, partial		D	X		1	H-522	Henry et al. 1996	
Z-543	A	US?	Tower bases, radio station		A, C, D	X		0	0218-T-50; D-2	Donham 1986:34, 59; Denfeld 1983	
Z-544	D	US?/P	B Battery of the 17th AAA; and ABCD Annex (?); fuel drum enclosures		A, C, D		X	1	H-332; D-21	Henry et al. 1996	
Z-545	A	US	Quonset Hut		A, C, D	X		0	D-16	Denfeld 1983:34	
Z-546	A	?	Airplane wreck		D	X		1	H-002	Henry et al. 1996	
Z-547	A	US	Landing craft remains, invasion remnants		A, D		X	1	H-003	Henry et al. 1996	
Z-548	A	?	Gun enclosure, earthen		D	X		1	H-036	Henry et al. 1996	
Z-549	D	US	D Battery, 17th AAA; earthen enclosure, fuel drum enclosures, metal posts		A, C, D		X	1	(H-039, 66, 67)	Henry et al. 1996	
Z-550	D	JC/JM	Homestead, intact, reused for defense		A, D		X	3	H-128	Henry et al. 1996	
Z-551	D	JM	Gun enclosure, fuel drum		A, D		X	1	H-179	Henry et al. 1996	
Z-552	B	US	Slab, dump		D	X		1	H-336	Henry et al. 1996	(3)
Z-553	?	J	Overhang with trash		D	X		2	H-311	Henry et al. 1996	
Z-554	Q	US	Landing craft fragments		A, D		X	1	H-355	Henry et al. 1996	
Z-555	?	US	Water pumping station; slab, with 12th CB inscription		A, D		X	1	H-362	Henry et al. 1996	
Z-556	D	US	Cistern		D	X		2	H-376	Henry et al. 1996	
Z-557	?	JM	Water pumping complex		D		X	2	H-379	Henry et al. 1996	(6)
Z-558	P	?	Gun position, fuel drum enclosure		A, D		X	1	H-380	Henry et al. 1996	
Z-559	N	P	Pottery scatter		D	X		3	OG-P-08 (T4-JMP-1)	Craib 1993: Fig. 22	
Z-560	D	JM/US	Mixed WWII Japanese and American sites		A, D	X		2	P1; OG-J-01	Craib 1993:4, Fig. 2	
Z-561	A	JC	Land boundary marker		D	X		1	OG-J-02	Craib 1993:4, Fig. 2	
Z-562	J	JM	Gun emplacement, enclosure		D	X		1	DS-15; J-2010?	Franklin and Haun 1995: Tables 5 and 13	
Z-563	H	P	Pictograph cave		A, C, D		X	3	?	Craib 1994	(3)
Z-564	K	JC	Cistern		D	X		1	1571-T-37	Henry and Haun 1995	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-565	U	P	Sherd scatter		D	X		3	1571-T-39	Henry and Haun 1995	
Z-566	U	PWC	Camp Churo ditch		A, D		X	1	1571-T-40	Henry and Haun 1995	
Z-567	U	US	Quarry		D	X		0	1571-T-41	Henry and Haun 1995	
Z-568	U	JC	Habitation complex		A, D		X	2	1571-T-43	Henry and Haun 1995	
Z-569	U	JC	Habitation complex		A, D		X	2	1571-T-47, 50	Henry and Haun 1995	
Z-570	K	US	Refuse dump, and crash site		D	X		0	BS-T-01	Eble et al. 1995	
Z-571	K	US	Camp		A, D		X	2	BS-T-04	Eble et al. 1995	
Z-572	K	JM?	Concrete structure		A, D	X		1	BS-T-07	Eble et al. 1995	
Z-573	K	JM?	Bunker; fuel drum		D		X	1	BS-T-08	Eble et al. 1995	
Z-574	K	J	Concrete structure, unknown function		D	X		1	BS-T-10	Eble et al. 1995	
Z-575	K	JC	Concrete stairway; shrine or residence		D		X	1	BS-T-11	Eble et al. 1995	
Z-576	K	JC	Cistern		D	X		2	BS-T-12	Eble et al. 1995	
Z-577	K	P	Sherd scatter		D	X		3	BS-T-13	Eble et al. 1995	
Z-578	K	JC	Homestead		A, D		X	2	BS-T-14	Eble et al. 1995	
Z-579	K	P	Sherd scatter		D	X		3	BS-T-15	Eble et al. 1995	
Z-580	K	JC	Cistern		D	X		2	BS-T-17	Eble et al. 1995	
Z-581	K	P	Sherd scatter		D	X		3	BS-T-19	Eble et al. 1995	
Z-582	K	JC	Homestead		D		X	2	BS-T-23	Eble et al. 1995	
Z-583	L	P	Sherd scatter		D	X		3	BS-T-27	Eble et al. 1995	
Z-584	K	J/US	Massive concrete structure; US use		D		X	1	BS-T-28	Eble et al. 1995	
Z-585	K	M	Dump, mixed US, Japanese		D	X		0	BS-T-29	Eble et al. 1995	
Z-586	K	?	Cobble paving, small; unknown age		D	X		2	BS-T-30	Eble et al. 1995	
Z-587	K	JC	Homesteads		A, C, D		X	2	BS-T-31	Eble et al. 1995	
Z-588	K	P/JC	Rockshelter, *latte*, and cistern	?	A, D		X	3	BS-T-32	Eble et al. 1995	
Z-589	T	JM	Gurguan Point Airfield		A, D		X	1	J-2015	Jones 1991:201	
Z-590	T	P	*Latte* sets (2), mortars		A, D		X	3	M-05	Moore et al. 1986:175	
Z-591	K	P	Latte sets, quarry, mortars		A, D		X	3	M-06	Moore et al. 1986:175	
Z-592	V	P	*Latte* sets (5), mortars, quarry		A, D		X	3	M-08-10	Moore et al. 1986:175	
Z-593	T	P	Rock shelters (2) mortars, pottery		A, D		X	3	M-22	Moore et al. 1986:175	
Z-594	T	P	Mortar, pottery		D		X	3	M-24	Moore et al. 1986:175	
Z-595	T	P	Surface material		D	X		3	M-25	Moore et al. 1986:175	
Z-596	K	P	Surface material		D	X		3	M-26	Moore et al. 1986:175	
Z-597*	K	US	505th BG		A, D	?	?	2		*	
Z-598*	L	US	Radio Transmission St.		D	?	?	2		*	
Z-599*	V	US	696 Sig. AW Co		A, D	?	?	2		*	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-600*	V	US	Hospital		A, D	?	?	2		*	
Z-601*	T	US	444th BG		A, D	?	?	2		*	
Z-602*	K	US	6th BG		A, D	?	?	2		*	
Z-603*	K	US	9th BG		A, D	?	?	2		8	
Z-604*	T	US	468th BG		A, D	?	?	2		*	
Z-605*	T	US	40th BG		A, D	?	?	2		*	
Z-606*	V	US	87 & 25 Service Corps		A, D	?	?	2		*	
Z-607*	V	US	240 Ord Ammo Co; 813, 827, 891 Chem. Co.		A, D	?	?	2		*	
Z-608*	K	US	Civilian Affairs		A, D	?	?	2		*	
Z-609*	T	US	C Battery, 18th AAA		A, D	?	?	2		*	
Z-610*	T	US	A Battery, 180th SCA		A, D	?	?	2		*	
Z-611*	U	US	HQ LAA 18th AAA		A, D	?	?	2		*	
Z-612*	T	US	Napalm Bomb Dump		A, D	?	?	0		*	
Z-613*	V	US	D Battery, 18th AAA		A, D	?	?	2		*	
Z-614	C	JC	Tori (?) remains		A, D		X	1	777-T2	Haun, Brown, and Dili 1990	

KEY;

Site Number: TN=CNMI DHP numbers; Z= Site Protection Plan numbers in CNMI DHP sequence (see text); Z-* = sites identified primarily from historic aerial photographs.

SPA: Site Protection Area

Site Assoc. J = Japanese (civilian or military); JC =Japanese civilian; JM = Japanese military; M =mixed; P =prehistoric; PWC = post-war civilian; US = US WWII military; ? =uncertain.

Site Description: site description provides composite functional and formal characteristics. For details see references.

HR =human skeletal remains present at site.

NR eligible criteria = criteria under which site is recommended eligible to the National Register of Historic Places' site has integrity and meets one or more of the following:

A: sites that are associated with events that have made a significant contribution to the broad patterns of our history
B: sites that are associated with the lives of persons significant in our past

C: sites that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction
D: sites that have yielded, or may be likely to yield, information important in prehistory or history

(after NRHP Criteria Evaluation from National Register Bulletin 16, U.S. Department of the Interior, National Park Service, Interagency Resources Division)

Sig. DR: site is recommended as significant and appropriate for data recovery as a means of mitigation of adverse impact if preservation is not possible.

Sig. P: Site is recommended as significant and as appropriate for long-term preservation; adverse effects should be avoided.

Other Number:

0218-T-*	Donham (1986) with the project number "218".
1571-T-	Henry and Haun (1995). (Site numbers in the EMUA that represent locales with limited pottery or artifact scatters are not included here).
BS*	(Eble et al. 1995): Number (T-n) with BS prefix added.
C*	Craib (1995).
D*	Denfeld (1983).
H-	Henry et al. (1996).
DS	Prefix for Dangkulo survey site numbers in Franklin and Haun (1995a).
HS	Prefix for Hagoi survey site numbers in Franklin and Haun (1995a).
J*	Jones (1991) 1000, 2000, 3000 series.
M*	Moore et al. (1986).
OG-P-*	Prehistoric sites recorded in Craib (1993).
OG-J-*	Pre-WWII and WWII Japanese sites recorded in Craib (1993).
OG-U-*	WWII U.S. sites recorded in Craib (1993).

*Indicates a prefix added to the investigator's site number.

Threat

"Threat" represents a ranking of susceptibility to damage (0=low susceptibility; 3=high susceptibility).
0=threat posed only by bulldozing;
1=threat posed only by heavy vehicles and/or tracked vehicles;
2= threat posed by heavy vehicles and/or tracked vehicles; light vehicles, and general ground disturbance;
3= threat posed by heavy vehicles and/or tracked vehicles; light vehicles, general ground disturbance; pedestrians, intensive digging, and vandalism.

Notes: (1) overlaps SPA D; (2) overlaps SPA A; (3) exact location uncertain; (4) overlaps SPA N; (5) same as TN-14?; (6) Maga Ridge/Hagoi area?

APPENDIX B: SITES RECOMMENDED AS NOT SIGNIFICANT, MILITARY LEASE AREA, TINIAN

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian.

Site Number	Site Assoc.	Site Description	References
0218-T-02	US	Metal rack and trough, secondary	Donham 1986:31, 77
0218-T-13	?	Rubble mound	Donham 1986:31, 73
0218-T-20	?	Secondary trash	Donham 1986:32, 79
0218-T-27	?	Secondary trash	Donham 1986:32, 81
0218-T-39	?	Backdirt from pit	Donham 1986:33, 71
0218-T-43	J	Rails, debris	Donham 1986:33, 81
1571-02	M	Sherd scatter	Henry and Haun 1995
1571-04	M	Artifact scatter	Henry and Haun 1995
1571-T-32	US	Culvert	Henry and Haun 1995
1571-T-35	M	Sherd scatter	Henry and Haun 1995
1571-T-38	M	Artifact scatter	Henry and Haun 1995
1571-T-42	M	Artifact scatter	Henry and Haun 1995
1571-T-44-46	M	Artifact scatter	Henry and Haun 1995
1571-T-54-57	M	Sherd scatters	Henry and Haun 1995
BS-T-06	JM?	Bunker, fuel drum	Eble et al. 1995
BS-T-09	JM	Debris, disturbed?	Eble et al. 1995
BS-T-16	US	Military refuse	Eble et al. 1995
C-07	US recent	Sandbag enclosure	Craib 1995:59, 63
C-12	P	Sherd scatter	Craib 1995:59, 66
C-33	US	Cluster of broken asphalt	Craib 1995:60, 72
C-38	US, modern	Tire dump; iron box	Craib 1995:60, 74
C-44	US	Concrete pads	Craib 1995:60, 81
C-45	US	Concrete pad	Craib 1995:60, 81
C-47	P	Sherd scatter	Craib 1995:64
DS-04	JM	Cement bag blocks, military, secondary	Franklin and Haun 1995: Tables 5 and 13; 31
H-006	?	Steel beams and concrete trench	Henry et al. 1996
H-014	JM	Slabs with drainage holes	Henry et al. 1996
H-016	?	Metal boxes (ammo*)	Henry et al. 1996
H-025	?	Alignment of 3 fuel drums	Henry et al. 1996
H-026	US	Trash scatter	Henry et al. 1996
H-027	US	Dump	Henry et al. 1996
H-029	US	Alignment, stone	Henry et al. 1996
H-030	?	Mound, stone	Henry et al. 1996
H-031	?	Pit cut into limestone	Henry et al. 1996
H-032	US	Pile of concrete bags, solidified	Henry et al. 1996
H-033	?	Stone wall and pipes	Henry et al. 1996
H-037	?	Concrete block	Henry et al. 1996
H-038	?	Truck frame remnant	Henry et al. 1996
H-043	US	Dump	Henry et al. 1996
H-044	mixed	Bulldozed pile of debris	Henry et al. 1996
H-046	US	Slab, trash	Henry et al. 1996
H-047	US	Slab, pit; encampment	Henry et al. 1996
H-053	?	Dump	Henry et al. 1996
H-060	US	Dump	Henry et al. 1996
H-061	US	Trash scatter	Henry et al. 1996
H-062	US	Temporary encampment; slab, pit;	Henry et al. 1996
H-063	US	Dump	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-064	US	Pontoons, 3	Henry et al. 1996
H-069	?	Road	Henry et al. 1996
H-080	US	Trash scatter	Henry et al. 1996
H-084	US	Trash scatter	Henry et al. 1996
H-085	JC?	Pipeline	Henry et al. 1996
H-086	?	Metal posts	Henry et al. 1996
H-097	US	Slabs, footings, pontoons, trash	Henry et al. 1996
H-100	US	Pipeline	Henry et al. 1996
H-101	mixed	Bulldozed pile of debris	Henry et al. 1996
H-102	?	Trench, concrete	Henry et al. 1996
H-103	?	Metal posts	Henry et al. 1996
H-110	?	Pipeline	Henry et al. 1996
H-117	US	Dump	Henry et al. 1996
H-122	?	Pipeline	Henry et al. 1996
H-124	?	Culvert	Henry et al. 1996
H-125	JM	Pipeline	Henry et al. 1996
H-127	US	Cart, metal	Henry et al. 1996
H-137	?	Tower base	Henry et al. 1996
H-138	?	Trench	Henry et al. 1996
H-141	?	Culvert	Henry et al. 1996
H-142	mixed	Dump	Henry et al. 1996
H-144	?	Trench	Henry et al. 1996
H-146	mixed	Bulldozed debris	Henry et al. 1996
H-147	?	Slabs	Henry et al. 1996
H-148	US	Slab, depression; encampment,	Henry et al. 1996
H-149	US	Slab; encampment?	Henry et al. 1996
H-150	?	Slabs, trash	Henry et al. 1996
H-151	?	Concrete boxes, trash	Henry et al. 1996
H-152	?	Metal tower	Henry et al. 1996
H-157	US	Dump	Henry et al. 1996
H-158	US	Bulldozed debris	Henry et al. 1996
H-159	US	Dump	Henry et al. 1996
H-160	US	Dump	Henry et al. 1996
H-161	?	Pipeline	Henry et al. 1996
H-162	?	Road bed	Henry et al. 1996
H-163	US	Dump	Henry et al. 1996
H-164	?	Concrete boxes	Henry et al. 1996
H-165	US	Slabs, depression	Henry et al. 1996
H-166	?	Slab	Henry et al. 1996
H-168	US	Slabs	Henry et al. 1996
H-169	US	Road bed	Henry et al. 1996
H-170	?	Defensive enclosure, stone	Henry et al. 1996
H-171	US	Tower base	Henry et al. 1996
H-172	US	Tower base	Henry et al. 1996
H-173	?	Culvert	Henry et al. 1996
H-174	?	Culvert	Henry et al. 1996
H-175	US	Tower base, Bulldozed	Henry et al. 1996
H-180	?	Metal posts	Henry et al. 1996
H-181	JC	Bulldozed debris, primarily Japanese material	Henry et al. 1996
H-183	US	Dump	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-184	mixed	Bulldozed debris	Henry et al. 1996
H-185	mixed	Bulldozed debris	Henry et al. 1996
H-186	?	Culvert	Henry et al. 1996
H-187	?	Culvert	Henry et al. 1996
H-188	US	Slab, compartmentalized	Henry et al. 1996
H-189	US	Temporary encampment, slabs, encampment	Henry et al. 1996
H-190	mixed	Bulldozed debris	Henry et al. 1996
H-191	mixed	Bulldozed debris	Henry et al. 1996
H-192	mixed	Bb debris	Henry et al. 1996
H-193	US	Slabs, encampment	Henry et al. 1996
H-195	?	Culvert	Henry et al. 1996
H-196	US	Dump	Henry et al. 1996
H-197	mixed	Dump	Henry et al. 1996
H-198	US	Slab	Henry et al. 1996
H-199	?	Culvert	Henry et al. 1996
H-200	?	Culvert	Henry et al. 1996
H-202	US	Slab, encampment	Henry et al. 1996
H-203	?	Stone mound	Henry et al. 1996
H-204	?	Culvert	Henry et al. 1996
H-205	US	Slab	Henry et al. 1996
H-206	mixed	Bulldozed debris	Henry et al. 1996
H-207	mixed	Bulldozed debris	Henry et al. 1996
H-208	US	Slabs and road bed	Henry et al. 1996
H-216	US	Trash	Henry et al. 1996
H-217	?	Culvert	Henry et al. 1996
H-218	?	Slab	Henry et al. 1996
H-221	US	Trash	Henry et al. 1996
H-222	?	Concrete blocks	Henry et al. 1996
H-226	JC	Curb	Henry et al. 1996
H-232	?	Slab	Henry et al. 1996
H-233	US	Trash	Henry et al. 1996
H-238	JM	Mound, stone	Henry et al. 1996
H-246	JM	Wall, stone	Henry et al. 1996
H-248	?	Pipeline	Henry et al. 1996
H-249	US	Dump	Henry et al. 1996
H-257	US	Dump	Henry et al. 1996
H-266	?	Slabs	Henry et al. 1996
H-273	US	Trash	Henry et al. 1996
H-275	US	Slabs and trash	Henry et al. 1996
H-280	?	Culvert	Henry et al. 1996
H-282	US	Pontoon	Henry et al. 1996
H-298	?	Slab	Henry et al. 1996
H-299	?	Pier blocks	Henry et al. 1996
H-300	US	Slabs	Henry et al. 1996
H-301	?	Pipeline	Henry et al. 1996
H-306	?	Slab	Henry et al. 1996
H-308	?	Alignment, stone	Henry et al. 1996
H-310	?	Slab	Henry et al. 1996
H-312	US	Metal posts	Henry et al. 1996
H-315	US	Trash	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-317	US	Slabs and stone walls, temporary encampment	Henry et al. 1996
H-320	US	Dump	Henry et al. 1996
H-321	US	Slab, pit	Henry et al. 1996
H-322	US	Trash	Henry et al. 1996
H-323	US	Alignment, stone; trash	Henry et al. 1996
H-324	US	Alignment, stone	Henry et al. 1996
H-327	US	Tent stakes	Henry et al. 1996
H-328	US	Dump	Henry et al. 1996
H-333	US	Slabs, stone walls	Henry et al. 1996
H-335	?	Pipeline	Henry et al. 1996
H-337	US	Dump	Henry et al. 1996
H-338	?	Pad	Henry et al. 1996
H-340	?	Sinkhole with debris	Henry et al. 1996
H-341	US	Dump	Henry et al. 1996
H-342	J	Trash	Henry et al. 1996
H-343	US	Trash	Henry et al. 1996
H-345	?	Alignment, stone	Henry et al. 1996
H-346	?	Slab	Henry et al. 1996
H-347	US	Slabs	Henry et al. 1996
H-349	US	Asphalt pads	Henry et al. 1996
H-351	US	Bottle dump	Henry et al. 1996
H-352	?	Pads, tower base?	Henry et al. 1996
H-360	?	Trench, concrete	Henry et al. 1996
H-361	?	Tank, metal	Henry et al. 1996
H-363	?	Road and bricks	Henry et al. 1996
H-366	?	Culvert	Henry et al. 1996
H-372	?	Mound, stone	Henry et al. 1996
H-377	JC	Cistern	Henry et al. 1996
H-378	?	Culvert	Henry et al. 1996
H-385	?	Pipeline	Henry et al. 1996
H-387	?	Road	Henry et al. 1996
H-390	JC	Cistern	Henry et al. 1996
H-394	?	Boxes, metal	Henry et al. 1996
H-395	US	Fuel storage, earthen enclosures	Henry et al. 1996
H-396	US	Trash	Henry et al. 1996
H-397	?	Pipeline	Henry et al. 1996
H-398	?	Dump	Henry et al. 1996
H-409	US	Metal posts	Henry et al. 1996
H-423	US	Trash	Henry et al. 1996
H-426	US	Slabs	Henry et al. 1996
H-431	US	Dump	Henry et al. 1996
H-433	?	Wall foundation	Henry et al. 1996
H-434	?	Foundation, tank	Henry et al. 1996
H-436	US	Slab, road	Henry et al. 1996
H-438	US	Metal posts	Henry et al. 1996
H-439	US	Dump	Henry et al. 1996
H-440	US	Slab, pontoon	Henry et al. 1996
H-443	?	Pipeline	Henry et al. 1996
H-448	?	Metal frames	Henry et al. 1996
H-452	US	Trash	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-453	JC	Cistern	Henry et al. 1996
H-456	?	Wall, stone	Henry et al. 1996
H-461	US	Dump	Henry et al. 1996
H-463	JM?	Mounds, stone	Henry et al. 1996
H-469	?	Trench	Henry et al. 1996
H-473	?	Tank, metal	Henry et al. 1996
H-474	?	Alignment, stone	Henry et al. 1996
H-475	?	Wall, stone	Henry et al. 1996
H-492	US	Trash	Henry et al. 1996
H-511	JM	Trash	Henry et al. 1996
H-512	JM	Trash	Henry et al. 1996
HS-07	J	Transportation complex	Franklin and Haun 1995: Tables 5 and 13
HS-12	?	Road debris, construction	Franklin and Haun 1995: Tables 5 and 13
OG-U-02	US	Quonset hut foundations	Craib 1993:Fig. 3
H-020	?	Slab	Henry et al. 1996
H-353	?	Metal boxes	Henry et al. 1996
H-358	?	Trench	Henry et al. 1996
H-374	JC	Concrete box	Henry et al. 1996
H-509	US	Central bomb dump	Henry et al. 1996

APPENDIX C:

IDENTIFICATION OF THE ATOMIC BOMB ASSEMBLY AREA

During the planning for the interpretive program and the preparation of earlier drafts of archaeological assessments, we became concerned with the identification of the location of the atomic bomb assembly areas. A photograph of an assembly building had been published in several sources, but the location of the building had never been determined. Because of the importance of the assembly buildings as part of the overall historic complex associated with the atomic bomb, an effort was made to identify the location. The conclusion regarding this is presented here in order that appropriate attention can be given to the area in EIS preservation planning and in other related cultural resource management of the MLA, including redefining the boundaries of the National Historic Landmark. We propose that the area of the atomic bomb assembly, as identified below, be included in the Landmark.

It had been suggested that the assembly took place in the camp of the 509th Composite Group or in the 509th service area. An examination of the sites of these areas, maps, and other documents indicated that these are unlikely locations for the assembly buildings. This review did suggest the probability that assembly took place in buildings located in the three large earthen revetments located on the northwest coast of Tinian. These were designated Site 3016 by Jones (1991) who proposed that these may have been related to the atomic bombs because of the roadway leading from them to the airfield bomb pits, but he did not recognize these as the assembly areas. Jones site 3016 was subsequently designated CNMI Site TN-047. The use of the features as the atomic bomb assembly areas was suggested to us by their location and connection to the airfield, by the similarity of their features to the detail shown in the WWII photographs of an assembly building, and by WWII map designations indicating this was a "special projects" area. The identification was confirmed through an interview with Mr. Henry Fleming conducted in November 1994. Mr. Fleming came to the island immediately after the war, worked for the military, was involved with the filling of the bomb pits, and was quite familiar with the location and use of the assembly buildings (still standing in the late 1940s). The recent survey of these features (Henry et al. 1996, Site H-497) has provided the detailed measurements of the concrete pads inside the revetments. A comparison of these measurements with the assembly building's dimensions estimated from a photograph shows that they are consistent, and further supports this identification.

Appendix H
Socioeconomic Factors on Tinian
(1996)

I - Introduction

Under contract with the U.S. Department of the Navy, Belt Collins Hawaii is completing an Environmental Impact Statement (EIS) pertaining to the conduct of military exercises in the Mariana Islands. As part of the study leading to the EIS, Ernst & Young LLP was engaged to compile and report on information relevant to socioeconomic factors. This report is intended for the use of Belt Collins Hawaii as it pertains to the island of Tinian.

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Information for this report was obtained from publicly available government records and from interviews with selected individuals on Tinian and Saipan. Every effort was made to ensure the reasonableness of information received from sources but no assurance is provided as to the accuracy or completeness of this report.

II - Background

The island of Tinian is the least developed of the four major islands in the Mariana chain; major island being defined as one with a public power supply. Together with Saipan, Rota and several minor islands, Tinian is a part of the Commonwealth of the Northern Mariana Islands (CNMI), a United States Commonwealth similar in status to Puerto Rico.

The Covenant which created the CNMI in 1976 brought tremendous extended financial support from the U.S.; established jurisdiction of U.S. laws, agencies and programs; provided for a CNMI Constitution, elected government and defined self-rule; and bestowed full U.S. citizenship upon CNMI residents.

In return for perceived benefits, the CNMI committed to numerous political, economic and social actions over an extended period of years. In addition, the U.S. Department of Defense received complete control and possession of the northern approximately 71% of the island of Tinian under several complex land-holding arrangements. A return of 1,245 acres around the harbor in 1995 reduced the total federal holding to approximately 16,550 acres, or 66% of the island.

Since the Covenant became effective in 1976, the Military Area has often been used for training exercises but no military personnel are stationed on Tinian. When not in use for exercises, access to the Military Area is unrestricted but land may not be privately owned and no one may live or develop there. The people of Tinian in general, even the younger generation, strongly regard the surrender of two-thirds of their island to be the major concession made to the U.S. under the CNMI Compact.

Economic growth has been slow to occur on Tinian despite enactment of a popular initiative in 1989 which legalized casino gambling (Section V below). However, development of the other major Mariana Islands (Guam, Saipan and Rota) can best be described as explosive over the last ten years. These events have perplexed Tinian residents and led to a closer scrutiny of the only significant socioeconomic anomaly which does exist on the island, the Military Area.

III - Demographic Adjustments

During research on this engagement, data were identified which serve to update or more realistically state certain publicly available demographic figures of Tinian on an estimated basis. The figures shown for "Population" and "Population Density" in Exhibit III-A are mathematical estimates incorporating currently available data.

3.1 Population - The increase in population is based on extrapolated airport activity figures as presented in Exhibit IV-A. It is assumed that the number of tourists and existing residents arriving on Tinian during the reporting period is equal to those departing. Though not exact in interpretation, Exhibit IV-A clearly shows an excess of arrivals over departures at the Tinian airport of 1,789 persons during the last four years, resulting in an estimated population of Tinian island at the end of 1995 of 3,718. It is very unlikely that a person would arrive on Tinian by air and depart by sea. On rare occasions, a seaman has arrived on Tinian by air to depart on a ship in port, but, for practical purposes, excess arrivals at the airport can be assumed to represent new residents.

Based on local awareness and casual confirmation, it is logical to assume that this 45% increase in the population of Tinian in the last four years is basically correct. It is also logical that most of these new residents were alien contract workers. Lone Star Casino was closed and all employees departed before the end of 1995. Nothing else of local explanation is noteworthy except for the accelerated trend throughout the CNMI toward more alien workers.

3.2 Population Density - Exhibit III-A also shows an estimated recalculation of population density utilizing the 1995 population estimate and only the one-third of Tinian land mass which is available for use by the local population. Excluding the Military Area from the population density calculation results in a more true density of approximately 285 persons per square mile at the end of 1995. This is roughly 3.5 times the density of Rota but still does not begin to approach the 1992 published figure of 1,062 persons per square mile on Saipan.

IV - Existing Economy of Tinian

Due to the inadequacy of existing public records, any statistical measurement of economic activity on Tinian is impossible without a comprehensive private sector survey which was beyond the scope of this engagement. Generally, however, the Tinian economy can be segmented as follows:

4.1 Government Employment - Considering the lack of any significant industry, natural resource or export, the indigenous population of Tinian remains relatively affluent with the latest statistical data available showing the mean annual income on Tinian in 1990 to be $33,651 per family (SOURCE: 1993 Commonwealth of the Northern Mariana Islands Statistical Yearbook). This relative prosperity is due to the artificially large percentage of the local work force engaged in government employment. No statistical information is available to quantify labor force segments on Tinian. However, it is safe to say that the CNMI percentage trend away from government service and towards private sector employment cannot be observed on Tinian. Excluding alien contract workers, the percentage of the Tinian labor force employed in government jobs is usually estimated at around 75% by local officials.

4.2 Tourism - Though insignificant when compared to Saipan, tourist visits to Tinian appear to have increased substantially during recent years. Reliable visitor arrival information does not exist due to the CNMI practice of recording visitors only when they clear customs in Saipan. However, there are currently six small tour operators on Tinian who bring day-trip tourists from Saipan on a daily basis. Four of the tour operators are Korean, one is Japanese and a locally-owned operator caters to history-seekers for ground tours of WWII historical sites.

Tinian Tour Operators

Sunshine Tours (Korean)	Mideco (Korean)
Friendly Tour (Korean)	Meitetsu Fleming (Japanese)
Tour Tinian (Korean)	Tourific Tinian (local independent)

Information provided by one operator indicates that an average of 400 to 600 Japanese visit Tinian from Saipan each month, most as a day-trip optional tour though a few stay overnight in the Meitetsu Fleming Hotel. Casual physical observations of arriving Korean groups over the last several months indicate that there may be 30 to 50 Korean visitors per day provided by the four operators combined. Including the sporadic groups of war veterans served by Tourific Tinian and occasional FIT eco-tourists, hikers and cyclers; an educated guess of total visitor arrivals to Tinian is roughly 1,200 to 2,000 per month or say 60 per day as a working average.

All tourist arrivals to Tinian come by air with the exception of the *Emerald II*, a tour boat which brings Japanese day-trip visitors to Tinian from Saipan daily. Most optional day-trip tours for Japanese and Koreans include a half-day at a beach in San Jose Village, lunch and a tour of North Field and other Japanese and American historical sites within the Military Area of the island.

Tinian currently has only about 30 hotel rooms housed in three small sub-standard motels; Lori Lynn's, Meitetsu Fleming and Main Street. Car rental concessions are operated at the Tinian airport by Islander and Budget.

4.3 Agriculture and Fishing - There is limited commercial farming on Tinian with produce being marketed on the island and also shipped to Saipan. Crops include cucumbers, egg plant, sweet potatoes, Chinese cabbage, long beans, shallots, taro, watermelon, bananas and papaya. A poultry and egg farm ceased operation about two years ago but the breeding and training of fighting cocks is a very popular part of local culture practiced by many Chamorro men.

The Bar K Ranch has operated for many years on grazing land leased within the Military Area and on other private land. The Bar K includes a fully equipped slaughter house and cold storage facility. With the discontinuance of sophisticated artificial insemination and experimental breeding programs three years ago, herd size has attrited from a high of approximately 10,000 head to the present modest size of around 1,000. Tinian Beef from the Bar K is sold in supermarkets in Saipan and Guam as a low-cost alternative to U.S. and Australian beef. There are also three small family-owned ranches on Tinian and many people raise beef or pork for family consumption.

Most Tinian families include fishing (line, net and underwater) as some portion of their personal subsistence. There is no commercial fishing operation based on Tinian but tuna transshipment is an often busy if inconsistent enterprise. At times, there may be eight or ten commercial tuna fishing boats and two or three large cold storage transport ships in the Tinian port. At other times, the port sits empty for weeks. When tuna transshipment is active on Tinian, it is a solid contributor to the island economy, primarily the two stevedore companies, local nightclubs and the dockside fueling facility operated by Mobil Oil.

4.4 Consumer Trade - The retail community of Tinian includes several convenience stores, about six nightclubs, gift shops, two hardware stores, three gas stations, an auto parts store, two bakeries, four small restaurants, a print shop and assorted other small businesses. Available consumer services include branches of the Bank of Guam and Bank of Saipan, two part-time independent insurance agents, a certified public accountant and several manpower agencies supplying alien contract workers.

4.5 Air Service and Airport Operations - The life-line of daily existence and commerce on Tinian is West Tinian Airport. Regular air travel to Saipan for business and shopping is a routine but critical part of life for residents of Tinian, most of whom take the 10-minute flight at least monthly with many flying weekly and some even daily. Presently, all Tinian scheduled air service is to and from Saipan utilizing 6-seat, 19-seat and 30-seat propeller aircraft operated by Freedom Air and Pacific Island Aviation. Other airlines, including Continental Micronesia, have served Tinian in the past with direct flights to Guam and Rota and may do so again in the future.

As shown in Exhibit IV-A, total passenger traffic at West Tinian Airport has increased steadily over the last four years from an average of 165 passengers a day in 1992 to 265 a day in 1995. Exhibit IV-B is a graphic depiction of monthly passenger traffic from 1992 to 1995. As seen in the exhibit, the month of May is normally the heaviest for Tinian air traffic. This is explained by the San Jose Fiesta and San Isidro Fiesta which annually consume available Tinian facilities with visitors from Guam and Saipan during the first and fourth weekends in May, and also by off-island students returning to Tinian for the summer break. The record-breaking 11,965 total passengers (386 per day) in May 1995 is attributed to the opening of Lone Star Casino on May 1.

Substantial renovation of the airport, including a new runway to accommodate B-747 aircraft, is planned by the Commonwealth Ports Authority if a major hotel/casino begins construction on Tinian. This project is discussed more fully in Section V below.

V - Tinian's Casino Industry

The people of Tinian, as a unit, have fought for a casino industry since 1986 in a concerted effort of the citizenry rarely witnessed anywhere. The movement has spanned the terms of three mayors representing both political parties and five municipal councils. The casino issue also successfully overcame the opposition of the powerful Catholic church and steadily grew to the point that, today, virtually every resident is pro-casino.

5.1 History - A local initiative to legalize casino gambling on Tinian first appeared on the ballot in 1987. It was narrowly defeated by 14 votes. The Mayor's Task Force on Gaming Industry for Tinian was then created to pursue the issue more formally for the 1989 election. A cross-section of 20 Tinian public and private sector leaders were appointed to the Task Force with the mission of learning all they could about the casino industry and then educating the people of Tinian prior to the 1989 election.

The Task Force was divided into two groups and over the course of a year members of each group visited various casino operations of the world and reported their findings back to the Task Force. One group traveled to casinos in Asia and Australia while the other visited casinos in North America and the Caribbean. For the six months immediately preceding the election, the Task Force staged an effective public awareness campaign and on November 4, the people of Tinian approved the Tinian Casino Gaming Control Act of 1989 (Act) by an overwhelming vote of 90% in favor. The Act remains as the only popular initiative ever approved in the 30-year history of the CNMI.

The Act proscribed the appointment of a five-member Tinian Casino Gaming Control Commission (TCGCC) to regulate the industry and issue the five hotel/casino licenses allowed. The original commissioners assumed their offices early in 1990 and, quickly, Tinian became a known player in the booming international casino market. During 1990-91, serious inquiries were received from and meetings held with such renowned casino developers as Caesar's World, Golden Nugget, ITE Sheraton, Hilton, Casinos Austria and the Korean Shilla Group. Land

prices skyrocketed to ten times their former value on Tinian and local citizens began building apartments and expanding businesses in anticipation of long-awaited development.

During the first application acceptance period set by TCGCC, seven completed applications were received for the five possible licenses, each applicant submitting $200,000 as a non-refundable fee. Since passage of the Act, TCGCC has received over 100 inquiries of varying interest from different groups, processed some 15 applications for a Tinian casino license and actually issued two licenses, yet no casino currently operates or is under construction on Tinian. The reasons for this involve complex political, cultural, economic and personality issues. For whatever reasons, failure to capitalize on the casino boom years of 1990-92 while the Japanese economy was also at full strength has forced Tinian to now seriously compete with other potential locations in trying to attract a casino developer. That process continues today.

5.2 Current Status - The only casino to open on Tinian was Lone Star Casino which opened in a converted small office building in May 1995. Questions have been raised by the CNMI Governor and others as to the legality of Lone Star because of the absence of a 300-room hotel as required by the Act. Suffice it to say that Lone Star appears to have been an ill-conceived, under-capitalized and poorly managed venture which was licensed by TCGCC in an act of desperation. Lone Star Casino closed on December 20, 1995 and its license has been revoked.

On March 12, 1996, the Tinian Casino Gaming Control Commission (TCGCC) issued two new final casino operator licenses to the separate Hong Kong companies of Hong Kong Entertainment (Overseas) Investments Ltd. and Tinian Shipping Co., Inc. Both companies have paid the $500,000 licensing fee.

Hong Kong Entertainment is currently constructing a $100 million hotel and casino, the Tinian Dynasty Hotel and Casino. The project, scheduled for a soft opening in December 1997, is located on 7.5 hectares of land at the intersection of Broadway and Wall Street in San Jose. The project consists of a 410 room resort hotel, casino gaming area of 75,000 square feet, three restaurants, swimming pools, health club, tennis courts, driving range and other amenities. The project will have its own seven megawatt power generation plant. It is expected that the hotel and casino will employ approximately 1,200 people, a significant addition to the current estimated population of 3,700 for the island of Tinian. Housing for the employees is expected to be constructed by the project's investors on property adjacent to the hotel and casino. During the construction phase it is estimated that 400 containers arrive daily at Tinian's main harbor in the village of San Jose.

Additionally, the investors of Hong Kong Entertainment have purchased two $6 million turbo-jet catamaran ferries, Tinian Express and Saipan Express. Each ferry is capable of transporting 300 to 400 passengers from Saipan to Tinian in approximately 50 minutes. The ferries are operated by Tinian Shipping Co., Inc., an affiliated company. There are tentative plans to add a third ferry which would allow for water transportation between Saipan and Tinian every half-hour. It is expected that the ferry service will be utilized by tourists staying on Saipan and residents from the CNMI and Guam.

In addition to ferry service, Hong Kong Entertainment is negotiating with several regional airlines for direct flights from Asian cities to Tinian. Given the current size and condition of Tinian West Airport, current air passenger service would not be adequate to ensure the required number of guests for the successful operation of the hotel and casino. The current airstrip can accommodate narrow body jet aircraft, such as the Boeing 727 or 757 which have a capacity of approximately 200 passengers. To allow landings of larger aircraft such as a 747 or DC-10, the Commonwealth Ports Authority plans to add a 10,000 foot runway which would be parallel to the current one in use. Financing for this airport expansion is under consideration by the CNMI government. There are also plans for $30 million of improvements to the San Jose harbor.

A summary of announced casino resort projects follows:.

Active Tinian Casino Ventures

Name	Origin	Proposed Project	Status
HK Entertainment	Hong Kong	410 room hotel; 75,000 sq. ft. casino $100M project	Under construction; 12/97 soft opening
Tinian Shipping	Hong Kong	400 room hotel; large casino	License awarded; Construction pending
Tinian Marine Resorts	Taiwan & Saipan	500 room hotel; large casino; golf course; marina; theme park; $250M project	Casino license issued; Nov 95; $500,000 license fee unpaid, license is suspended
CNMI Investments	Taiwan	Hotel/casino	Casino license issued; Lease for 1,000 acres; of public land signed, but canceled later
CNMI Touring and Entertainment	Philippines & Hong Kong	Hotel/casino	Casino license issued;

In addition to these, TCGCC has recently received new inquiries from other Japanese and Macau casino developers and continues to actively solicit interest.

5.3 Prognosis and Projections - A big factor in the future of a casino industry on Tinian is the island of Guam. With it's existing world-class tourism infrastructure and rapidly approaching 2,000,000 visitors a year, Guam would provide formidable competition in attracting a casino developer to Tinian. However, a recent Guam initiative to allow casino gaming was soundly defeated. It is not expected that casino gaming will be legalized within the near future; however, if the Tinian experiment is successful, the residents of Guam may reconsider their position.

Major casino development on Tinian will affect life on the island in virtually every respect, including planning for future military exercises. Exhibit V-A superimposes the most popularly discussed hotel/casino and golf course locations onto a militarily delineated map of Tinian which was presented by Belt Collins Hawaii at a scoping meeting held on Tinian in preparation for development of the EIS.

The Governor has publicly pledged CNMI funds for construction of public infrastructure necessary to support a Tinian casino industry. In keeping with that promise, the Commonwealth Ports Authority (CPA) recently announced formal plans to rebuild an abandoned runway parallel to the existing runway at West Tinian Airport to allow 24-hour access by wide-body aircraft.

In addition to a new 10,000 foot runway, the Tinian airport project will include a new terminal building, customs and immigration facilities and a bus staging area. Tinian will be formally designated as an international port-of-entry for the CNMI. As stated by CPA, funding, designs and planning are complete for the new airport and the project could be completed in one year. It only awaits financing.

Exhibit V-B provides projections of estimated air passenger traffic to Tinian assuming various levels of casino industry development. In the projections, the average hotel is assumed to consist of 400 rooms. This is considered reasonably conservative as the minimum rooms required under the Act is 300. Actual projects being put forth range from 300 rooms to 1,000 in the second phase of one project. Average passengers per international flight is assumed to be 200 to allow for the presumption that wide-body aircraft will probably not be used on all long-haul flights and many will be of the B-727 or 757 class.

As shown in Exhibit V-B, the opening of just one hotel/casino resort on Tinian could be expected to add approximately 17 flights a day of 30-seat commuter aircraft and one international flight per day direct from cities in Asia. One full-scale hotel/casino in operation on Tinian is estimated to effectively increase the existing Tinian passenger traffic tabled in Exhibit IV-A by a factor of 5 to 7.

Though not assumed in the projection, it is likely that any full casino operation would also include "gambler's express" flights several days a week in it's marketing mix. Passengers on these international flights do not stay overnight in the hotel but rather spend six to ten hours at the casino before being flown back to their city of origin.

It should also be noted that there would be a dramatic increase to the number of residents on Tinian if the casino resorts are completed. Using information provided by a large casino gaming company, a 450 room hotel with approximately 25,000 square feet of casino space would employ approximately 1,100 employees. Resort hotels in Guam and Saipan report a ratio of slightly less than 1:1 employees to rooms. If the current two projects are completed, it would be expected that at least 1,500 employees would be hired for hotel and casino operations. If five casino resorts, averaging 300 rooms per resort, are constructed (the maximum allowed under the Tinian Casino Gaming Initiative), it would be expected that 3,500 to 5,000 employees would be

required for the resorts' operations. With the addition of these hotel projects, it would not be unreasonable to assume that 2,000 to 3,000 additional people would be required for support services, including the various government agencies such as public safety, revenue and taxation and customs/quarantine/immigration.

Given current population demographics, these new employees would most likely be recruited from sources outside of Tinian and the CNMI. In the case of the Lone Star Casino which recently closed, most of the employees were recruited from the US mainland. After the casino's closure, most of these expatriates left Tinian with a few exceptions. As noted above, the first project is expected to be complete in December 1997 and, accordingly, the impact of future projects would not be expected to occur until 1998 or 1999. As previously noted, approximately 1,200 people are expected to be employed by the Tinian Dynasty Hotel and Casino.

With the significant increase to population from the casino resorts, the island's existing infrastructure would be severely strained. Currently, power, water and sewer facilities are inadequate. It is expected that the casino resort developers would contribute to a central development fund for infrastructure improvement. However, the casino gaming law is not specific as to how the investment would be made. Conceivably, the resorts could install their own equipment for power generation, water wells and sewage treatment. The project currently under construction will add a seven megawatt

VI - Impact of Past Military Exercises

The impact of a military exercise on socioeconomic elements of the Tinian community appears to vary greatly depending on the number of personnel participating and the nature of billeting arrangements, field bivouac or lodging in San Jose Village.

Tandem Thrust 95, held on Tinian in November and December of 1994, was the largest exercise of the last few years. It included a total of roughly 2,000 personnel located on Tinian some of whom stayed in the Village while others bivouacked in the Military Area. Approximately 300 were housed in the municipal gymnasium.

Interviews were conducted with prominent government and business leaders on Tinian to gain insight into the impact and mitigation of Tandem Thrust 95 and other military exercises over the years. Their comments and observations are collectively summarized here.

6.1 Private Sector - There is general agreement among business owners that military exercises on Tinian are good for the economy, though no specific figures are available. There is a feeling, however, that the extent of annual economic contribution falls short of expectations established in the '70s during Compact negotiations when it was agreed to reserve two-thirds of Tinian island for the military. Specifically, the perception is that hotels and nightclubs do fairly well during exercises while stores and other businesses realize little benefit.

Tandem Thrust 95 contributed sporadically to the economy of Tinian throughout the year of 1994 as various parties of two to ten persons visited the island for several days at a time on numerous occasions. During the exercise itself, every hotel room, vacant apartment and rental car on Tinian was in use by military personnel. The extra revenues were welcomed by the Tinian hospitality sector but regular tourism and business visitors were displaced for about three weeks.

From small ranchers, two incidents of disruptions to livestock from low-flying and hovering helicopters were reported. Though not directly related to exercises, a specific complaint was registered that the Navy contract for cleaning and maintaining North Field was awarded to a Hawaii vendor and never offered for bid to interested local companies who could probably be lower on price and more attentive.

6.2 Tourism - During most exercises, civilian access to North Field and the Military Area is restricted. A regular daily tour business of these historic sites is prospering and growing on Tinian. 1995 was an especially busy year for these sites because of the many American, Japanese and Korean religious orders, ancestors and veteran's groups which came to Tinian for various WWII 50th anniversary commemorations.

Tour operators and the Marianas Visitors Bureau complain that they are often notified only two or three days in advance of Military Area closure, forcing last minute cancellations and refunds to Japanese and Korean tourists some of whom paid for their tour of North Field months before as part of a package. These tourists are in the CNMI for only three or four days. They select Tinian as a day-trip component of their package only to waste that day, reportedly, when access to the shrines, monuments and artifacts is unexpectedly denied.

Most Japanese tourists to the CNMI arrive on a structured prepaid excursion sold to them by one of the enormous travel agencies in Japan. Local tour operators regularly sell reservations to travel agencies up to six months in advance in return for discounting the cost. To allow an orderly force majeure type cancellation of tour reservations and reroute the tourists to another optional tour, the operators believe they need to be notified at least one month in advance of access restrictions to the Military Area.

No complaints were registered over the loss of tour revenues from closure of the Military Area, only the lack of timely, systematic notification.

6.3 Commercial Aviation - West Tinian Airport is of great importance to island residents for business, medical care, shopping and the regular supply of cargo and mail. Two scheduled airlines fly approximately 50 flights every day of the year over the Military Area to traverse the Saipan/Tinian channel. During military exercises, alternate civil aviation flight paths are utilized but, out of necessity, the amount of traffic in the corridor remains the same. As with the tourism sector, the several reports of disruption to civil aviation during Tandem Thrust 95 seem to have in common some degree of breakdown in communication.

- Advance notification of military flight patterns, landings and parachute drops was not sufficient at times to allow proper warnings to civilian aircraft.

- Three large troop-transport helicopters suddenly landed on the runway at West Tinian Airport during daylight hours and began discharging troops and equipment apparently in a mock situation of securing the airfield. Two commercial flights were forced to return to Saipan and other flights were suspended while Tinian airport officials tried to make sense of the unexpected intrusion. Military personnel walking on the runway at other times reportedly also delayed commercial flights.

- Reportedly, landings and takeoffs at North Field do not receive clearance from civil aviation control and are only known as they appear on radar.

On the positive side, the Commonwealth Ports Authority (CPA) reports that it is regularly reimbursed for all costs associated with military exercises with no problems, including overtime pay to CPA personnel. The Tinian airport manager is grateful for the barrels of runway foam which are often donated upon conclusion of an exercise.

6.4 Public Safety - As reported, the military exercises of recent years have presented far fewer public safety problems than those in the '80s. During Tandem Thrust 95, no complaints arose involving military personnel in the Village other than two skirmishes with local men at the gymnasium/barracks which apparently were instigated by the local individuals. The military policy of restricting town passes to a limited number of personnel at a time is appreciated by DPS and comments were made that military personnel were well behaved even in the bars.

Much unreimbursed overtime was recorded by police officers during Tandem Thrust 95. However, the continual shortage of officers routinely forces a large amount of overtime at DPS anyway and it is believed that no claim for reimbursement was ever submitted.

6.5 Other Government Services - After Tandem Thrust 95, several invoices for overtime of customs and quarantine officers were reportedly submitted to Andersen Air Force Base but payment was never received. A copy of a representative invoice is attached as Exhibit VI-A. As can be seen, the invoice is not very descriptive and is not directed to any particular party or department. It was admitted that no procedure or designated party was established with the military for invoicing overtime costs. The total amount involved, around $10,000, represents the marginal costs of customs and quarantine officers (two different agencies) meeting arriving flights around the clock at West Tinian Airport and North Field for ten to twelve days.

6.6 Community Life - Loss of use of the municipal gym and multi-purpose center during Tandem Thrust 95, because of the billeting of military personnel, forced rescheduling of some youth programs and suspended afternoon basketball pick-up games.

Engineering and construction of a community improvement is apparently becoming a tradition of Tinian military exercises. In conjunction with Tandem Thrust 95, a scenic jogging/walking path was constructed along the water's edge in San Jose Village connecting the public beaches. This gift was warmly received and appreciated by the people of Tinian. For locals and tourists alike, it is a welcome enhancement of the most popular leisure area on the island.

VII - Conclusions and Mitigation Recommendations

In general, military exercises on Tinian, though disruptive at times, are accepted by residents as a part of the local modern-day culture. There is some economic benefit to the island though it would be properly measured marginally against lost revenues in the tourism and hospitality sectors. The temporary nature of the exercises along with military mitigation attempts have resulted in a noticeable acquiescence in the community.

If large scale casino resort development activities commence, the military training exercises could have an adverse impact by restricting air and water traffic. However, this situation could be mitigated with advance notice to the civilian population and government agencies.

Most complaints and unresolved problems seem to involve poor communication between military authorities and affected civilians. The fault for this may lie with military planners or within the local information dissemination system on Tinian. Regardless, better communication with those actually affected by military exercises would resolve the bulk of complaints. With that in mind and to summarize other findings, the following actions are recommended to help mitigate the socioeconomic impact of future military exercises on Tinian.

Recommended Socioeconomic Impact Mitigation Measures

1. When military exercises are scheduled for Tinian, provide a courtesy fax or telephone notification of dates and expected civilian impact directly to certain local entities in addition to the normal notification channel through the Mayor's office. As much advance notice as possible should be given especially if the exercise involves restricting access to the Military Area. Tour operators would like notice one month in advance when possible. At a minimum, the following should be directly notified:

   Mr. Carlos Shoda, Executive Director
   Commonwealth Ports Authority
   P.O. Box 1055
   Saipan, MP 96950
   Phone: (670) 664-3534
   Fax: (670) 234-5962

   Ms. Ellen Ikehara, Field Operations Supervisor
   Marianas Visitors Bureau Tinian Field Office

Phone: (670) 433-9365
Fax: (670) 433-0653

2. Consider excluding the busier and busier West Tinian Airport from future military exercises, especially during daylight hours. If a need for unexpected use of the airport or runway should arise, immediately directly notify the airport manager, Mr. Sylvestre Palacios at (670) 433-9296.

3. Restrict the area immediately surrounding West Tinian Airport from ground exercises to prevent military personnel from encroaching on the operating runway.

4. To prevent what some believe to be an inevitable tragic accident, strengthen the coordination of all landings, takeoffs and parachute drops anywhere on Tinian with the new civil air traffic control in Saipan.

5. Designate a finance officer to whom reimbursement billings should be submitted by local agencies. Document the procedures to be followed in obtaining military reimbursement of costs associated with exercises and disseminate that information through the Tinian Mayor's office.

6. Continue or even expand the practice of community service projects during military exercises.

7. In scheduling military exercises on Tinian, take into consideration the following annual events which normally bring substantial numbers of visitors to the island:

Cliff Fishing Derby	3rd weekend in February
San Jose Fiesta	1st weekend in May
San Isidro Fiesta	4th weekend in May
Agri-Food Fair	1st weekend in June
MVB 10K Fun Run	4th Saturday in September

8. Reevaluate socioeconomic impact to incorporate new data if a hotel/casino resort is constructed on Tinian.

9. Continue the sensitivity to the island of Tinian and it's residents exhibited in the excellent briefing instructions provided to personnel of the Tandem Thrust 95 exercise under the heading TINIAN TRAINING AREA: THINGS YOU NEED TO KNOW (Exhibit VII-A).

Appendix I
Supplemental Underwater Detonation Information

I-1: COMNAVMARIANAS Instruction 5090.7—Underwater Detonation of Explosives In and Around Apra Harbor

I-2: Fish Kill Data from the Navy Underwater Mine Detonation

Appendix I-1
COMNAVMARIANAS Instruction 5090.7—Underwater Detonation of Explosives In and Around Apra Harbor

RETURN TO PACIFIC CENTRAL FILES

DEPARTMENT OF THE NAVY
U.S. PACIFIC FLEET
COMMANDER U.S. NAVAL FORCES MARIANAS
FPO AP 96536-0051

IN REPLY REFER TO:
COMNAVMARIANAS
INST 5090.7
N45
05 APR 1994

COMNAVMARIANAS INSTRUCTION 5090.7

Subj: UNDERWATER DETONATION OF EXPLOSIVES IN AND AROUND GUAM

Ref: (a) OPNAVINST 5090.1A
(b) USCINCPAC REP GUAM/CNMI/FSM/ROP//COMNAVMARIANAS INST 5400.1B
(c) COMSEVENTHFLT OPORD 201 (Tab J to APP 16 to Annex C)
(d) NOAA MD ltr of 27 Aug 93, Subj: Biological Opinion
(e) Guam EPA ltr of 24 Nov 93, Clearance for explosive for ship repairs

Encl: (1) Underwater Detonation Request Format
(2) Underwater Detonation Process Flowchart
(3) Statement Regarding Incidental Taking under Endangered Species Act

1. Purpose. To outline specific responsibilities and establish policy for coordination of underwater detonation of explosives in and around Guam.

2. Background. As established in references (a) and (b), COMNAVMARIANAS is responsible for coordinating activities among various naval commands on Guam, including activities conducted by the Navy in Apra Harbor. In addition, COMNAVMARIANAS serves as the regional environmental coordinator and assists commands in obtaining permits for various activities that might adversely affect the environment including endangered plants and animals. In accordance with reference (c), COMNAVMARIANAS provides local concurrence prior to COMSEVENTHFLT approval of underwater detonations within the regional Area of Responsibility (AOR).

3. Policy. The underwater detonation of explosives in Apra Harbor or in waters surrounding Guam will only be undertaken per the guidance provided in this instruction and then, only if consistent with the Navy's environmental policy and the Endangered Species Act provisions contained in reference (d). It is essential for continued operations and training that the various conservation recommendations, as well as reasonable and prudent measures, be taken to reduce adverse effects, which explosive charges may have on endangered or threatened species and water quality.

4. Exceptions. The sole exceptions to this policy will be diver recall charges [NALC L378 (M-80)] and EOD underwater Shock Wave Action Generator (SWAG) countercharges. Use of either of these charges containing less than ten grams of net explosive weight

RETURN TO PACIFIC CENTRAL FILES

4. Exceptions. The sole exceptions to this policy will be diver recall charges [NALC L378 (M-80)] and Explosive Ordnance Disposal (EOD) underwater shock wave action generator (SWAG) countercharges. Use of either of these charges containing less than ten grams of net explosive weight will not require prior permission as they are used to recall divers to the surface, and in countering limpet mines attached to ship hulls and/or piers, and do not pose a significant threat to endangered or threatened species or detrimental effect on water quality.

5. Pre-Existing Certification. Reference (e) provides water quality certification to Naval Ship Repair Facility for use of explosives when necessary for propeller removal. Reference (e) delineates conditions and required Environmental Protection Agency (EPA) notifications required for this specific utilization of explosives.

6. Responsibilities

a. Naval Station (NAVSTA), Guam. The Commanding Officer, as host for various tenant commands, will be responsible for applying for environmental permits and providing necessary notifications, as required, to federal and Government of Guam agencies, e.g., National Marine Fisheries Service (NMFS), Guam Environmental Protection Agency (GEPA), Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR), etc., for proposed detonation of explosives in the waters surrounding Guam including Apra Harbor. COMNAVMARIANAS will be responsible for permits and coordination of underwater explosives in other areas in the AOR.

b. Requesting Activity. The activity, which requires the underwater detonation of explosives, is responsible for requesting permission from local and federal agencies via NAVSTA Guam and from COMSEVENTHFLT directly. Additionally, the requesting activity is responsible for ensuring area safety and security during the evolution, and meeting the reporting and other requirements outlined in reference (d).

7. Action

a. Commanding Officer, NAVSTA Guam will coordinate with local officials for all underwater detonation requests and permits involving Apra Harbor, and the surrounding waters of Guam as stated in paragraph 6a above.

b. Requesting activities will:

(1) Initiate underwater detonation of explosives requests by completing enclosure (1), and submitting it to NAVSTA Guam no later than 30 days prior to the intended date of detonation.

(2) Provide military divers, and other personnel (e.g., security watches, guards, roving patrols, etc.) as necessary, to assess the presence of non-military divers and endangered marine life in the vicinity of intended detonation site prior to any detonation of explosives. Additionally, they will assist GEPA personnel in determining the number of fish kills, and whether sea turtles were killed/maimed as a result of the explosion, when requested.

(3) Coordinate with the U.S. Coast Guard to ensure adequate security support is provided.

(4) Submit underwater detonation of explosives request messages to COMSEVENTHFLT as required by reference (c).

(5) Conduct underwater detonation of explosives following the process outlined in enclosure (2).

(6) Assist NMFS, GEPA, Guam Department of Agriculture, and DAWR in assessing the impact of underwater detonations on indigenous marine life. In the event the endangered sea life are injured or killed, enclosure (3) will be used to assist with required notifications. Notify the Commanding Officer, Naval Station, Guam and COMNAVMARIANAS, Code N4, immediately.

(7) Retrieve, preserve, and forward via proper export/import permit any killed endangered sea life as required by enclosure (3).

(8) Provide public affairs information, including draft press releases, that might be necessary for notification of the public regarding detonations and related activities.

(9) Ensure appropriate Notice to Mariners, Broadcast Notice to Mariners, and Notice to Airmen are issued prior to detonation.

E. R. KRISTENSEN

Distribution:
USCINCPAC REP GUAM/CNMI/FSM/ROP//
COMNAVMARIANAS JOINT INST 5216.1L
List I (1 copy ea.)
List II

Copy to:
USCINCPAC
CINCPACFLT
COMSEVENTHFLT
PACNAVFACENGCOM

UNDERWATER DETONATION REQUEST FORMAT

From: Requesting activity
To: Commanding Officer, U.S. Naval Station, Guam

Subj: UNDERWATER DETONATION REQUEST

Ref: (a) COMNAVMARIANASINST 5090.7

Encl: (1) Detailed Inner Apra Harbor Survey Plan (Written plan which outlines details of intended training evolution. A sample is provided.)

1. Per reference (a), representation is requested to the Guam Environmental Protection Agency (GEPA) for all necessary permits to authorize an underwater detonation of an (less than 2 pounds, 10 pounds or 20 pounds) explosive charge on (date) as part of our Mine Countermeasures (MCM) training at (area where detonation is planned to take place) in a depth of XXX feet of water. Purpose of detonation is for (training, blasting, EOD disposal, etc.).

2. A baseline survey of this area was conducted on (date) and the area was found to consist of (type of bottom-sand, coral, mud). Further, no protected species of hawksbill or green sea turtles have been observed by divers who conducted an area search.

3. Desire to commence using explosives on (date) using the detailed plan outlined in enclosure (1).

4. My point of contact is xxxxxxxxx, (671) 339-yyyy.

Signed

Copy to:
COMNAVMARIANAS (N45)

Detailed Inner Apra Harbor Survey Plan

1. All underwater explosive detonations scheduled to take place in Inner Apra Harbor area will be conducted as outlined in the attached flowchart and as follows:

a. Prior to commencing operations, a general boat sweep will be conducted around the intended detonation site. This sweep will consist of a spiraling circular pass from the intended site out to approximately 100 yds. In addition to the boat coxswain, two observers will look for turtles in the operating area.

b. Next a preliminary dive will be conducted at the intended detonation site to determine the existence of turtles/schools of fish. An EOD Diver will be available to assist GEPA to liaison with the Demolition Supervisor and assist in Communications.

c. Absent any turtles/schools of fish, civilian divers, or waterborne craft in the immediate vicinity and an explosive charge not to exceed two pounds will be placed in no more than 40 feet of water. If turtles are present, all operations will cease until the area is clear. Prior to initiating the main explosive charge, a hand thrown diver recall scare charge will be thrown in the general vicinity to scare away fish.

d. Another area sweep will be conducted via boat following placement of the charge to ensure no turtles are present. If no turtles are present, and all monitoring activities are in place, an all clear signal will be given, the boat will exit to a safe standoff distance and three loud "FIRE IN THE HOLE" exclamations will be made just prior to detonating the charge.

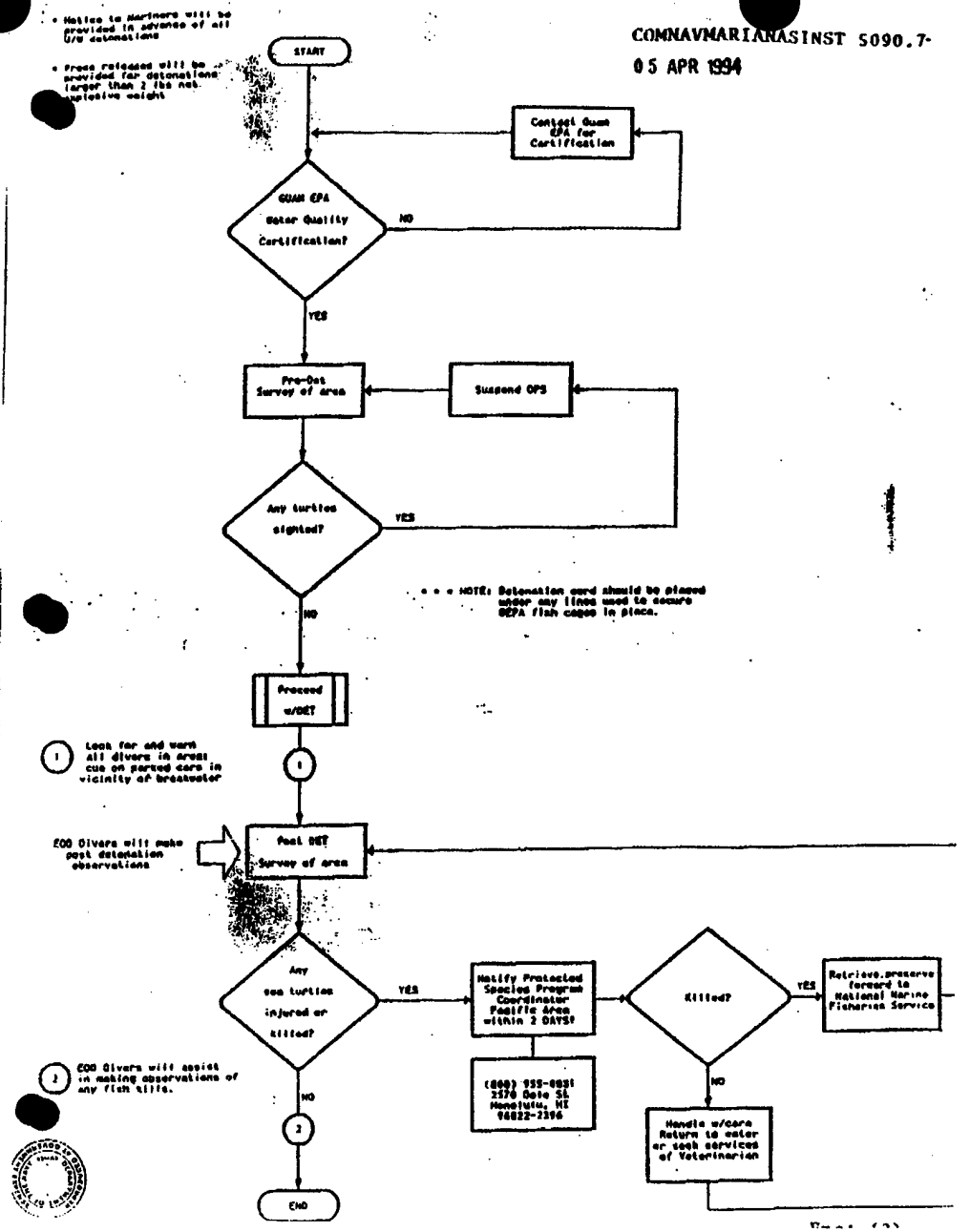
e. While preparing for the verification dive, and as part of the 30 minute waiting period, the boat will transit the area and look for signs of injured or dead turtles/marine life. If any are found, they will be turned over to DAWR for forwarding to the National Marine Fisheries Service.

f. During the verification dive, made to ascertain the effectiveness of the explosive charge, divers will scan the area for any signs of sea turtles or fish kills. A Navy Dive team will assist GEPA by making and collating observations of any fish kills (noting general numbers of fish killed).

2. A request will always be made to the United States Coast Guard to provide perimeter security services. When provided, these assets will also be used to conduct surface searches prior to, and following the detonation of the explosive charges.

3. The mine will be floated and towed to Polaris Point for beaching and recovery, avoiding shoals and coral formations.

COMNAVMARIANASINST 5090.7
05 APR 1994



Statement Regarding Incidental Taking
Pursuant to Section 7(b)(4) of
the Endangered Species Act of 1973, as amended

Section 7(b)(4) of the Endangered Species Act requires that when a proposed agency action is found to be consistent with Section 7(a)(2) of the Act and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact (amount or extent) of such incidental taking. It also states that reasonable and prudent measures be provided that are necessary to minimize such impacts. Incidental taking by the federal agency or applicant that complies with the reasonable and prudent measures of this statement is authorized and exempt from the taking prohibition of the ESA.

The available information indicates that incidental taking of listed sea turtles may occur as a result of mine warfare training conducted by the U.S. Navy in Apra Harbor. However, there are no data on the anticipated level of incidental take from these exercises.

On the basis of the best available information which includes reports of confirmed nesting activity by hawksbill turtles in Apra Harbor, sightings of green turtles within the proposed training area and information on the abundance and distribution of these two species around Guam and the northern Mariana Islands, an incidental take by harassment of listed sea turtles is authorized at 10 individuals per year. Of those 10 authorized takes by harassment, only one injury or mortality of listed sea turtle is authorized per year.

If the authorized level of take is met or exceeded, or if mortalities or serious injuries exceed the authorized levels, then consultation must be re-initiated and further conservation measures may be imposed.

Reasonable and Prudent Measures

The following reasonable and prudent measures must be implemented to allow training activities proposed by Explosive Ordnance Disposal Mobile Unit Five (EODMU FIVE) in Apra Harbor. These measures are necessary to monitor and minimize impacts on endangered and threatened sea turtles:

COMNAVMARIANASINST 5090.7
05 APR 1994

(1) All mine warfare training operations must be monitored to insure that the potential for injury or mortality of green or hawksbill turtles is reduced or eliminated. If turtles are sighted within the training area, activities involving detonation of explosive charges must be suspended until the animals have left the area. During placement, detection, detonation and disposal of the practice munitions, the site must be surveyed for the presence of sea turtles. A detailed survey plan, including pre-detonation and post-detonation surveys for turtles, must be submitted to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) at least two weeks prior to the first exercise.

(2) If any listed sea turtles are injured or killed during these exercises, notification must be made to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) within two working days. Consultation will be re-initiated at that time as appropriate.

(3) Any sea turtle killed during the conduct of training activities must be retrieved, preserved and forwarded with the proper export/import permits to the NMFS for necropsy and further evaluation. Any sea turtle injured during training must be handled with due care to prevent further injury, observed for activity, resuscitated if necessary, and returned to the water, or retained for treatment by an authorized veterinarian as appropriate.

(4) The U.S. Navy must provide annual reports on the results of the training exercises conducted for the previous calendar year by 31 January of the following year. Copies of the report should be forwarded to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) and the Guam DAWR. The reports should include the number of exercises conducted, number, type and weight of charges detonated, and the number and species of sea turtles observed, disturbed, injured or killed.

Conclusion

Based on the available information, NMFS concludes that the proposed relocation of U.S. Navy and U.S. Air Force activities from the Philippines to Guam and facilities development associated with the transfer of activities will not jeopardize the continued existence of endangered hawksbill turtles (Eremochelys imbricata) or threatened green turtles (Chelonia mudas) that may be found associated with Guam or the Marianas Archipelago. However, NMFS concludes that the training proposed for EODMU FIVE may adversely affect hawksbill and green sea

turtles. Due to the uncertainty in the number of sea turtles during an exercise, the determination of an allowable incidental take must be conditioned to trigger re-initiation of consultation at low levels of mortality and/or injury.

Conservation Recommendation

The following conservation recommendation is provided pursuant Section 7(a)(1) of the ESA to assist the Navy in reducing adverse impacts to listed species within the Apra Harbor project site:

EODMU FIVE should notify the Guam DAWR sufficiently in advance of each exercise so that they may have the opportunity to monitor the proposed activities for potential adverse effects to listed sea turtles.

Appendix I-2
Fish Kill Data from the Navy Underwater Mine Detonation

FISH KILL from the Navy Underwater Mine Detonation on September 20, 1995; Apra Harbor (LAT 13°27'42"/LONG 144°38'30")	
SPECIES	**QUANTITY**
Chaetodon auriga (Threadfin butterflyfish)	1
Cheilodipterus quinquelineata (Five-lined cardinalfish)	1
Dascyllus aruanus (Humbug dascyllus)	2
Stegastes fasciolatus (Pacific gregory)	5
Cheilinus fasciatus (Red-breasted wrasse)	1
Chromis viridis (Blue-green chromis)	2
Amblygobius nocturnus (Nocturn goby)	5
Oplopomus oplopomus (Blue-spotted hole goby)	19
Fusigobus longispinsus (Longspine goby)	2
Stolephorus sp.?	36
Dussumieria sp. B (Sharp-nosed sprat)	3
Letognathus stercorarius (Oblong slipmouth)	8
Vanderhorstia ornatissima (Ornate prawn goby)	4
Myripristis juv. ?	13
Myripristis juv. ?	1
TOTAL NUMBER OF SPECIES: 15	**TOTAL: 103**

*Photos taken

GEPA FILE

FISH KILL from the Navy Underwater Mine Detonation (TAV) on 12/13/95; Apra Harbor (LAT 13°27'42"/LONG 144°38'30')		
SPECIES	**QUANTITY**	**SIZE (cm)**
Pseudobalistes flavimarginatus (Yellomargin triggerfish)	1	18
Lutjanus fulvus	1	23.5
Lutjanus gibbus	1	22
TOTAL NUMBER OF SPECIES: 3	**TOTAL: 3**	

NOTE: We were unable to collect a number of gobies seen during the dive; species and number of gobies are unknown.

**Down-time restricts the complete collection of fishes killed.

GEPA FILE

FISH KILL from the Navy Underwater Mine Detonation (Training) on MARCH 6, 1996 at Apra Harbor (LAT 13°27'42"/LONG 144°38'30")		
SPECIES	**QUANTITY**	**SIZE (cm)**
Upeneus taeniopterus (Band-tailed goatfish)	1	24
Lutjanus fulvus	1	8.5
Lethrinus olivaceus (Longnose emperor)	1	16
Gerres argyreus	1	28
TOTAL NUMBER OF SPECIES: 4	**TOTAL: 4**	

GEPA FILE

**Down-time restricts the complete collection of fishes killed.

FISH KILL from the Navy Underwater Mine Detonation (Training) on MARCH 27, 1996 at Apra Harbor (LAT 13°27'42"/LONG 144°38'30")		
SPECIES	**QUANTITY**	**SIZE (cm)**
Lutjanus bohar	1	51.5
L. gibbus	13	18, 15, 20, 17, 19, 19, 18, 11, 20, 18, 20, 15, 15
Chaetodon auriga	2	14, 15
C. ulietensis	1	9
C. ephippium	1	11
Psuedobalistes flavimarginatus	1	23
Suflamen chrysoptera	2	15, 13
Gerres argyreus	4	19, 20, 21, 22
Parupeneus heptacanthus	1	31
Cheilinus fasciatus	4	22, 13, 13, 12, 28
Epibulus insidiator	1	28
Pomacentrus amboinensis	8	9.5, 9.5, 7, 10, 8.5, 8.5, 9.5, 8
Lethrinus olivaceus	5	17.5, 22, 21, 24.5, 23.5
L. harak	3	21, 22, 24.5
L. obsoletus	1	29.5
Neoniphon sammara	11	11, 13, 12, 13.5, 9.5, 13.5, 10.5, 14, 13, 12, 13
Family: *Holocentridae* (sp.?)	2	13, 14
Family: *Holocentridae* (sp.?)	1	11
Caesio caerulaurea	13	19, 14, 14, 17, 17.5, 15, 15.5, 16.5, 15.5, 17.5, 18, 18, 14
Pterelеotris (sp?)	1	19.5
Total species: 20	**Total: 76**	

**Photos taken of collected fishes

GEPA FILE

**Down-time restricts the complete collection of fishes

Appendix J
Revised Prefinal Military Exercises and Historic Sites in Military Training Areas on the Island of Guam: An Archaeological Assessment (December 1996)

— revised prefinal —

MILITARY EXERCISES AND HISTORIC SITES IN MILITARY TRAINING AREAS ON THE ISLAND OF GUAM: AN ARCHAEOLOGICAL ASSESSMENT

by

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We are very grateful to Mr. David DeFant for providing preliminary information on the findings of the PHRI survey at the Ordnance Annex prior to the submittal of the prefinal report, assisting us in the early planning of protection measures for the survey area. Ms. Annie Griffin, NAVFACENGCOM archaeologist, assisted our work in a number of ways, discussing site protection concerns and providing copies of the necessary reports and advance copies of certain essential maps and letter reports.

Mr. Richard Davis, Guam Historic Preservation Officer, shared us with his concerns regarding site protection and military exercises. Ms. Annie Flores and Mr. Victor Torres provided the guidance we needed in searching the HPO files for information on recorded sites.

We are especially appreciative of the efforts of the base resource managers who willingly took a great of their time to assist us in the field assessments on Guam. Mr. Jennings Bunn, cultural resource manager for NAVACTS, arranged our field visit to the Ordnance Annex and accompanied us on our visits to Orote Peninsula and the Ordnance Annex, and discussed his views and those of the Navy on several of the management issues in regard to the sites on NAVACTS installations. Ms. Heidi Hirsh, natural and cultural resource manager at Andersen AFB, and LT Eric Waters, environmental engineer, also assisted us with obtaining permission to visit restricted areas, accompanied us on site visits to Tarague and Northwest Field, and shared their insights into the site protection needs at the air base.

Mr. Roger Blankfein and Ms. Judith R. McNeill prepared the maps used in this report.

EXECUTIVE SUMMARY

The present document is an archaeological assessment of proposed training areas on the island of Guam related to the development of an Environmental Impact Statement for military training.

The training areas are located on the U.S. Naval Activities (NAVACTS) Guam Waterfront Annex (formerly Naval Station Apra Harbor Complex), NAVACTS Guam Ordnance Annex (formerly Naval Magazine), Naval Computer and Telecommunications Area Master Station (NCTAMS) WESTPAC Finnegayan and Barrigada sections, and Andersen Air Force Base (including Andersen South). Many of the proposed training areas have been covered by archaeological surveys, but of varying levels of intensity; however several of the areas have never been surveyed. Archaeological sites on the bases have been summarized in several draft overview survey reports and prefinal cultural resource management plans.

The results of the various archaeological surveys are summarized, the archaeological site inventory for all the installations is listed, and the significance of those sites which have been given a recommended evaluation following the surveys or during the preparation of the management plans is presented in the site table. Sites which have been placed on the National Register and Guam Register of Historic Places are identified. The definition of site and the means by which sites are organized varies from survey to survey. Duplicate site designations are eliminated where possible, but no attempt has been made to redefine sites in a manner that would make the inventory consistent.

There are 374 archaeological sites in the inventory for these bases, of which 253 have been evaluated as eligible for the National Register. Eight sites are listed on the National Register, and these and nine additional sites are on the Guam Register. These sites range from prehistoric ceramic scatters to ruins of World War II structures, and reflect many of the significant events and characteristics of the island's history. These sites include the largest cluster of *latte* sets recorded on Guam, numerous coastal and inland *latte* sets, caves with prehistoric artifacts and art, and World War II Japanese bunkers and defensive caves.

In order to avoid or mitigate the potential impacts of military training on sites eligible for the National Register, a set of protective measures is recommended. These measures include the evaluation of training areas in terms of their archaeological sensitivity related to potential impacts, with suggested constraints for each area. These potential adverse impacts to sites in each of the training areas are discussed and measures to protect significant sites recommended.

INTRODUCTION

Purpose

The present document is an assessment of the historic resources (archaeological sites and historic structures) in proposed training areas on the military bases on the island of Guam, prepared as a background document for the Environmental Impact Statement developed for military training in these areas. The areas of concern are located on the U.S. Naval Activities (NAVACTS) Guam Waterfront Annex (formerly Naval Station Apra Harbor Complex), NAVACTS Guam Ordnance Annex (formerly Naval Magazine), Naval Computer and Telecommunications Area Master Station (NCTAMS) WESTPAC Finnegayan and Barrigada sections, and Andersen Air Force Base (including Andersen South) (Fig. 1).

Preparation of this assessment has been based on information derived from existing survey reports, overview survey reports, draft and final cultural resource management plans, and consultation with archaeological contractors conducting surveys in proposed training areas. These include consultations with Paul H. Rosendahl, Inc. (PHRI) concerning archaeological survey in the southern portion of the Ordnance Annex (D. DeFant, pers. com.), and with International Archaeology, Inc. (IAI) archaeologists concerning the archaeological portion of Tarague Embayment Legacy survey (J. Liston and R. Olmo, pers. com.). In addition, International Archaeological Research Institute, Inc. (IARII) archaeologists undertook a one week in-field assessment of selected sites and training areas on the military bases on Guam and consultation with the Guam Historic Preservation Officer (GHPO) and base cultural resources managers.

The Undertaking and the Area of Potential Effect

Military training on Guam may involve Guam-based elements of the US Navy, US Air Force, US Army Reserve-Marianas, Guam Army National Guard, and Guam Air National Guard (Belt Collins Hawaii 1996). The following summarizes the proposed training exercises on each of the military bases.

The exercises proposed for NAVACTS Guam Ordnance Annex are the use of a sniper range, a land navigation course, small unit patrolling, bivouacs, field exercises, parachute drops, military police security training, and helicopter landing and rappelling. Areas to be used in training include strips of land in the northeast section and the northwest section, and a large portion of the south part of the annex (Belt Collins Hawaii 1996: 20, Figure 3).

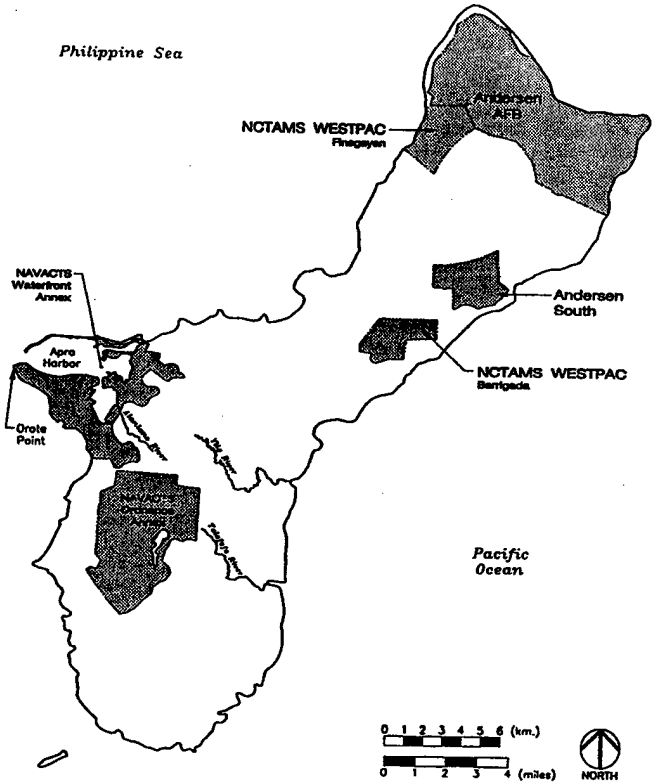


Figure 1. Map of Military Base Areas Included in this Study.

The exercises proposed for NAVACTS Guam Waterfront Annex at Apra Harbor include both activities in the harbor itself and land based activities on Orote Peninsula. Proposed Apra Harbor exercises are combat swimmer training, limited charge surface and underwater demolition training, water parachute drops, helicopter swimmer insertions and recovery, riverine training, and assault craft landings. On Orote Peninsula proposed training consists of small arms fire and maneuver and sniper training at the existing rifle and pistol ranges and shooting house, unit bivouacs, nuclear, chemical, and biological (NBC) gas mask training, helicopter and fixed-wing personnel and cargo parachute operations on the old runway, and combat swimmer insertions from the harbor (Belt Collins Hawaii 1996: 20-21, Figure 4).

At Andersen AFB the proposed exercises are aviation training, airfield security exercises, TRUE training, NBC training, helicopter-operations, and parachute drops. The main airfield at Andersen AFB will also be used as a staging area for assembly of troops and equipment for large joint-service exercises in the Marianas region. In the Northwest Field area small unit bivouacs and maneuvers, land navigation, C-130 aircraft flight crew training, and parachute operations are proposed. On the Tarague coastal plain swimmer insertions are planned along with continued use of the firearms range and the EOD range (Belt Collins Hawaii 1996: 21, Figure 5).

The southern portion of Andersen South is proposed as the location for bivouacs, land navigation, field maneuvers, and defensive tactics (blank fire only) (Belt Collins Hawaii 1996: 21, Figure 5).

Proposed training at NCTAMS Finegayan will be mainly restricted to the coastal plain along the west coast below the cliff line. Exercises proposed are swimmer insertions at Haputo and Double Reef Beaches and overland maneuvers along the coastal strip to Andersen AFB Northwest Field. The small arms range will be used for pistol and rifle firing. At NCTAMS Barrigada, small unit bivouac and maneuvers are proposed, but no specific training area has been defined (Belt Collins Hawaii 1996: 21, Figure 5).

Research and Consultation Activities

Preparation of this document has been based on a review by Judith McNeill, project director, of the five draft overview survey reports prepared by Ogden for military bases on Guam (Craib and Yoklavich 1992a,b,c,d, Yoklavich and Craib 1992) and one prefinal overview survey report (Craib and Yoklavich 1996), the draft Cultural Resource Management Plan (CRMP) for Andersen AFB (Schilz 1996), the draft CRMP for NAVACTS Waterfront Annex (Naval Station Apra Harbor Complex) (Lauter-Reinman 1995), and the draft management plan for World War II Resources (Lauter-Reinman 1994). Several archaeological survey reports were also reviewed.

Between March 23 and 31 and on April 16, 1996 IARII archaeologists, David Welch, principal investigator, and McNeill conducted inspections of proposed military

training areas and associated archaeological sites on Guam. Welch conducted an inspection of Orote Peninsula (closed in March) on August 9, 1996. In addition to the field inspections, consultations were held with Richard Davis, Guam Historic Preservation Officer, Jennings Bunn, NAVACTS cultural resources manager, Heidi Hirsh, cultural and natural resources manager for Andersen AFB, and LT Eric Waters, Andersen AFB environmental engineer. IARII archaeologists also met with David DeFant, PHRI Guam projects manager, to discuss the PHRI survey of the southern portion of the NAVACTS Ordnance Annex.

Field inspections were conducted at NAVACTS Waterfront Annex and the Ordnance Annex, at NCTAMS, and at Andersen AFB. Mr. Bunn assisted with the NAVACTS inspections, accompanying the archaeologists on the tour of the Ordnance Annex and portions of Apra Harbor and discussing areas of concern from his point of view. Ms. Hirsh and LT Waters assisted with the Andersen AFB inspections. Certain areas could not be inspected. These included southern portions of the Ordnance Annex because of the difficulties of access and the Gab Gab Beach area on Orote Peninsula (closed for ammunition unloading throughout the entire fieldwork period).

In addition to the site inspections, literature reviews were conducted at the IARII Guam office, the NAVACTS Cultural Resources Management office, and the Guam Historic Preservation Office. Site files at the GHPO were checked to collect site information not included in the overview survey reports and CRMPs and to reconcile discrepancies in site numbering within and between reports. The site inventory list was checked and copies of the lists of Guam Register sites and site reports were obtained.

During a meeting with Richard Davis, HPO, the following concerns were raised:

1. NAVACTS Waterfront Annex: The HPO and COMNAVMARIANAS disagree on the significance of Orote Airfield. However the Airfield has been placed on the National Register. Therefore the HPO is treating it as a significant site and will be concerned about any potential impacts to the airfield from training exercises. The HPO accepts that a redefinition of boundaries is in order.

2. NAVACTS Ordnance Annex. The PHRI survey has discovered what appears to be the largest and best preserved *latte* set on Guam, associated with several other potentially significant sites. Any training in this area will require careful evaluation.

3. NCTAMS. While the Seal landings at Haputo Beach in the vicinity of a major *latte* complex are an ongoing activity, the potential effects of these activities have never been evaluated.

4. Andersen AFB. Northwest Field has been evaluated as significant in the Ogden CRMP. Previously the National Park Service had determined it eligible for

nomination as a National Historic Landmark and prepared a National Register nomination form for the site. The HPO reviewed the nomination and concluded that the significance evaluation was not adequately justified. The form was never revised, and the status of the field remains a question that needs resolution. If the field is considered a significant site, then rapid runway repair training might not be an acceptable training activity at the airfield.

5. Andersen AFB. The Explosive Ordnance Disposal (EOD) Range includes burials and significant cultural resources. Activities, as stated in a letter to Roy Tsutsui, Andersen AFB, dated 6 March 1995, will have no effect as long as they are restricted to approved locations and follow agreed upon procedures. Any changes will require a new assessment of potential effects.

HISTORIC RESOURCES INVENTORY AND SIGNIFICANCE EVALUATIONS

Archaeological Research on Guam Installations

Reviews of previous archaeological research on Guam's military bases and summaries of the historic resources are included in the series of cultural resource management overview survey reports prepared by Ogden Environmental and Energy Services Co. in 1992. In addition, historic resources and evaluations of their significance are presented in the cultural resource management plans prepared by Ogden for NAVACTS Waterfront Annex and Andersen AFB and in the management plan for World War II resources on Guam.

The location of archaeological surveys conducted on Guam military bases is shown on Figures 2 through 4. These maps do not include several of the earliest surveys, which tended to be general surveys and not confined to particular bounded survey areas. In any event most of the pre-1970 reports do not include maps showing areas of survey coverage. Also, Spencer Mason Architects has completed inventories of the historic buildings on all the military installations on Guam, but these are not shown on the map, since the surveys were not confined to specific bounded areas. The following section discusses the surveys conducted on each installation, the level of coverage, the approximate area covered in the survey, and the primary results.

Previous Archaeological Surveys

Hornbostel surveyed and conducted excavations in several areas now under military jurisdiction including Andersen AFB and NAVACTS Ordnance Annex (Thompson 1932). However it is not possible to systematically map the survey coverage for the present project. Other early work includes the coastal surveys of Osborne (1947) and Reinman (1977), which found numerous coastal prehistoric sites, generally with *latte*.

More recently, Shun (1988) surveyed 7 acres in the NAVACTS Ordnance Annex in a disturbed area along Norton Road. He identified no sites, but did encounter isolated surface finds of prehistoric ceramics. Four very small parcels, totaling 0.8 acres, were surveyed in the north central portion of the Ordnance Annex by IARII (Tuggle 1993). No sites and no cultural materials were encountered. Craib conducted two surveys in the Ordnance Annex. The first (Craib 1993) included three parcels with a total area of 35 acres of hilly grasslands near the northern boundary. The survey team identified several surface artifact scatters. A second survey (Craib and Nees 1995) of 310 acres distributed among five parcels located 41 *latte* sites and two rockshelters. PHRI recently completed survey in the southern one-third of

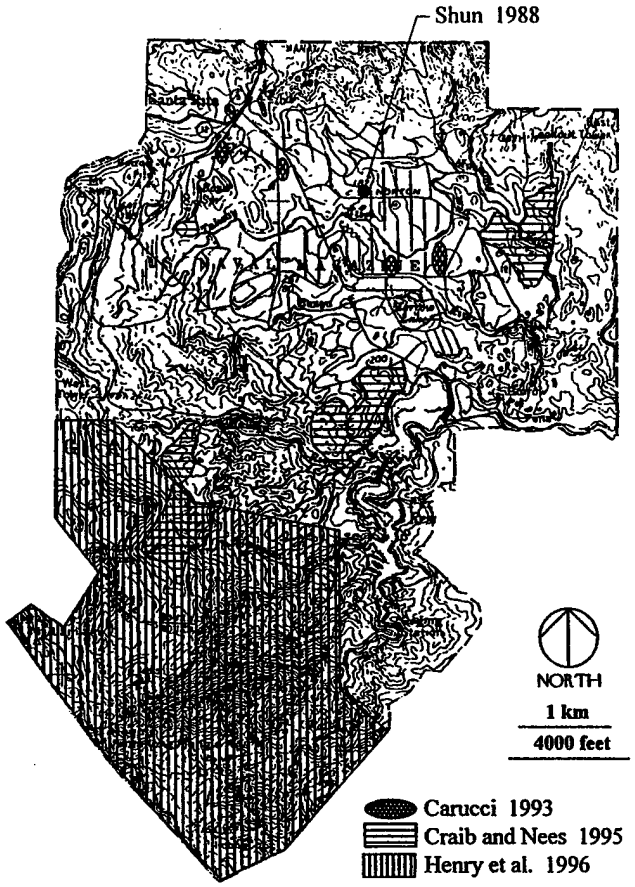


Figure 2. Location of Archaeological Surveys at NAVACTS Ordnance Annex.

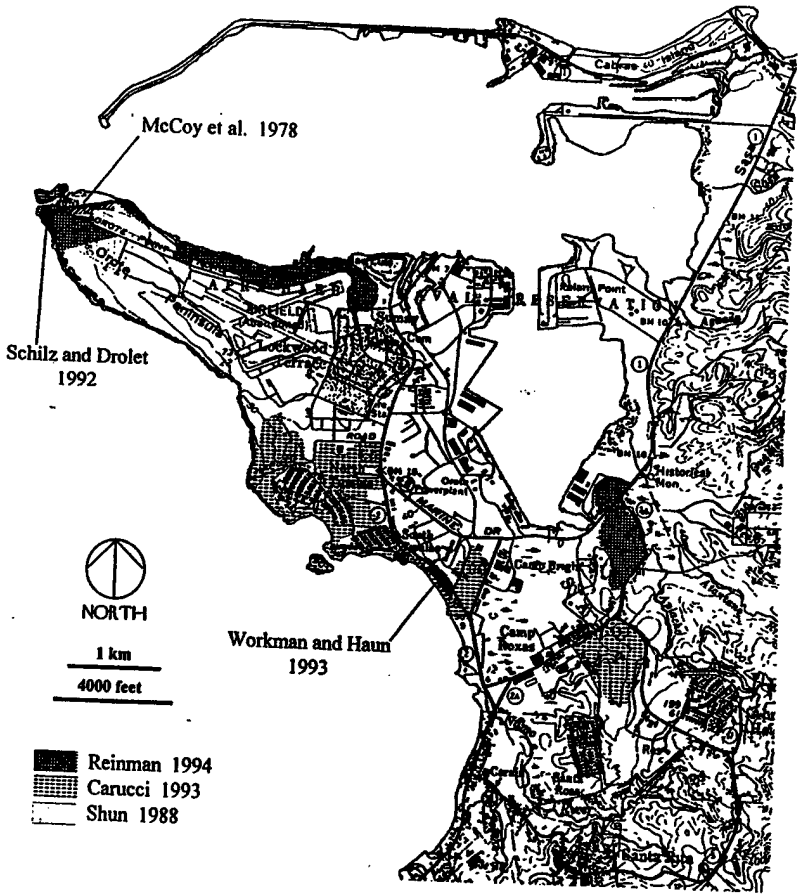


Figure 3. Location of Archaeological Surveys at NAVACTS Waterfront Annex.

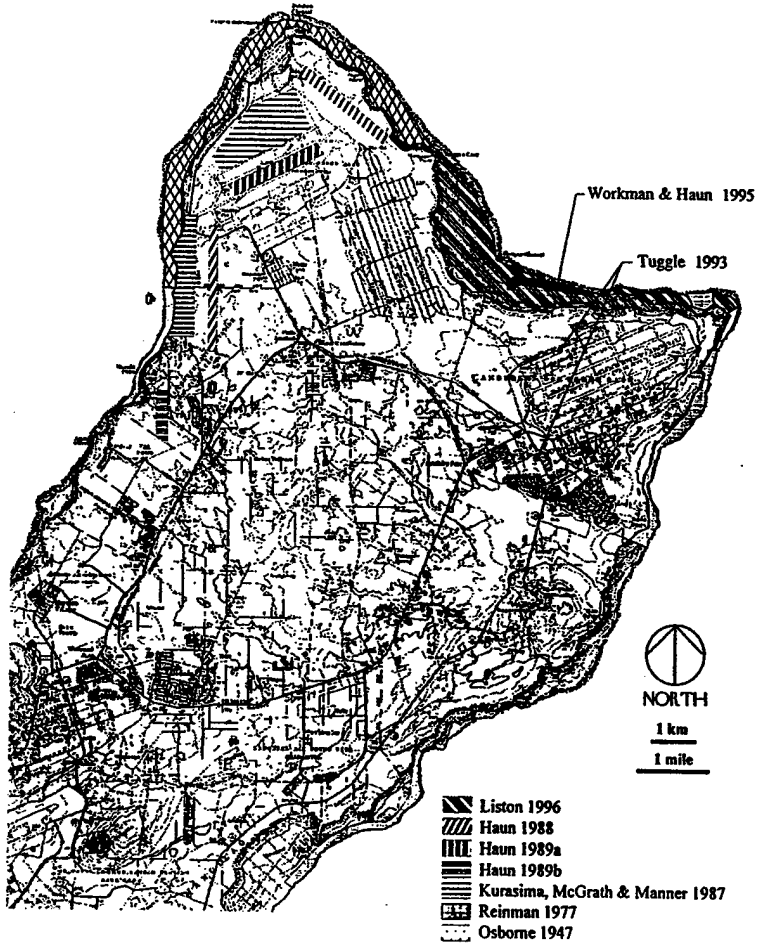


Figure 4. Location of Archaeological Surveys at Andersen AFB and NCTAMS.

the Ordnance Annex, identifying 122 sites, of which 114 are prehistoric sites. Among these are 48 *latte* sites, including one of the largest *latte* complexes yet identified on Guam (Henry et al. 1996).

Within the boundaries of the Waterfront Annex, in 1978, a Bishop Museum survey at the western end of Orote Peninsula identified nine surface pottery scatters and one previously recorded rockshelter site (McCoy, Price, and Craig 1978). IARII's survey (Shun 1988), also toward the western end of the peninsula, produced 8 sites from the Japanese and World War II periods within a generally disturbed 71 acre area. Near the tip of the peninsula in a 2 acre parcel, Schilz and Drolet (1992) identified historic period features only. Another small parcel, 3 acres between Shoreline Drive and Dadi Beach, produced 30 post World War II features (Workman and Haun 1993). Two larger scale surveys have been conducted, one by Ogden and one by IARII. The IARII survey (Carucci 1993) covered 250 acres, in several parcels south of Marine Drive. Thirty sites and 18 potential sites, both prehistoric and WWII era, were recorded. Ogden (Reinman 1994) surveyed several areas including Orote Island, Gab Gab Beach, and San Luis Point totaling 540 acres. The work yielded 39 new features and relocated 10 known sites, most of which are from the WWII era.

At Andersen AFB University of Guam and Bishop Museum (Kurashina, McGrath and Manner 1987) surveyed 900 acres in two parcels near Urano Point and Falcona Beach. They identified 14 surface prehistoric pottery scatters, but found no associated buried deposits or surface structures. Additional survey conducted in the Northwest Field area of Andersen by PHRI (Haun 1988, 1989a) included 3 parcels totaling 600 acres. Six surface prehistoric pottery scatters and two isolated sherds were recorded on Andersen AFB property. In addition to field surveys, extensive archival documentary research, primarily of World War II documents, has been carried out by PHRI in regard to Northwest Field (Dili and Haun 1991).

Tuggle (1993) reported finding no sites during survey of 8.3 acres in the maintenance hanger and fuel storage tank areas of North Field. Two survey projects have recently been conducted in the Tarague area of Andersen AFB. Work in a long narrow parcel of 7.5 acres along the EOD access road produced one feature and several surface ceramic scatters as well as evidence of buried cultural deposits (Workman and Haun 1995). International Archaeology, Inc. (IAI) has recently conducted survey of a 950 acre parcel in the Tarague embayment. Within the survey area, 140 sites with surface features and artifact scatters were recorded (Liston 1996).

Kurashina, McGrath and Manner's (1987) survey areas 2 and 2A extended into NCTAMS were an additional 3 prehistoric pottery scatters were identified. A portion of one of the PHRI Andersen AFB survey areas also extended into NCTAMS (Haun 1988). Two prehistoric pottery scatters, one with subsurface materials, and an isolated *Tridacna* adze fragment were identified on the NCTAMS property. As part of the same overall project, PHRI (Haun 1989a) surveyed a ca 200 acre area that extended from NCTAMS into the adjoining FAA property to the southwest. They found only a single site, a prehistoric pottery scatter located in the NCTAMS portion of the survey area.

Except for research for the Andersen AFB CRMP, no archaeological surveys have been conducted of Andersen South.

Archaeological Sites on Guam Military Bases

Appendix A lists the sites recorded on the military installations on Guam which will be involved in the training exercises. Sites are ordered by location, with the sites from each installation grouped together. The location is indicated in column 2. The table lists the common name by which each site is referred to, a brief description of the site, and the exact or approximate age of the site.

Because of variation in the way researchers have identified and grouped sites, it is difficult to precisely enumerate the total number of sites on most of the bases. What is counted as one site with several features in one report may be broken down into several sites in another report. In several cases differences in the description or the indicated location between one report and another make it impossible to be certain if two descriptions refer to a single site or to two separate sites. In some cases a second survey team in a survey area has been unable to relocate sites identified in a previous survey.

Site numbering poses a number of problems and conflicts. A few sites, primarily those listed on the National or Guam Registers, have permanent GHPO site numbers (these are found in column 3 of the table). However most sites are identified only by the temporary numbers used in particular reports. It is common for each new survey to assign new (temporary) numbers to sites that have already been assigned (temporary) numbers by previous researchers. Single sites may have two or three temporary numbers. Even when permanent GHPO site numbers are assigned to sites, the temporary numbers are sometimes still used in subsequent reports. Thus combining the reported sites into a single list using the temporary site numbers assigned by the various researchers can result in a great deal of confusion in site labeling.

Because most researchers begin their temporary series with "1" and number sites in order, there is a great deal of repetition of these temporary numbers. The overview survey reports in general did not refer to sites by number, but simply by name. Each Cultural Resource Management Plan numbered the sites included in the plan with a new set of numbers beginning with 1. Even though the CRMPs may contain descriptions and references to the same site, that site will have been assigned a different reference number in each report.

While assigning new temporary site numbers for this report may seem to be simply repeating the same mistake and compounding the confusion, we see little choice in order to maintain clarity in this report. Therefore each site covered in this assessment is assigned a unique number starting with "1" for purposes of this report. This is the number listed in column 1 of the Appendix A table and is the number used to identify sites on the site maps. Column 8 lists the numbers used for sites in previous reports; a number listed in column 8 is the number for the site used in the reference cited on the same line in column 7.

Significance Assessments

Archaeological sites are evaluated for significance in terms of their ability to meet the criteria of eligibility for nomination to the National Register of Historic Places (NR). To be considered eligible sites must possess integrity and meet at least one of following four criteria of historic value:

A: The site is associated with events that have made a significant contribution to the broad patterns of our history.

B: The site is associated with the lives of persons significant in our past.

C: The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D: The site has yielded, or may be likely to yield, information important in prehistory or history.

Significance evaluations as determined during previous surveys or during the preparation of the overview surveys and CRMPs are listed in Appendix A column 9. Column 9 also lists the criterion of significance where this is included in the report. For historic buildings, the Navy National Register Resource Treatment Category is also listed in this column. Comments in column 10 are those of the researchers making the evaluations. No attempt is made in this report to resolve the contradictions between reports in the significance assessments of some sites. Columns 11 and 12 note those eligible sites which have been placed on the National Register of Historic Places (NR) and the Guam Register of Historic Places (GR).

The National Park Service at one point prepared a nomination form to designate Northwest Field at Andersen AFB as a National Historic Landmark. This however was never approved. The Air Force now intends to nominate Northwest Field for the National Register (Hirsh, personal communication).

There are eight sites on the Guam military bases considered in this report that are listed on the NR. All these sites plus an additional nine sites are listed on the GR. NAVACTS Waterfront Annex includes 7 NR sites plus 3 GR sites, while the Ordnance Annex includes only 1 GR site. Andersen AFB possesses 2 NR sites and 5 GR sites, and NCTAMS Finegayan contains 1 NR site.

Archaeological Sites at NAVACTS Ordnance Annex

Prior to this past year's PHRI survey of the southern portion of the Ordnance Annex, 21 sites (counting those sites that form complexes as a single site) had been identified on the base. These are listed in Appendix A and their locations shown in Figure 5. Most of these

are historic sites dating to World War II and associated with the U.S. military build-up on Guam in the last year of the war. Seven of the U.S. World War II military structures have been determined eligible to the National Register. One structure, the Maanot Water Reservoir, dates to before World War II; its eligibility to the National Register remains undetermined, pending further study.

In the 1992 overview survey eight site complexes were reported to include prehistoric remains or to have a high potential (e.g. cave sites) for possessing prehistoric remains. At that time three sites were reported to have been destroyed; three others could not be relocated and the information concerning them was minimal. A survey in 1994 (Craib and Nees 1995) relocated all six of these sites, plus evidence of a *latte* site with an associated artifact scatter and three caves/rockshelters at Maemong, one of the potential site complexes. The survey also found portions of three surviving *latte* at San Isidro, another previously reported site believed to have been destroyed. All these complexes include *latte* sites, containing 1 to 13 *latte* sets. The Alifan Ridge Complex in the northwest corner of the Annex was not surveyed; it includes caves which are reported to contain prehistoric deposits as well as Japanese military artifacts and features.

One of the prehistoric sites, the West Bonya Complex (Site 30) with 7 *latte* sets has been determined eligible for the NR and has also been placed, combined with the East Bonya Complex (Site 29), consisting of 6 *latte*, under a single site number (2-0145), on the GR. In total, there were seven to nine prehistoric site complexes reported prior to the PHRI survey, depending on whether one divides the Laquet and Bonya complexes into two separate complexes.

The survey conducted by PHRI (Henry et al. 1996) has resulted in the identification of 122 sites in the southern portion of the Ordnance Annex. The vast majority of these, 114 in all, are prehistoric sites; 48 of these sites include a *latte* set or sets. Only 7 historic sites, mostly artifact scatters, were found during the survey, although 18 prehistoric sites also include a historic component, and one modern structure was recorded. Other common site types were overhangs, caves, and artifact scatters. All sites are evaluated as eligible for the National Register under Criterion D because of their information content. In addition, two cave sites containing pictographs are also significant under Criterion C and culturally significant. One other site, a set of prehistoric chiseled steps, is assessed as significant under Criterion C as a unique site type.

Archaeological Sites at NAVACTS Waterfront Annex

The Apra Harbor Waterfront Annex contains the largest number of previously reported sites of the bases being investigated. In part this reflects a greater intensity of survey in this area. Recent intensive surveys at the Ordnance Annex and Andersen AFB have resulted in a great increase in the number of sites on these installations. Recorded sites at the Waterfront Annex are indicated in Appendix A. Sites that are listed on the National Register

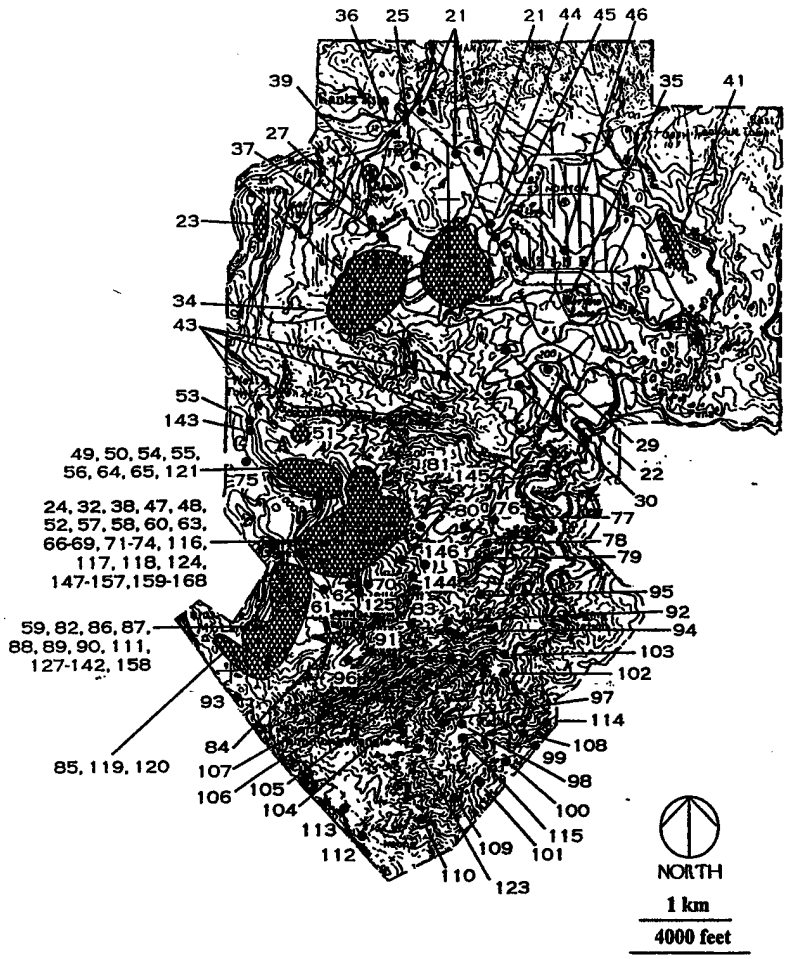


Figure 5. Archaeological Sites at NAVACTS Ordnance Annex.

or on the Guam Register or that have been assigned a GHPO site number, all submerged vessels, and all sites that have been evaluated as eligible to the National Register are shown in Figure 6. These include approximately 70 of the 198 sites at Apra Harbor, of which six are listed on the NR and nine on the GR. Reference should be made to the cultural resource management maps in the Apra Harbor CRMP for locations of all sites.

There are several areas of site concentrations which have been proposed as historic districts in the CRMP. The Sumay Historic District would include the archaeological remains of the former village of Sumay, GHPO Site 3-1038 (Site 319), the Sumay Cemetery, GHPO Site 3-1041 (Site 318), as well as GHPO Site 3-1043, the Pan Am cable station (Site 194), hotel (Site 269) (GHPO Site 3-1042), and seaplane landing ramp remains. The cable station is listed on the National Register; it and the cemetery and hotel are listed on the Guam Register. In the general vicinity of this district are a number of World War II Japanese sites: a mass grave site, GHPO Site 3-1092 (Site 250), cave sites, POW steps, and an anti-aircraft gun. There are also several Quonset huts dating to US military re-occupation of Guam found to the east of Sumay in the Ship Repair Facility; and a Quonset hut, office and shop buildings, and a former outdoor theater to the south.

A second concentration of sites is found at the end of Orote Peninsula. Both the prehistoric and historic features here have been grouped together as GHPO Site 3-1009, the Orote Historic Complex (Site 265). This complex consists of the Spanish steps, the Spanish well, a cave with midden and artifacts, and pottery scatters. The Orote Historic Complex is listed on the Guam and National Registers. Several U.S. and Japanese military defensive features are also found along the cliffline on the peninsula. The Gab Gab Beach area on the north coast of the peninsula may contain prehistoric deposits (Site 229) as well as two Japanese defensive structures (Site 227). Also, on the peninsula, GHPO Site 3-1066, Orote Airfield (Site 264), built by the Japanese during World War II, is listed on the NR and GR.

Outer Apra Harbor contains the remains of at least 27 sunken vessels, most of them dating to World War II. Those include four vessels which have been evaluated as significant historical resources: the Kitsugawa Maru (GHPO Site 3-1154, Site 355), the Tokai Maru (GHPO Site 3-1089, Site 359), the Nichiyu Maru (GHPO Site 3-1155, Site 356), and the SMS Comoran (3-1037, Site 358). The Tokai Maru is listed on the NR and the GR and the SMS Cormoran on the GR. The other submerged vessels have not been evaluated.

Finally, ten significant sites are located along the Dadi Beach coastline. These include GHPO Site 2-1302, a prehistoric rockshelter (Site 278), five Japanese World War II defensive caves, GHPO Site (Sites 243-247), three Japanese bunkers, GHPO Sites 2-1303 and 1301 (Sites 237 and 238), and GHPO Site 2-1300, the remains Camp Bright (Site 306), an American WWII camp.

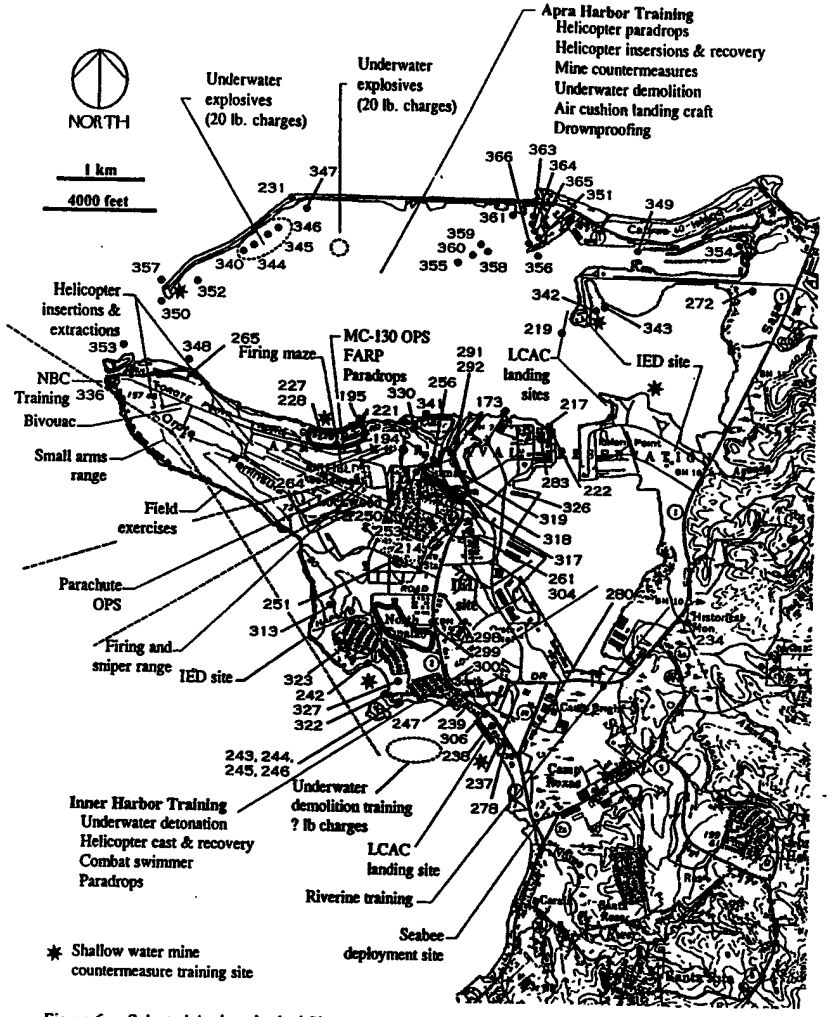


Figure 6. Selected Archaeological Sites at NAVACTS Waterfront Annex.

Other sites, mostly historic military sites, both Japanese and American World War II sites, are scattered throughout the base. These include structures, concrete structure foundations, bunkers, caves, gun positions, and aircraft remains. Some are consider eligible to the NR; others are not. The remaining site listed on the GR, GHPO Site 3-1088, is the Japanese submarine (Site 251), which is on display in the Lockwood area.

Archaeological Sites at Andersen AFB

The Andersen AFB CRMP lists nine prehistoric sites and nine historical sites on the main base (Schilz 1996). These are identified in Appendix A and located on Figure 7. The majority of sites are located on the coastal plains directly behind the beaches and below the steep cliffs which characterize most of the coast. Almost all of these sites are complexes consisting of several latte sets, pottery scatters, and associated cultural deposits. All have been determined eligible for the National Register, except for the Lafac pottery scatter, for which no determination has been made.

Kurashina, McGrath and Manner identified 14 sites. Five sites were found within survey area 1/1A to the north of the Northwest Field runway area. The area appears to have been extensively modified, but there are remnant areas of the original limestone forest. Sites 398 to 401 and 409 are all surface finds of prehistoric pottery sherds. Small test excavations were conducted at each locality, but no subsurface materials were encountered. The northern half of survey area 2/2A lies with Andersen AFB property. Survey area 2/2A is predominately pristine limestone forest, with little evidence of disturbance. No surface structures were encountered, however 10 additional surface scatters of prehistoric pottery were identified (Sites 402 to 411). These scatters vary in area from approximately 16 to 1200 m^2 and produced as few as 1 to over 30 sherds at a single locality. Subsurface testing, conducted at most localities, failed to produce subsurface cultural materials.

PHRI (1988, 1989a) surveyed three areas on Andersen AFB property. In the P-002 survey area near Ritidian Point, they identified two 10-15 m in diameter surface scatters of prehistoric pottery, with sherd densities of 3-6 sherds per m^2. Survey of the P-223 project area, located within Northwest Field, failed to identify any prehistoric archaeological sites, but did note various historic remains and structures. The P-225 survey area overlaps Andersen AFB and NCTAMS properties. Sites 383 through 389 were identified in the Andersen portion. All of the sites are surface finds of prehistoric pottery. One site, Site 386, also produced a *Tridacna* adze fragment. Subsurface materials were encountered at two of the sites.

None of the sites identified by Kurashina, McGrath, and Manner or the PHRI surveys are included in the Andersen AFB CRMP. No significant evaluations were included in the original survey documents.

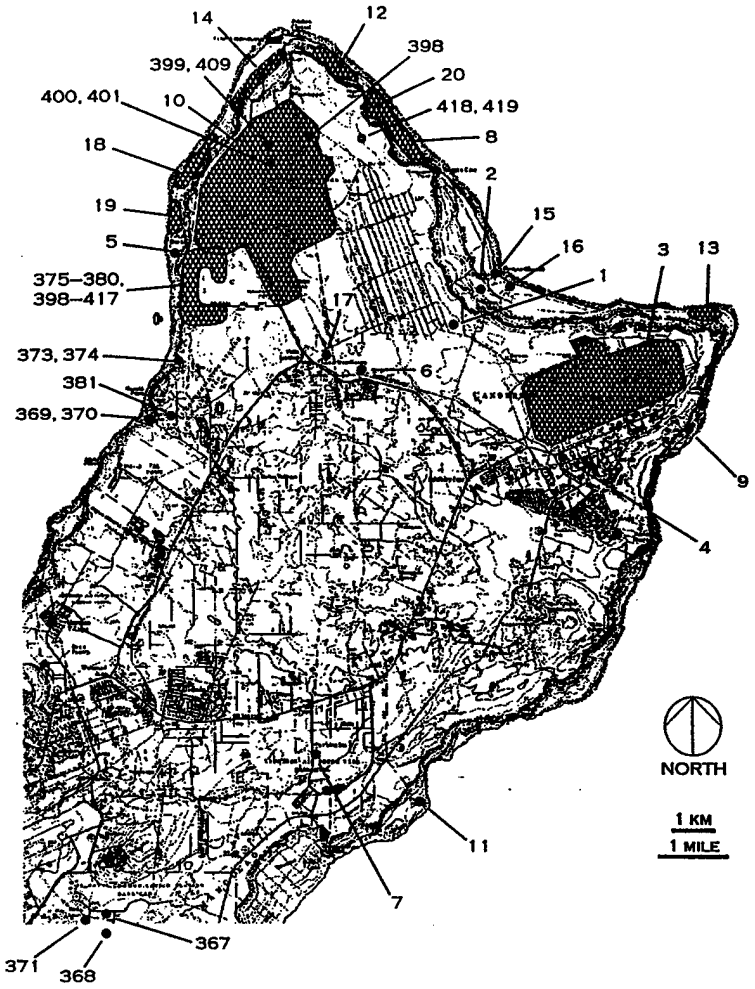


Figure 7. Archaeological Sites at Andersen AFB and NCTAMS.

The original Tarague site has been nominated to the NR and was placed on the GR in 1974. The recent intensive archaeological survey conducted by IAI at Tarague has vastly expanded the number of identified sites in the area. The former prehistoric site number 7-0015 (Site 16) was intended to include all the prehistoric features along the beach. These alone consist of at least four separate village clusters. Survey has now been conducted of the entire Tarague plain from the beach strand to the cliff line. The survey has resulted in the identification of 139 additional sites comprised of 311 features. These sites include 38 multi-feature complexes, generally composed of one or more rock mounds and rock alignments adjacent to or near a block rock shelter with an artifact scatter of Latte Period pottery sherds within or immediately outside the rock shelter. Other prehistoric sites include 24 rock alignments, 20 artifacts scatters, 16 rockshelters, seven bedrock mortars, six water-bearing caves, three caves, three trails, one sink and one remnant *latte* set. Ten historic sites were recorded, including three World War II refuge caves used by Japanese soldier stragglers. Many of the sites may have been used in both prehistoric and historic times (Liston 1996).

Each site identified during the Tarague survey has been assigned a GHPO site number. All the Tarague sites were evaluated as significant for their information content. Nine sites that also are associated with important World War II events are considered significant under Criterion A. Six sites are evaluated as unique or as excellent examples of a site type (significant under Criterion C): a coastal village site with a prehistoric well (GHPO Site 7-1614), a large inland block rockshelter complex (GHPO Site 8-1588), an inland agricultural complex (GHPO Site 7-1637), a well-preserved trail (GHPO Site 7-1638), the Tarague Cave with its pictographs (GHPO Site 8-1514), and a Japanese World War II straggler's cave (GHPO Site 8-1515) (Tomonari-Tuggle 1996: 123-128).

Two sites are listed on Andersen South (sometimes referred to as Marbo Annex). The Pagat Point *latte* site, the one prehistoric site, is actually on the east edge of the base. The only historic site is Building 01125 located in the middle of the base; its eligibility status has not been determined and will require more detailed architectural and historical study.

Archaeological Sites at NCTAMS WESTPAC

Four archaeological sites have been recorded at the Finegayan section and three sites in the Barrigada section. All the sites at Finegayan are located on the coastal plain or along the coastal cliff face. The Haputo Beach *latte* site, GHPO Site 8-0007 (Site 370) is an extensive village behind Haputo Beach with at least 20 *latte* sets identified. It has been placed on the NR and the GR. The other three sites, which consist of two rockshelters at Pugua Point, one of them Tweed's Cave, and a site at which human remains and World War II artifacts have been found, are significant sites, potentially eligible for the NR.

Portions of both Kurashina, McGrath, and Manner's (1987) and PHRI's (1988) Andersen AFB surveys extended into NCTAMS property. Approximately half of another survey conducted by PHRI (1989b) was also on NCTAMS property. A total of 7 prehistoric sites were identified (Sites 375 to 381), one with evidence of subsurface materials. In

addition to pottery, the remains included a *Tridacna* adze fragment. None of these sites are included in the CRMP documents examined.

Three potentially eligible sites, all dating to the historic World War II period, are located on the Barrigada section. The Barrigada Battlefield, GHPO Site 4-1059 (Site 367), would clearly be significant, but there are no known physical remains and the location of the most important feature in the battle, the Barrigada well, is unknown. The significance of the Officers Country Club entry gates and the golf course has not been determined.

POTENTIAL EFFECTS AND RECOMMENDED PROTECTION MEASURES

General Potential Adverse Effects

The military exercises proposed for Guam could adversely impact sites in a number of ways. The most serious threat would result from activities associated with any new construction; with area clearance (such as bulldozing for landing zones); with the use of vehicles off established roads (all-terrain vehicles, bulldozers, landing vehicles); with maneuvers that involve the digging of foxholes, latrines, and other subsurface excavations; and with the use of live fire and underwater explosives. Other damage to the historic resources could come from the presence of large numbers of individuals and involve removal of historic artifacts and vandalism.

Potential Adverse Effects at NAVACTS Ordnance Annex

Training at the Ordnance Annex will cover a broad area with potential impact on numerous sites. Most of the historic structures as well as the one site listed on the GR (the Fena massacre site) are located in the central area of the base and outside the primary training areas. Evaluation of potential effects in the northern part of the annex is difficult because much of the training is concentrated in areas that have not been surveyed but have a high potential for sites. Archaeological survey of these training areas to address potential adverse effects should be a priority concern.

Helicopter landings and bivouacs are planned in the northwest section of the annex. The helicopter landing site currently indicated does not lie within a site area and should pose no danger of adverse impact. However use of the slopes of the Alifan Ridge for bivouac activities could potentially impact the prehistoric and historic remains of the Alifan Ridge Complex. This area has only been cursorily surveyed, and a detailed inventory survey is highly recommended for this area before bivouac activities are permitted.

Small unit bivouac is also planned along the east half of the northern boundary of the annex. No survey has been conducted of this area, so the potential impacts are uncertain. Again it is recommended that archaeological survey be conducted of this area. It is likely that, with a few restrictions, training should not pose a major danger in this zone. In the meantime, no restrictions should be placed on land navigation, but the use of the area for bivouac should await results of the survey.

The recent completion of the PHRI survey of a large portion of the southern part of the annex allows a more informed evaluation of the potential adverse effects of training in this area.

The small unit patrol and land navigation activities in the southern third of the annex as now planned should not have a significant impact on archaeological sites. However, because the area contains a large number of sites evaluated as eligible for the National Register, the unit patrolling will need to be conducted in a way that will avoid impacts to the sites. A large number of *latte* sets are scattered through the northern part of the survey area and several are found near the southeast corner. Caves and overhangs are particularly numerous in the central west portion of the survey area along the east slope of Mount Almagosa. Special constraints will be placed on the way rockshelters and caves are used, with strict prohibitions against digging, artifact collection, or other disturbance in these areas.

Four site areas, two major *latte* set complexes and two caves should be placed off-limits. On the ridges above the Lost Marsh wetland is a *latte* village (Site 84) consisting of a cluster of 46 *latte* sets. It is recommended that the location of this large *latte* site, perhaps the largest and the best preserved in Guam, an island on which most of these features have been destroyed, be considered off-limits to all exercises. A second large latte group (Site 51), consisting of 12 sets, is also recommended as an off-limits area. Two caves (Sites 122 and 152), which contain undisturbed deposits, prehistoric artifacts, and pictographs, have been evaluated as significant for their information content, as excellent examples of a site type, and as culturally significant (Henry et al. 1996: 143), and should be placed off-limits.

A sniper and firing range is planned near the annex west boundary with targets placed to the south. The range will consist of two firing positions, a breaching house, and two target areas. The breaching house will serve both as a target and firing position. According to current plans, the range would only be used as a sniper range with targets placed approximately 400 to 1400 m from the firing area and the impact limited to the immediate vicinity of the targets.

The two firing positions and the breaching house contain no known sites and there should be no constraints on the use of these areas. There are also no known sites in the locations selected for the target areas and there should be no adverse effect from setting up targets at these positions. The range safety arc covers an area containing approximately 100 significant archaeological sites, including Site 84, the large off-limits *latte* set, although most of these sites would be protected from any possible damage by distance, by intervening high land, or by their positioning relative to the range. However the range, as currently designed, could potentially have adverse impacts on three significant archaeological sites within the immediate range area. All are *latte* sites, containing both standing and disturbed *latte* stones, with associated prehistoric artifacts and midden deposits. Testing has shown that subsurface cultural deposits are present and there is a high potential that burials could be present not far below the surface. Figure 8 shows the archaeological sites potentially impacted by activities at the sniper and firing range.

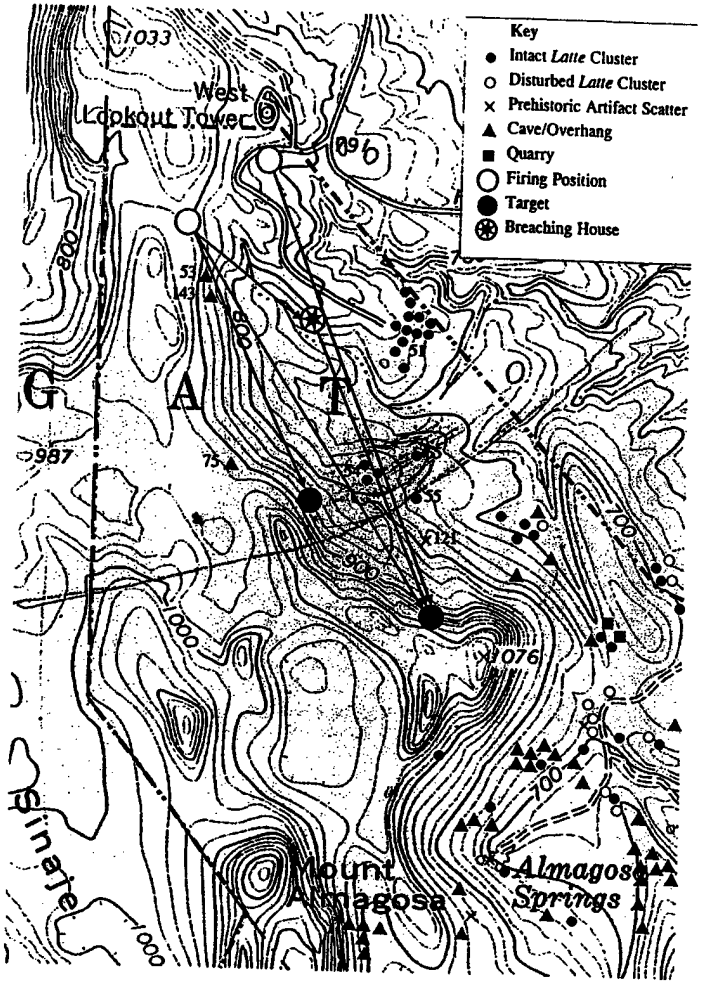


Figure 8. Archaeological Sites Potentially Impacted by the ORDANX Firing Range.

Shots fired from the firing positions toward the west target would appear to pose no danger to archaeological sites. Two overhang sites (Sites 53 and 143) near the southwestern firing position are oriented in such a way that they should not be impacted by the firing. However shots fired from the southwestern firing position toward the breaching house and from all three positions toward the east target could potentially impact Sites 51, 54, and 55.

Site 51, east of the range, is a large complex of 12 *latte* sets, comprising an area recommended as off-limits because of the importance of this major site and its sensitivity. All 12 sets have standing stones, often nearly complete sets. The site is located about 300 m behind the target area, and the southern portion of the site extends to a position almost directly in line with the firing line. There is a potential for shots passing over the target and slightly to the left to impact the southern portion of this site. Whether factors of topography, such as heavy vegetation and the position of the site in a valley would protect it during training exercises, is difficult to determine simply from maps.

Shots fired from the breaching house toward the east target area will pass directly over or through Site 54, a prehistoric site containing three *latte* sets with intact standing *latte* stones up to 1 m high. The site includes a basalt mortar near the Feature A *latte* set. Shots from the southwest firing position will pass not far west of Site 54, while shots from the firing position near the West Lookout Tower will also pass even closer to Site 54 and also close to Site 55, a single latte set. There is a potential for adverse impacts from shots fired short, low, or slightly off line to impact these sites. The potential for damage to Site 54 would seem to be particularly high.

It is recommended that adjustments be made in the location of the firing positions, breaching house, or target areas to lessen the potential impacts to these sites. Whatever the configuration of the range, the NAVACTS cultural resource specialist and an archaeologist familiar with the location of Sites 51, 54, and 55 should be present during the laying out of the range. Determination should be made in the field whether the range can be designed to avoid potential impacts to these sites and to move target areas and firing positions in ways that would lessen the impacts to the archaeological sites. If the range is configured in a way that would still pose a danger of adverse impacts to any of these sites, data recovery recording and excavations should be conducted in areas likely to be impacted, and protective measures should be taken to prevent damage to *latte* stones and basalt mortars.

Potential Adverse Effects at NAVACTS Waterfront Annex

No training activities are planned within the major concentration of significant historic resources located around the old village of Sumay. However there are three areas of major concern in regard to the proposed training at Apra Harbor.

The first area of concern is Orote Peninsula. In general this is an area with a number of historic structures and foundations, but a low potential for prehistoric sites. Thus training with limited constraints, primarily no digging within 3 feet of structures, should be permitted

and should not pose a threat to the historic properties on the peninsula. However there are three locations which will require special treatment.

First Orote Airfield has been placed on the National Register and the Guam Register as a significant World War II site. Because of this, the HPO has expressed concern over the use of the area around Orote Airfield for firing and sniper ranges, particularly firing across the runway. The runway has to some extent clearly lost its physical integrity through years of repaving, but the HPO remains concerned that adequate concern is given to the site's significance as an important part of our World War II heritage. Placement of a buffer zone of 5 meters along the runway with a restriction on any ground disturbing or potentially ground disturbing activities within the buffer zone might resolve this issue. This is an issue requiring resolution between the Navy and the HPO.

Near the far west end of Orote Peninsula, the Orote Historic Complex contains several historically important features, including a prehistoric cave site which is already suffering from vandalism and pot-hunting. Any training activities in the area of the complex should be constrained, limited to pedestrian access with no digging and strong prohibitions on any artifact collection, digging, or other disturbance in the cave. Bivouac activities are planned in the nearby area; these should not impact the site area.

Gab Gab Beach, along the north shore of Orote Peninsula, contains a prehistoric deposit behind the beach, Japanese defensive fortifications, and World War II American recreational facilities. Primarily because of the danger of impacting subsurface deposits of the prehistoric beach site, it is recommended that ground disturbance and the use of vehicles off-road in this area be forbidden. Exercises on Orote Peninsula outside these last two areas and the Airfield should have no major impact on archaeological sites.

The second area of concern is the potential effect of activities in the harbor on underwater resources. There are four submerged ships which have been evaluated as eligible to the National Register. These are all located near the east end of the breakwater, and no underwater demolition should take place in the vicinity of these vessels. The setting of underwater explosives along the Cabras Island breakwater and possibly mine countermeasures could potentially impact some of these ships. The areas now designated for underwater explosives and mine countermeasures should have no adverse effect with one exception. The underwater demolition training area nearest the breakwater would take place directly over several sunken barges and a Val dive bomber (Site 340). No determination has been made concerning the eligibility of these sites for the National Register. In the absence of a determination, the area with these vessels should also be considered as one in which the use of explosives is restricted. On the other hand, no resources are reported in the Inner Harbor area or offshore from Dadi and Tipalao Beaches and underwater detonation in these areas would not seem likely to impact any historic resources.

The third area of concern is Dadi Beach, where LCAC landings are proposed. While landings on the beach should pose no danger to historic properties, vehicular traffic should be

prohibited behind the beach where significant cultural deposits occur both within and in front of the caves and rockshelters behind the coastline.

The IED sites appear to lie in areas with no cultural resources, except for one location at the west end of Inner Apra Harbor, which is near Quonset hut 1686 (Site 304). Care should be taken that no damage occurs to the structure. The Seabee deployment area should result in no impact, but again care should be taken to avoid damage to any historic structures in this area, which appears to include Camp Roxas. Foundations of some historical structures remain in this area.

Potential Adverse Effects at Andersen AFB

The main areas of concern in regard to the proposed training activities are the potential impact on prehistoric resources in the coastal areas that will be involved and on the historic resources at Northwest Field. Activities in the built-up area at the east end of the base should not have any potential adverse effect on cultural resources.

At Tarague, activities at the small arms range and the EOD range are ongoing and should continue to be conducted in accordance with agreements with the GHPO. The EOD range does include several sites, including burials, along the beach berm and the remains of a village site on the first terrace behind the beach. Therefore any changes in activity areas should involved further consultation with the HPO. Vehicle access should be restricted to the established road; vehicles leaving the road to turn around have damaged part of one site. Training activities at Tarague are restricted to swimmer insertions and should therefore have no adverse effect on the sensitive cultural resources of the Tarague embayment.

Communications exercises and True training are planned for Ritidian Beach area. These lie outside the Ritidian site area as currently defined and involve an abandoned building which is not eligible to the NR. No adverse impact is anticipated.

The Air Force considers Northwest Field a significant site because of its role in World War II and therefore consultation should be conducted with the HPO concerning exercises in this area. The planned exercises in this area would seem to have a very limited potential for damaging prehistoric or historic sites. Ongoing rapid runway repair exercises could damage a portion of the runway, which is a major component of Northwest Field as a significant archaeological site. Consultation should be held with the HPO concerning these exercises. The proposed bivouac area was a developed part of the Northwest Field complex during the last year of World War II and the post-war years, but only structural foundations and roads remain in the area today. These foundations have not yet been adequately recorded. However, as long as these foundations are avoided during bivouacking and there is no digging within 3 feet of the structures, then there should be no adverse effect from the training.

At Andersen South only one historic site. Building 1125 has been listed as having any potential significance. It is not in an area of proposed training. However no archaeological survey has been conducted of the undeveloped portion of the base. Bivouac, field maneuvers, land navigation, and defensive tactics are planned for this area. Bivouacking in particular could potentially impact any sites that might be present. Archaeological survey of the proposed training area is recommended to determine if significant sites are present.

Potential Adverse Effects at NCTAMS WESTPAC

The Finegayan portion of NCTAMS will see only minimal training activities. The major activity, currently being conducted, is swimmer insertion and maneuvers conducted by Navy Seals. Landings take place at Haputo Beach and then the members of the landing party make their way along the coast to Andersen AFB.

The plain behind the Haputo landing beach is the location of the Haputo *latte* complex, an extensive *latte* village site, that is listed on the NR. Farther north the troops will pass by the Pugua Point rockshelter and Tweed's Cave, both NR eligible sites. Constraints should be placed on any activities in these areas which might impact these sites.

In the Barrigada portion, maneuvers and bivouacs are planned. However, in the absence of any specified locations for the training and in the absence of previous archaeological survey of the station, it is difficult to determine potential impacts of these exercises.

It is recommended that archaeological survey be conducted of the undeveloped portions of the station in which training may occur to identify if historic properties are present.

GENERAL SITE PROTECTION PLANNING

Recommended Protection Measures

The following measures are recommended for the mitigation of potential adverse impacts on the historic resources of Guam as a result of military exercises.

I. Identification and Marking of Site Protection Areas.

It is recommended that the proposed training areas be divided into Site Protection Areas, based on site sensitivity. Proposed boundaries for the Site Protection Areas are presented in Figures 9-11. It should be noted that only those areas that are shaded in on the maps have been evaluated. Land areas in white are those in which no training activities are proposed in the Belt Collins 1996 scoping document or the 1996 Draft EIS. These areas have not been evaluated for their archaeological resources and constraints on training activities and would require evaluation if training exercises in the future are planned for these areas. Water areas, on the other hand, should be considered unconstrained, unless specifically marked as constrained in some way. Following a final and accepted definition of the site protection areas, they should be clearly marked on the ground and identified on appropriate operational military maps.

The categories of the protection areas are:

Category 1. Off-limits areas.

Restrictions: No military use of these areas would take place except for troop and vehicular movement on established roads. These roads would be marked on maps and identified on the ground with appropriate right-of-way signs.

Areas: Four site areas in the Ordnance Annex are considered Category 1, off-limits areas. These include two large *latte* complexes and two caves. The two caves each contain prehistoric artifacts, pictographs, and their integrity remains unaltered. Because of the high integrity and value of these caves, they should be placed off-limits. Site 51 is an unusually large cluster of *latte* sets, with several well-preserved sets, and it is recommended that the site be placed off-limits. Site 84 is the largest preserved *latte* set in the Mariana Islands. It is particularly unusual in that most inland *latte* sets on Guam outside the Ordnance Annex have been destroyed by 20th century military, agricultural, and development activities. The site has high research, cultural, and interpretive value. It is associated with some of the earliest evidence of rice cultivation in the Mariana Islands. To insure its protection, the site should be placed off-limits.

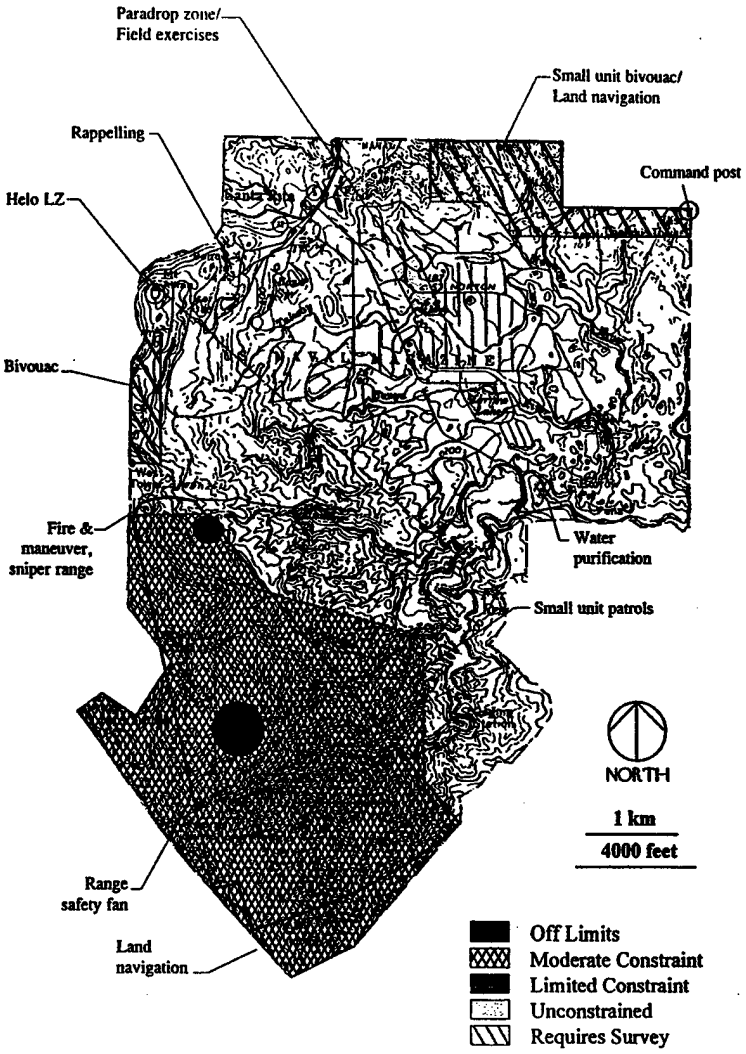


Figure 9. Site Protection Areas for NAVACTS Ordnance Annex Training.

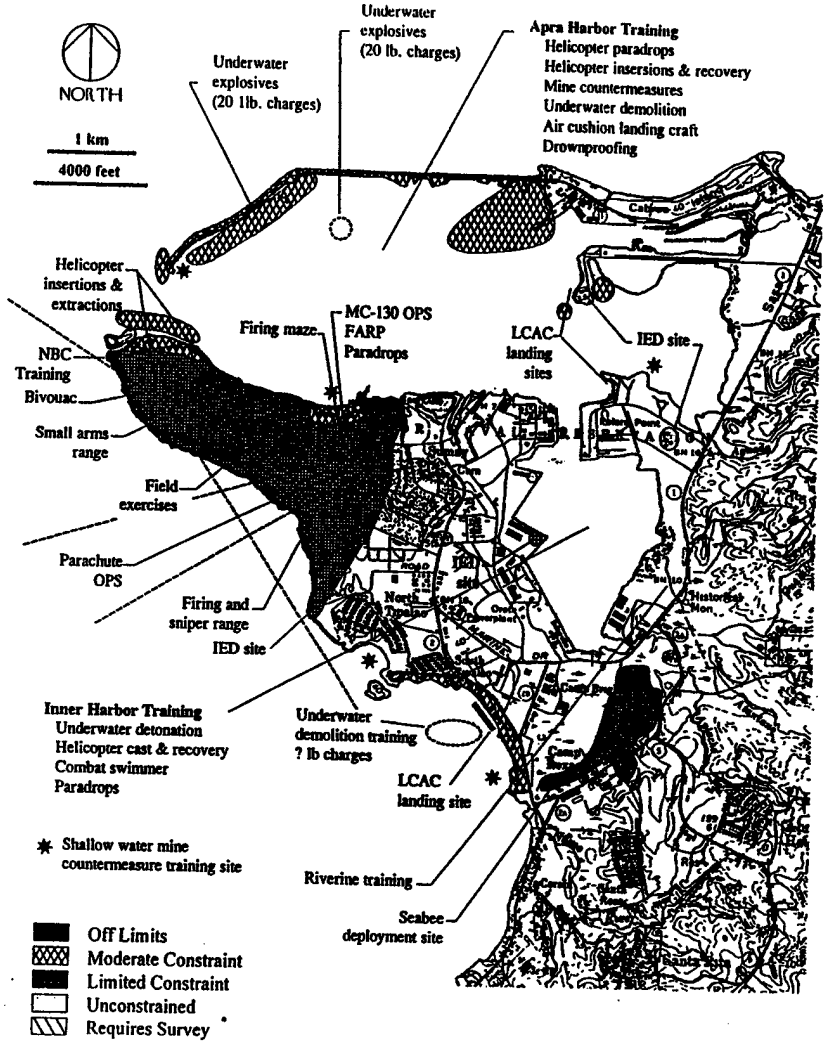


Figure 10. Site Protection Areas for NAVACTS Waterfront Annex Training.

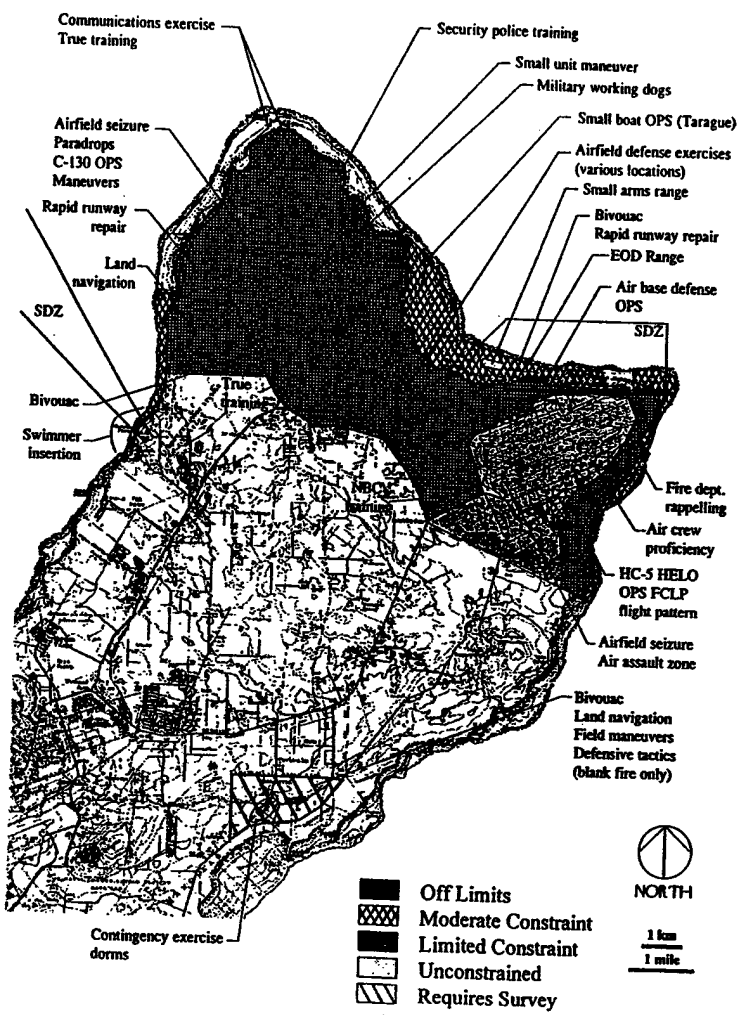


Figure 11. Site Protection Areas for Andersen AFB and NCTAMS Training.

Category 2. Moderate Constraint.

Restrictions: These areas would be limited to pedestrian activity off-road, with vehicles restricted to established roads. No digging would be allowed. Where appropriate, these areas would have permanent on-the-ground markers for identification. Highly sensitive sites in this areas might also be marked as off-limits.

The major training activities which would be constrained would be exercises involving off-road vehicles and bivouacking (where these would involve any subsurface activities such as digging latrines), explosives detonation, and weapons firing. Constrained areas would not be closed to exercises with no likely impact such as pedestrian unit patrolling, land navigation, swimmer insertions.

Areas: The Ordnance Annex southern training area, including the sniper and firing range, except for the off-limits areas; Dadi Beach, Gab Gab Beach, and the Orote Historic Complex at the Waterfront Annex; Apra Harbor areas with submerged ships; coastal areas at Andersen AFB and NCTAMS Finegayan. The areas recommended for inclusion in this category are shown in Figures 9-11.

All of the proposed training area in the south section of the Ordnance Annex is listed as a constrained area, except for those site areas placed off-limits. The area contains numerous potentially significant prehistoric sites which are highly sensitive to impacts from training except for those types of training which only involve pedestrian movement through the area.

At the Waterfront Annex, Dadi Beach is a Category 2 constrained area. Swimmer insertion would be permitted, but not amphibious vehicle landings followed by off-road maneuvers. LCAC landings should be restricted to the current beach area only. Caves and rockshelters behind the beach are significant sites and should be avoided during training activities. Orote Historic Complex and Gab Gab Beach contain sites that could be adversely impacted by ground disturbing activities and are therefore listed as Category 2 areas.

Outer Apra Harbor contains numerous significant and potentially significant shipwrecks. The areas where these are concentrated have been marked as Category 2 constrained areas. The main concern is the potential impact that detonation of explosives might have on these remains. All underwater demolition should take place outside these constrained areas.

The Tarague embayment, except for the already existing small arms range and EOD disposal area, is considered a Category 2 moderate constraint area because of the large number of significant sites the area contains. Consistent with current plans, training should be limited to activities, such as swimmer insertions, that would not have an adverse impact on these resources.

In addition areas which have not been surveyed and for which archaeological survey is recommended should be treated as constrained areas (see Recommendation III below).

Category 3. Limited constraint.

Restrictions: Restrictions in these area would include general prohibition against collection of historic artifacts; prohibition against vandalism; and restrictions on digging within three feet of any structure with concrete walls (concrete pads are not included in this category) or digging within any caves.

Areas: Seabee Deployment area and one IED site at the Waterfront Annex, Orote Peninsula except for Gab Gab Beach and the Orote Historic Complex, and Northwest Field and surrounding areas at Andersen AFB.

At Andersen AFB, Northwest Field and the surrounding area which may be used for training falls into this category. Digging should not take place within three feet of any structures or of the paved runways and taxiways. At the Waterfront Annex, the same restrictions would apply to the use of Orote Airfield and to training elsewhere on Orote Peninsula outside the areas of the Orote Historical Complex and Gab Gab Beach. In the case of some activities the training areas are not well defined and previous archaeological survey of the areas limited, so that the potential for adverse impacts cannot be fully evaluated. Based on the sample areas surveyed, In areas that have been surveyed, only foundations of historic structures and pottery scatters have been found, so the potential impact should be limited. Avoidance of structures should insure adequate protection of cultural resources.

Category 4. Unconstrained.

Restrictions: In these areas, no restrictions (concerning historic resources) would be placed on military actions as currently planned.

In addition, if actions of Recommendation II and III are followed, additional areas might be placed in this category with appropriate data recovery.

Areas: Apra Harbor except for Category 2 areas shown on the maps; small training areas slated for helicopter insertions and extractions, riverine training, IED training, and Apra Harbor LCAC landings at the Waterfront Annex; small training areas slated for helicopter landing, rappelling, field exercises, and a paradrop zone in the north portion of the Ordnance Annex; the developed portion of Andersen AFB around North Field, the developed portion of Andersen South, and the Andersen AFB small arms range.

II. Identification Of Specific Military Project Areas.

The historic preservation actions and site protection planning place their emphasis on avoiding damage to historic sites. To accomplish this, it is recommended that, where

possible, specifics of military exercises, specialized training areas, and any required facilities be identified regarding types of terrain, necessary total area, and recommended location. This information should be evaluated in terms of the distribution of historic resources to attempt to define the most appropriate areas for these actions with the least possible damage to any historic resources. Additionally, if specific military actions/projects as indicated above might be most effectively placed in areas of historic resources of lesser value, then appropriate data recovery might be considered to allow the action/project to take place. It is recommended that consultation take place with the NAVACTS cultural resource manager preceding any new training activities at NAVACTS Ordnance Annex or Waterfront Annex and with the Andersen AFB cultural and natural resource manager preceding new activities at that base.

III. Further Archaeological Survey.

Archaeological inventory survey is recommended for several areas which have not been previously surveyed or only cursorily surveyed. Four areas in which bivouac activities are proposed should have the highest priority in terms of future surveys. These are the northwest area of the Ordnance Annex, the northeast section of the Ordnance Annex, the undeveloped southern portion of Andersen South, and the undeveloped portions of NCTAMS Barrigada. Until such survey is conducted and the sensitivity of sites in these areas to impacts from training evaluated, these unsurveyed areas should be considered Category 2 areas, with moderate constraints on training activities.

Small portions of other areas in which general training exercises are proposed, namely Orote Peninsula and Northwest Field, have been surveyed, providing a sample of the types of sites to be found in these area. Further, more complete survey would allow a better definition of the potential impacts to sites and might permit placement of portions of the training areas into Category 4, unconstrained.

IV. Information and Instructions.

Information on the historic importance of Guam and on the site protection areas, with identified restrictions, will be placed in all relevant instruction manuals and on operational maps, where possible. Written and oral instructions which will alert the troops participating in exercises to the need to be careful to protect the cultural resources of the island. These instructions would involve the caution not to move, pick up, or in any way disturb artifacts or other historic properties on the island. Those participating in the exercises should be briefed on the significance of archaeological and historical resources on the island. Protective measures should be written into the instructions for the specific exercises. Prohibited and constrained areas should be clearly marked on all maps to be used during specific exercises. The military should provide sufficient oversight of the exercises to insure compliance with these mitigation measures.

V. Program of assessment.

The US Navy and the Historic Preservation Office of Guam should develop a monitoring plan for the evaluation of site protection actions after they have been implemented. This would involve, at a minimum, determining the extent to which the measures have been effectively implemented (for example, whether protection areas are marked effectively) and the extent to which the required actions and regulations are followed (for example, whether vehicles have respected the boundaries of prohibited areas).

VI. Interpretation.

A program of site interpretation has been instituted by the US Navy at NAVACTS Waterfront Annex and by the Air Force at Andersen AFB. These programs are being implemented by the cultural and natural resource managers for these bases and should be expanded. The existing program at the Waterfront Annex involves an interpretive brochure that is available to the public, a driving trail, walking trails, and a number of on-site interpretive signs. The Air Force has placed an interpretive trial with on-site signs at Tarague Beach. The current Legacy of Tarague Embayment project will provide the basis for establishing a number of additional interpretive trails and preparing a brochure for the Tarague area (Tomonari-Tuggle 1996). These programs should be brought to the attention of all military users as a part of the briefing in appreciation of the history of the island and protection of its resources.

Management of Site Protection Areas

As noted above in the description of the Site Protection Areas, in general it is recommended that long-term protection be afforded areas by a variety of measures, possibly including permanent fencing for those areas that are eventually agreed to be designated as off-limits, and appropriate signage for selected portions of the Category 2 and Category 4 areas. Signage, rather than fencing, may be sufficient for the larger off-limits *latte* sites in the Ordnance Annex, where base security already severely restricts access. Base cultural resource managers should be consulted before any new, specific training activities are undertaken.

It is recommended that a Site Protection Plan, similar to the one prepared for military training areas in northern Tinian (Tuggle and Welch 1996), be prepared for Guam military training areas. The plan should include the assignment of GHPO site numbers to all significant sites on Guam military bases that have not previously been assigned these numbers. The plan should review the protection procedures suggested in this document, propose appropriate mitigation for sites that might be impacted and cannot be avoided, and define in more detail the site protection measures that should be taken.

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APPENDIX A:

LISTING OF PREVIOUSLY IDENTIFIED SITES

Listing of previously identified sites.

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
1.	AAFB	Abandoned Reservoir - Bldg. 09120		concrete structure	1949	Schilz 1996	1	yes	assoc. with development of permanent base			
2.	AAFB	Abandoned Water Treatment Plant - Bldg. 09601		concrete structure	1949	Schilz 1996	2	yes	assoc. with development of permanent base			
3.	AAFB	Andersen Airfield	66-07-1064	airfield	1945-1949	Schilz 1996	3	undeter.	critical role during Vietnam conflict			
4	AAFB	Arc Light Memorial	66-07-1022	surface structures commemorating events of Vietnam conflict	1974	Schilz 1996	4	undeter.				
5.	AAFB	Falcona Beach Complex	66-08-0009	*latte* remains, rockshelters, surface materials	prehistoric	Schilz 1996	10	yes	only one of its type			
6.	AAFB	Guerrero Water Catchment		above ground concrete water catchment	1920s	Schilz 1996	12	yes				
7.	AAFB	Housing Support Storage and Warehouse (former laundry) - Bldg. 01125		intact surface structure	1949	Schilz 1996	14	undeter.				
8.	AAFB	Jinapsan Complex	66-08-0014	extensive *latte* site with surface materials, rockshelters	prehistoric	Schilz 1996	15	yes		Dec 74	Dec 74	Cited as "Jinapsan Site, 66-08-1192" on Guam HPO Registered Historic Places list
9.	AAFB	Lafac	66-07-0017	surface pottery scatter; 0.5 acres, relatively level shelf below cliffs	prehistoric	Schilz 1996	16	undeter.				
10.	AAFB	Northwest Field	66-08-1065	airfield only	1945	Schilz 1996	21	yes	valued for construction history and role in WWII; considered eligible under criteria C and A by Guam HPO			
11.	AAFB	Pagat Point	66-08-0021	"extremely disturbed", *latte* remains, surface materials	prehistoric	Schilz 1996	23	yes				Not on AAFB property, but listed in CRMP document.
12.	AAFB	Pajon Point Complex	66-08-0013	*latte* site with surface materials	prehistoric	Schilz 1996	24	yes			July 74	
13.	AAFB	Pati Point Complex	66-07-0016	displaced *latte*, buried deposits, rockshelters, burials	prehistoric	Schilz 1996	25	yes			July 74	no systematic survey or mapping
14.	AAFB	Ritidian Complex	66-08-0012	surface materials, buried deposits, burials, *latte* features, rockshelters; 15 acres	prehistoric	Schilz 1996	30	yes			Aug 74	no systematic survey or mapping
15.	AAFB	Stone Pier		rock pier remnant	1920s	Schilz 1996	32	yes	"only extant copra plantation constructions"			
16.	AAFB	Tarague Beach	66-07-0015	stratified deposits and surface materials, rockshelters, burials	prehistoric	Schilz 1996	34	yes			Aug 85	
17.	AAFB	Torres Farmhouse		walls and foundation	1920s	Schilz 1996	36	yes	"rare example" of pre-WWII housing			
18.	AAFB	Urunao Beach Complex	66-08-0011	*latte* structures and surface materials	prehistoric	Schilz 1996	39	yes		Dec 74	June 74	
19.	AAFB	Urunao Complex	66-08-0010	4 *latte* structures and surface materials, rockshelters	prehistoric	Schilz 1996	40	yes		Dec 74	July 74	
20.	AAFB	World War II Bunker		damaged concrete bunker; Japanese	1944	Schilz 1996	47	yes	thematic or historic district eligibility			
382.	AAFB	Central Exchange Warehouse, Bldg. 00910		metal surface feature, modern modifications	1949	Schilz 1996	6	no				
383.	AAFB	Communications Facility, Bldg. 25008		surface feature with modern modifications	1949	Schilz 1996	7	no				
384.	AAFB	Dormitories - Officers and Airmen, Bldgs. 27000, 270001 [sic]		surface features, modern modifications, currently in use	1948	Schilz 1996	9	no	first permanent bachelor officers quarters			
385.	AAFB	Dormitories, Bldgs. 00001-00006		surface features, modern modifications, currently in use	1948	Schilz 1996	8	no				
386.	AAFB	Fleming Heights Houses, Bldgs. 28000-28113, 28116-28124, 28129-28139		surface features, modern modifications, currently in use	1948	Schilz 1996	11	no				

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387.	AAFB	Last Tank Action/Salisbury – Tarague Trail	66-08-1044	no surface remains extant	1944	Schilz 1996	17	no				
388.	AAFB	PME Lab, Bldg. 00286		surface feature with modern modifications	1949	Schilz 1996	27	no				
389.	AAFB	Post Office (former mess hall), Bldg. 21001		metal and concrete surface structure, modern modifications, currently in use	1948	Schilz 1996	28	no	first permanent mess hall for enlisted men			
390.	AAFB	Sanitary Sewage Pump Station, Bldg. 01120		surface and subsurface feature, modern modifications	1949	Schilz 1996	31	no				
391.	AAFB	Support Structure, Bldg. 00911		surface feature, minor modifications, but lacks significance	1949	Schilz 1996	33	no				
392.	AAFB	Water Supply Buildings and Water wells, Bldgs. 01498, 01499, 01600, 01601, 01622, and 01623		surface and subsurface features, modern modifications	1948	Schilz 1996	44	no				
393.	AAFB	Water Well, Bldg. 00608		metal surface materials	1947	Schilz 1996	43	no				
394.	AAFB	Water Well, Bldg. 02771		surface and subsurface feature, modern modifications	1945	Schilz 1996	42	no				
395.	AAFB	Wilson Homes, Bldgs. 00200, 00202, 00204, 00206, 00208, 00210, 00212, 00214, 00216, 00218, 00220, 00222-00239, 00241-00244, 00246, 00248, 00250, 00252, 00254, 00256, 00258, 00260, 00262, 00264, 00266, 00268, 00270, 00272-00280, 00290, 00292, 00294, 00296, and 00298		surface features, modern modifications, currently in use	1948	Schilz 1996	45	no	first permanent housing for Air Force personnel			
396.	AAFB	Wing Headquarters (former dormitory), Bldg. 21000		metal and concrete surface structure, modern modifications, currently in use	1948	Schilz 1996	46	no	first permanent dormitory for enlisted men			
397.	AAFB	WWII Remnant Equipment		airplanes and half-tracks, out of original context	1944-1945	Schilz 1996	48	no				
398.	AAFB			surface sherd scatter, 2 x 2.3 m, in remnant limestone forest; no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T1					Not included in CRMP document
399.	AAFB			surface sherd scatter, 22 x 6 m, in remnant limestone forest; no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T2					Not included in CRMP document
400.	AAFB			surface sherd scatter, 5 x 3 m; no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T3					Not included in CRMP document
401.	AAFB			isolated surface sherd; no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T4					Not included in CRMP document
402.	AAFB			surface sherd scatter, maximum dimension of 33 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T5					Not included in CRMP document
403.	AAFB			surface sherd scatter, 40 x 30 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T7					Not included in CRMP document
404.	AAFB			surface sherd scatter, 4 x 6 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T9					Not included in CRMP document
405.	AAFB			surface sherd scatter, 2 x 8 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T10					Not included in CRMP document
406.	AAFB			single surface sherd, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T11					Not included in CRMP document
407.	AAFB			surface sherd scatter, 7 x 7 m	prehistoric	Kurashina, McGrath, and Manner 1987	T12					Not included in CRMP document

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
408.	AAFB			surface sherd scatter, 10 x 10 m	prehistoric	Kurashina, McGrath, and Manner 1987	T13					Not included in CRMP document
409.	AAFB			surface sherd scatter, 3 x 3 m; no subsurface remains reported	prehistoric	Kurashina, McGrath, and Manner 1987	T15					Not included in CRMP document
410.	AAFB			surface sherd scatter, 17.5 x 8 m	prehistoric	Kurashina, McGrath, and Manner 1987	T16					Not included in CRMP document
411.	AAFB			surface sherd scatter, maximum dimension of 30 m	prehistoric	Kurashina, McGrath, and Manner 1987	T17					Not included in CRMP document
412.	AAFB			pottery scatter, ca 225 m^2, subsurface sherds recovered	prehistoric	Haun 1988	T-3					Not included in CRMP document
413.	AAFB			pottery scatter, ca 150 m^2, no subsurface remains reported	prehistoric	Haun 1988	T-4					Not included in CRMP document
414.	AAFB			pottery scatter, ca 150 m^2, no subsurface remains reported	prehistoric	Haun 1988	T-5					Not included in CRMP document
415.	AAFB			ca. 920 m surface and subsurface pottery scatter and *Tridacna* adze fragment	prehistoric	Haun 1988	T-7					Not included in CRMP document
416.	AAFB			isolated surface sherd find	prehistoric	Haun 1988	T-8					Not included in CRMP document
417.	AAFB			pottery scatter, ca 25m^2, no subsurface remains reported	prehistoric	Haun 1988	T-9					Not included in CRMP document
418.	AAFB			pottery scatter, ca 10-15.0 m in diameter	prehistoric	Haun 1988	—					Not included in CRMP document
419.	AAFB			pottery scatter, ca 10-15.0 m in diameter	prehistoric	Haun 1988	—					Not included in CRMP document
21.	ORDANX	Abandoned magazines; scattered locations		earth and metal surface structures, some damaged	1944, 1945	Craib and Yoklavich 1992b Lauter-Reinman 1994	1	II nce	assoc. with the broad patterns of Navy WWII base construction; distinctive construction type; examples of type			
22.	ORDANX	Airplane Crash Site		unable to relocate; surface remnants; possible WWII site		Craib and Yoklavich 1992b Lauter-Reinman 1994	5	II no				
23.	ORDANX	Alifan Ridge Complex		cave complex with WWII surface materials; "needs survey"	prehistoric/ historic	Craib and Yoklavich 1992b Lauter-Reinman 1994	6	II unev				
24.	ORDANX	Almagosa Springs Complex	66-02-0150	no information; unable to relocate		Craib and Yoklavich 1992b						
25.	ORDANX	Baseball Field - Bldg. 707		extant surface structure	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	8	II yes	assoc. with the broad patterns of Navy WWII base construction; eligible as part of thematic grouping			no systematic survey or mapping
26.	ORDANX	Bona Spring		latte remains	prehistoric	Craib and Nees 1995		D				
27.	ORDANX	Bona Spring Complex	66-02-0152	no visible surface remains; *latte* structure(s)	prehistoric	Craib and Yoklavich 1992b		II				} may be the same site
28.	ORDANX	Bonya Complex		multiple latte features; 19 acres	prehistoric	Craib and Nees 1995	WB1-7 EB1-6 SI1-3	D				may be equivalent to sites 29 and 30: East Bonya Complex and West Bonya Complex
29.	ORDANX	East Bonya Complex	66-02-0145	surface features reported "destroyed in 1977"; single *latte* structure	prehistoric	Craib and Yoklavich 1992b		II			Oct 77	Cited as "66-02-0145B" in report; cited as "Bona Site" on Guam HPO Registered Historic Places list
30.	ORDANX	West Bonya Complex	66-02-0145	surface features reported "destroyed in 1977"; single *latte* structure	prehistoric	Craib and Yoklavich 1992b	3	I		Mar 79	Mar 79	Incorrectly cited as "66-02-1145A" in report; cited as "West Bona Site" on Guam HPO Registered Historic Places list
31.	ORDANX	Displayed Objects; scattered locations		mines, torpedo, anchor, and mobile artillery launcher	unknown	Craib and Yoklavich 1992b Lauter-Reinman 1994	29	II no	possibly associated with the broad patterns of Navy WWII equipment design; removed from original locations			
32.	ORDANX	Dobo Complex	66-02-0151	no information; unable to relocate		Craib and Yoklavich 1992b						
33.	ORDANX	Dobo Spring Complex		multiple latte features; 30 acres	prehistoric	Craib and Nees 1995	DS1-10	D				} may be the same site

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
34.	ORDANX	Explosive Truck Holding Yard (total of 11) - Bldgs. 629-639		earthen revetments, open excavated storage areas; currently in use	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	31	II nce	assoc. with the broad patterns of Navy WWII base construction; distinctive construction type not unique			
35.	ORDANX	Fena Massacre Site-God's Cave	66-02-1313	two rockshelters	1944	Lauter-Reinman 1994	33	yes	Criterion A and as "a traditional cultural property"			
36.	ORDANX	Flagpole - Bldg. 706		metal surface feature; destroyed by typhoon	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	37	II no	assoc. with the broad patterns of Navy WWII base construction; eligible as part of thematic grouping			
37.	ORDANX	Inert Storehouse Sheds 3 and 11 - Bldgs. 309, 310		metal surface structures	1949	Craib and Yoklavich 1992b		II	assoc. with the broad patterns of Navy permanent base construction; earliest extant semi-permanent buildings at installation			
38.	ORDANX	Laquet Complex	66-02-0149	no visible surface remains; "two presumably destroyed house site components" - probably *latte* structures; 15 acres	prehistoric	Craib and Yoklavich 1992b Craib and Nees 1995	LQA-B	II D				
39.	ORDANX	Maanot Reservoir		concrete surface materials	?	Lauter-Reinman 1994	68	unev				
40.	ORDANX	Maemong		3 rockshelters, 1 latte site and 1 pottery scatter	prehistoric	Craib and Nees 1995		D				
41.	ORDANX	Maemong River Complex		rockshelters with prehistoric and historic surface materials; "needs survey"	?	Craib and Yoklavich 1992b Lauter-Reinman 1994	69	II unev				} may be the same site
42.	ORDANX	Old Bridge at NAVMAG		metal and concrete surface structure; poor condition	?	Lauter-Reinman 1994	74	unev				
43.	ORDANX	Open Storage Area, Revetments (total of 11) - Bldgs. 600, 602, 604, 605, 606, 616, 614-623, 625, 627, 628		earthen revetments, open excavated storage areas; mostly disused	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	75	II no	assoc. with the broad patterns of Navy WWII base construction; distinctive construction type			
44.	ORDANX	Vehicular Bridge - Bldg. 702		wood and concrete surface structure	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	13 133	II yes	assoc. with the broad patterns of Navy WWII base construction; very good condition, excellent example of type			
45.	ORDANX	Vehicular Bridge - Bldg. 705		wood and concrete structure; rebuilt	1944	Craib and Yoklavich 1992b Lauter-Reinman 1994	13 134	II no	assoc. with the broad patterns of Navy WWII base construction			
46.	ORDANX	Concrete Bridge - Bldg. 777		concrete surface structure	1945	Lauter-Reinman 1994	21	yes	only one of its type			
47.	ORDANX	*Latte* set		110.4 sq m; 6 column *latte*	prehistoric/ historic	Henry et al. 1996	3	D,TC	contains or may contain human remains			
48.	ORDANX	*Latte* set		71.5 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	5	D,TC	contains or may contain human remains			
49.	ORDANX	Complex (2 *Latte* sets, 2 *Latte* clusters, 2 Overhangs)		1153.3 sq m; 8 and 10 column *latte*, 2 *latte* remnants	prehistoric	Henry et al. 1996	6	D,TC	contains or may contain human remains			
50.	ORDANX	Historic artifact scatter		4.5 sq m	post-WWII	Henry et al. 1996	7	D				
51.	ORDANX	Complex (12 *Latte* sets)		4669.6 sq m; 6, 8, and 10 column *latte*	prehistoric	Henry et al. 1996	8	D,TC	contains or may contain human remains			
52.	ORDANX	Historic artifact scatter		168.0 sq m; also basalt mortar	prehistoric/ historic	Henry et al. 1996	9	D				
53.	ORDANX	Complex (2 Overhangs)		144.3 sq m; modified shelters	prehistoric/ historic	Henry et al. 1996	10	D				
54.	ORDANX	Complex (3 *Latte* sets)		293.2 sq m; 6, 8, and 10 column *latte*	prehistoric	Henry et al. 1996	11	D,TC	contains or may contain human remains			
55.	ORDANX	*Latte* set		44.1 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	12	D,TC	contains or may contain human remains			
56.	ORDANX	Overhang		6.5 sq m; ceramics	prehistoric	Henry et al. 1996	13	D				
57.	ORDANX	*Latte* set		33.3 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	14	D,TC	contains or may contain human remains			
58.	ORDANX	Overhang		21.3 sq m; ceramics	prehistoric	Henry et al. 1996	15	D				
59.	ORDANX	Cave		21.0 sq m; ceramics	prehistoric	Henry et al. 1996	16	D				
60.	ORDANX	Cave		679.4 sq m; artifacts	prehistoric	Henry et al. 1996	17	D				

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61.	ORDANX	*Latte* set		43.8 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	18	D,TC	contains or may contain human remains			
62.	ORDANX	Overhang		7.4 sq m; ceramics	prehistoric	Henry et al. 1996	19	D				
63.	ORDANX	Overhang		78.7 sq m; ceramics	prehistoric	Henry et al. 1996	20	D				
64.	ORDANX	*Latte* set		41.8 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	21	D,TC	contains or may contain human remains			
65.	ORDANX	*Latte* set		31.1 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	22	D,TC	contains or may contain human remains			
66.	ORDANX	Prehistoric artifact scatter		120.0 sq m	prehistoric	Henry et al. 1996	23	D				
67.	ORDANX	Historic artifact scatter		21.0 sq m	WWII	Henry et al. 1996	24	D				
68.	ORDANX	Overhang		7.1 sq m; ceramics	prehistoric/ historic	Henry et al. 1996	25	D				
69.	ORDANX	Overhang		286.0 sq m; artifacts	prehistoric	Henry et al. 1996	26	D				
70.	ORDANX	Complex (Cave, Overhang)		373.4 sq m; artifacts	prehistoric/ WWII	Henry et al. 1996	27	D				
71.	ORDANX	*Latte* set		46.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	28	D,TC	contains or may contain human remains			
72.	ORDANX	Historic artifact scatter		50.0 sq m	WWII	Henry et al. 1996	29	D				
73.	ORDANX	*Latte* set		42.1 sq m; 8 column *latte* with historic artifacts	prehistoric/ historic	Henry et al. 1996	31	D,TC	contains or may contain human remains			
74.	ORDANX	Historic artifact scatter		9.0 sq m	WWII	Henry et al. 1996	32	D				
75.	ORDANX	Overhang		39.0 sq m; ceramics	prehistoric	Henry et al. 1996	33	D				
76.	ORDANX	Complex (*Latte* set, *Latte* cluster)		75.6 sq m; 8 column *latte*, possible *latte*, historic artifacts	prehistoric/ historic	Henry et al. 1996	37	D,TC	contains or may contain human remains			
77.	ORDANX	Complex (6 *Latte* sets)		1060.3 sq m; 6, 8, 10 column *latte*	prehistoric	Henry et al. 1996	38	D,TC	contains or may contain human remains			
78.	ORDANX	Complex (2 *Latte* sets)		808.5 sq m; 6 column *latte*	prehistoric	Henry et al. 1996	39	D,TC	contains or may contain human remains			
79.	ORDANX	Complex (*Latte* set, *Latte* cluster, Shell midden)		482.3 sq m; 8 column *latte*; remnant *latte*; shell midden; historic artifacts	prehistoric/ historic	Henry et al. 1996	42	D,TC	contains or may contain human remains			
80.	ORDANX	Complex (2 *Latte* sets)		355.4 sq m; 6 and 8 column *latte* with historic artifacts	prehistoric/ historic	Henry et al. 1996	43	D,TC	contains or may contain human remains			
81.	ORDANX	Complex (2 *Latte* sets)		117.9 sq m; 6 column *latte*	prehistoric	Henry et al. 1996	44	D,TC	contains or may contain human remains			
82.	ORDANX	Cave		1098.0 sq m; ceramics	prehistoric	Henry et al. 1996	48	D				
83.	ORDANX	Complex (4 *Latte* sets, 4 *Latte* clusters)		2745.3 sq m; 6 and 8 column *latte*; 4 remnant *latte*	prehistoric	Henry et al. 1996	49	D,TC	contains or may contain human remains			
84.	ORDANX	Complex (Prehistoric artifact scatter, 33 *Latte* sets, 12 *Latte* clusters)		36301.4 sq m; 6, 8, 10 and 12 column *latte*; remnants of at least 12 *latte*	prehistoric	Henry et al. 1996	50	D,TC	contains or may contain human remains			
85.	ORDANX	Complex (Overhang, 3 Caves)		1519.6 sq m; ceramics	prehistoric	Henry et al. 1996	51	D,TC	contains or may contain human remains			
86.	ORDANX	Complex (Cave, 2 Overhangs)		158.7 sq m; ceramics	prehistoric	Henry et al. 1996	52	D				
87.	ORDANX	Cave		9.3 sq m; ceramics	prehistoric	Henry et al. 1996	55	D				
88.	ORDANX	Complex (2 Overhangs)		114.9 sq m; ceramics	prehistoric	Henry et al. 1996	56	D				
89.	ORDANX	Cave		26.0 sq m; ceramics	prehistoric	Henry et al. 1996	58	D				
90.	ORDANX	Overhang		15.5 sq m; ceramics	prehistoric	Henry et al. 1996	60	D				
91.	ORDANX	Complex (2 *Latte* clusters)		337.6 sq m; remnant *latte*	prehistoric	Henry et al. 1996	61	D,TC	contains or may contain human remains			
92.	ORDANX	Complex (5 *Latte* sets, 3 *Latte* clusters)		1559.2 sq m; 6, 8, 10 column *latte* and 3 remnant *latte*	prehistoric	Henry et al. 1996	62	D,TC	contains or may contain human remains			
93.	ORDANX	Overhang		4.9 sq m; ceramics	prehistoric	Henry et al. 1996	63	D				
94.	ORDANX	Prehistoric artifact scatter		90.0 sq m	prehistoric	Henry et al. 1996	64	D				
95.	ORDANX	Prehistoric artifact scatter		12.0 sq m	prehistoric	Henry et al. 1996	65	D				
96.	ORDANX	Prehistoric artifact scatter		520.0 sq m	prehistoric	Henry et al. 1996	66	D				
97.	ORDANX	*Latte* set		43.7 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	67	D,TC	contains or may contain human remains			
98.	ORDANX	Complex (*Latte* cluster, 2 *Latte* sets)		791.3 sq m; 6 column *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996	68	D,TC	contains or may contain human remains			

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99.	ORDANX	Complex (6 *Latte* sets, 2 *Latte* clusters)		2192.6 sq m; 8 and 12 column *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996	69	D,TC	contains or may contain human remains			
100.	ORDANX	Prehistoric artifact scatter		14256.0 sq m	prehistoric	Henry et al. 1996	70	D				
101.	ORDANX	Prehistoric artifact scatter		4950.0 sq m	prehistoric	Henry et al. 1996	71	D				
102.	ORDANX	Prehistoric artifact scatter		736.0 sq m	prehistoric	Henry et al. 1996	72	D				
103.	ORDANX	Complex (*Latte* set, *Latte* cluster)		168.7 sq m; 6 col. *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996	73	D,TC	contains or may contain human remains			
104.	ORDANX	*Latte* cluster		112.0 sq m; remnant *latte*	prehistoric	Henry et al. 1996	74	D,TC	contains or may contain human remains			
105.	ORDANX	Prehistoric artifact scatter		1000.0 sq m	prehistoric	Henry et al. 1996	75	D				
106.	ORDANX	Complex (*Latte* cluster, 2 *Latte* sets)		257.0 sq m; 8 and 10 column *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996	76	D,TC	contains or may contain human remains			
107.	ORDANX	Prehistoric artifact scatter		250.0 sq m	prehistoric	Henry et al. 1996	77	D				
108.	ORDANX	*Latte* cluster		374.0 sq m; remnant *latte*	prehistoric	Henry et al. 1996	78	D,TC	contains or may contain human remains			
109.	ORDANX	Chiseled steps		2.9 sq m; depressions excavated into basalt outcrop	prehistoric	Henry et al. 1996	79	C,D	unique site type			
110.	ORDANX	Prehistoric artifact scatter		140.0 sq m	prehistoric	Henry et al. 1996	80	D				
111.	ORDANX	Complex (*Latte* set, *Latte* cluster)		451.8 sq m; 10 col. *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996	81	D,TC	contains or may contain human remains			
112.	ORDANX	Prehistoric artifact scatter		6300.0 sq m	prehistoric	Henry et al. 1996	82	D				
113.	ORDANX	Prehistoric artifact scatter		50.0 sq m	prehistoric	Henry et al. 1996	83	D				
114.	ORDANX	Complex (2 *Latte* sets)		318.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	85	D,TC	contains or may contain human remains			
115.	ORDANX	Prehistoric artifact scatter		5200.0 sq m	prehistoric	Henry et al. 1996	86	D				
116.	ORDANX	Prehistoric artifact scatter		432.0 sq m	prehistoric	Henry et al. 1996	87	D				
117.	ORDANX	Prehistoric artifact scatter		110.0 sq m	prehistoric	Henry et al. 1996	88	D				
118.	ORDANX	Prehistoric artifact scatter		375.0 sq m	prehistoric	Henry et al. 1996	89	D				
119.	ORDANX	Prehistoric artifact scatter		75.0 sq m	prehistoric	Henry et al. 1996	90	D				
120.	ORDANX	Prehistoric artifact scatter		400.0 sq m	prehistoric	Henry et al. 1996	91	D				
121.	ORDANX	Prehistoric artifact scatter		500.0 sq m	prehistoric	Henry et al. 1996	92	D				
122.	ORDANX	Overhang		60.6 sq m; artifacts and pictographs	prehistoric	Henry et al. 1996	93	C,D,TC	human remains and pictographs present			restricted location information
123.	ORDANX	Prehistoric artifact scatter		5600.0 sq m	prehistoric	Henry et al. 1996	94	D				
124.	ORDANX	Prehistoric artifact scatter		525.0 sq m	prehistoric	Henry et al. 1996	95	D				
125.	ORDANX	Overhang		1000.0 sq m; artifacts	prehistoric	Henry et al. 1996	96	D				
126.	ORDANX	Concrete block		2.9 sq m; concrete survey marker	historic	Henry et al. 1996	97	D				
127.	ORDANX	*Latte* set		62.5 sq m; 10 column *latte*	prehistoric	Henry et al. 1996	98	D,TC	contains or may contain human remains			location not mapped in report
128.	ORDANX	Complex (2 *Latte* sets)		195.0 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	99	D,TC	contains or may contain human remains			
129.	ORDANX	Overhang		6.75 sq m; ceramics	prehistoric	Henry et al. 1996	100	D				
130.	ORDANX	*Latte* set		26.6 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	101	D,TC	contains or may contain human remains			
131.	ORDANX	*Latte* set		90.33 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	102	D,TC	contains or may contain human remains			
132.	ORDANX	Complex (3 Caves)		509.0 sq m; ceramics	prehistoric?	Henry et al. 1996	103	D				
133.	ORDANX	Overhang		10.8 sq m; ceramics	prehistoric	Henry et al. 1996	104	D				
134.	ORDANX	Crevice		125.3 sq m; ceramics	prehistoric	Henry et al. 1996	105	D				
135.	ORDANX	Overhang		17.2 sq m; artifacts	prehistoric	Henry et al. 1996	106	D				
136.	ORDANX	Overhang		2.76 sq m; artifacts	prehistoric	Henry et al. 1996	107	D				
137.	ORDANX	Overhang		13.4 sq m; ceramics	prehistoric	Henry et al. 1996	108	D				
138.	ORDANX	Overhang		5.7 sq m; ceramics	prehistoric	Henry et al. 1996	109	D				
139.	ORDANX	Overhang		12.6 sq m; artifacts	prehistoric	Henry et al. 1996	110	D				
140.	ORDANX	Overhang		24.7 sq m; ceramics	prehistoric	Henry et al. 1996	111	D				
141.	ORDANX	Cave		110.0 sq m; ceramics	prehistoric	Henry et al. 1996	112	D				
142.	ORDANX	Complex (Cave, 2 Overhangs)		185.4 sq m; artifacts	prehistoric	Henry et al. 1996	113	D,TC	contains or may contain human remains			

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143.	ORDANX	Overhang		22.8 sq m; artifacts	historic	Henry et al. 1996	114	D				
144.	ORDANX	Complex (*Latte* set, 2 *Latte* clusters)		217.6 sq m; 8 col. *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996	115	D,TC	contains or may contain human remains			
145.	ORDANX	*Latte* set		56.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996	116	D,TC	contains or may contain human remains			
146.	ORDANX	*Latte* set		133.6 sq m; 6 column *latte*	prehistoric	Henry et al. 1996	117	D,TC	contains or may contain human remains			
147.	ORDANX	Overhang		423.0 sq m; artifacts	prehistoric/ historic	Henry et al. 1996	118	D,TC	contains human remains			
148.	ORDANX	Complex (2 Overhangs)		239.3 sq m; artifacts	prehistoric	Henry et al. 1996	119	D				
149.	ORDANX	Complex (Cave, Overhang)		224.7 sq m; artifacts	prehistoric/ historic	Henry et al. 1996	120	D				
150.	ORDANX	Overhang		15.8 sq m; stacked wall and ceramics	prehistoric/ historic	Henry et al. 1996	121	D				
151.	ORDANX	Complex (Cave, 3 Overhangs)		340.3 sq m; artifacts	prehistoric	Henry et al. 1996	122	D				
152.	ORDANX	Cave		67.8 sq m; ceramics and pictographs	prehistoric	Henry et al. 1996	123	C,D,TC	human remains and pictographs present			restricted location information
153.	ORDANX	Complex (*Latte* set, 2 *Latte* clusters)		561.5 sq m; 10 col. *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996	124	D,TC	contains or may contain human remains			
154.	ORDANX	Complex (*Latte* set, Overhang, 2 Caves)		1028.3 sq m; 8 col. *latte*; other features have historic artifacts and/or prehistoric ceramics	prehistoric/ historic	Henry et al. 1996	125	D,TC	contains or may contain human remains			
155.	ORDANX	Overhang		10.4 sq m; ceramics	prehistoric	Henry et al. 1996	126	D				
156.	ORDANX	Complex (*Latte* set, 6 Overhangs)		1177.9 sq m; 8 column *latte*; ceramics	prehistoric	Henry et al. 1996	127	D,TC	contains or may contain human remains			
157.	ORDANX	Overhang		9.4 sq m; ceramics	prehistoric	Henry et al. 1996	128	D				
158.	ORDANX	Overhang		27.4 sq m; ceramics	prehistoric	Henry et al. 1996	129	D				
159.	ORDANX	Overhang		12.6 sq m; ceramics	prehistoric/ historic	Henry et al. 1996	130	D				
160.	ORDANX	Complex (*Latte* set, Overhang)		182.7 sq m; 8 column *latte*; ceramics	prehistoric	Henry et al. 1996	131	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* set 9 (DS 9) Craib and Nees 1995
161.	ORDANX	Complex (Historic artifact scatter, *Latte* set, 2 *Latte* clusters)		580.2 sq m; 8 column *latte* and 2 remnant *latte*; WWII artifact scatter	prehistoric/ WWII	Henry et al. 1996	132	D,TC	contains or may contain human remains			
162.	ORDANX	Complex (2 *Latte* sets)		380.8 sq m; 8 column *latte* with prehistoric and historic artifacts	prehistoric/ historic	Henry et al. 1996	133	D,TC	contains or may contain human remains			
163.	ORDANX	Complex (Historic artifact scatter, 2 *Latte* sets, 2 *Latte* clusters)		743.5 sq m; 6 and 8 column *latte* and 2 remnant *latte*; WWII artifact scatter	prehistoric/ historic	Henry et al. 1996	134	D,TC	contains or may contain human remains			
164.	ORDANX	Historic artifact scatter		1040.0 sq m; artifacts	historic	Henry et al. 1996	135	D				
165.	ORDANX	Overhang		3.71 sq m; artifacts	prehistoric/ historic	Henry et al. 1996	136	D				
166.	ORDANX	Complex (2 Quarries, 2 *Latte* sets)		676.9 sq m; 8 and 10 column *latte*; 2 *latte* stone quarries	prehistoric	Henry et al. 1996	137	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* sets 7 and 8 (DS 7, DS 8) and Laquet Complex features (LQA and LQB) Craib and Nees 1995
167.	ORDANX	*Latte* set		165.8 sq m; 10 column *latte* with historic artifacts	prehistoric/ historiac	Henry et al. 1996	138	D,TC	contains or may contain human remains			
168.	ORDANX	Complex (Prehistoric artifact scatter, 2 *Latte* sets, 4 *Latte* clusters)		2757.6 sq m; 6 and 12 column *latte* and 4 remnant *latte*	prehistoric	Henry et al. 1996	139	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* sets 1, 2, 3, 4, 5, and 6 (DS 1 – DS 6) Craib and Nees 1995
169.	WFANX	Administration Bldg. 101A		metal surface structure	?	Yoklavich and Craib 1992 Lauter-Reinman 1995	2	II unev	assoc. with broad patterns of pre-WWII Navy permanent base construction; "The architectural significance and integrity of these buildings is not high..."			

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170.	WFANX	Administration Bldgs. B100, B103, B104, B105		metal surface structures	1946	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1995	1	unev	Navy permanent base construction; "The architectural significance and integrity of these buildings is not high..."			
171.	WFANX	AFDL-23 (floating drydock)		floating metal structure	1944	Lauter-Reinman 1994	2	unev				
172.	WFANX	AFDM-5 (floating drydock)		floating metal structure	1943	Lauter-Reinman 1994	3	unev				
						Lauter-Reinman 1995	3					
173.	WFANX	AFDM-8		floating metal structure	1943	Lauter-Reinman 1994	4	mq	representative of a type *not* used at Guam			
						Lauter-Reinman 1995	4					
174.	WFANX	Apra Sports Diving Club - 2104		no longer extant; surface structure	1946	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	5	no	permanent base construction			
175.	WFANX	Apra Village		no remains reported; location uncertain	?	Craib and Yoklavich 1992d		II	potential cultural deposits			
						Carucci 1993						
176.	WFANX	Apuntua Point Remains		submerged discarded historic materials	WWII?	Lauter-Reinman 1995	6	unev				
177.	WFANX	Baseball Field - 95		surface feature	1946	Lauter-Reinman 1994						
178.	WFANX	Baseball Field -1962		surface feature	1946	Lauter-Reinman 1995	7	no				
179.	WFANX	Basketball Court - 1978		surface feature	1949	Lauter-Reinman 1995	8	no				
180.	WFANX	Battery Recharge Shop - Bldg. 779		surface structure	1947	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	9	no	WWII and permanent base construction			
181.	WFANX	Bldg. 5506 - A4-1		surface structure	?	Craib and Yoklavich 1992e		II	assoc. with the broad patterns of Navy			
182.	WFANX	Building 93-1		metal surface structure	1945	Lauter-Reinman 1995	10	unev	permanent base construction			
183.	WFANX	Bulldozed Debris & Pad TN-5		disturbed surface materials	?	Lauter-Reinman 1995	11	no				
						Carucci 1993	84	no	modified			
184.	WFANX	Bulldozed Debris TN-3		disturbed surface materials	?	Carucci 1993	TN-5	NE				
						Lauter-Reinman 1994	9	no				
						Lauter-Reinman 1995	12	no				
185.	WFANX	Bulldozed Debris TN-4		disturbed surface materials	?	Carucci 1993	TN-3	NE				
						Lauter-Reinman 1994	10	no				
						Lauter-Reinman 1995	13	no				
186.	WFANX	Bunker and Gun Emplacement A4-8 & 9				Carucci 1993	TN-4	NE				
						Lauter-Reinman 1994	11	no				
187.	WFANX	Butler 2016			?	Lauter-Reinman 1995	14	no				
						Lauter-Reinman 1995	15	no				
188.	WFANX	Butler 2028		metal surface structure	?	Lauter-Reinman 1994	12	mq	unusual construction type			
						Lauter-Reinman 1995	16	no				
189.	WFANX	Butler 2055		metal surface structure	?	Lauter-Reinman 1994	13	mq	unusual construction type			
						Lauter-Reinman 1995	17	no				
190.	WFANX	Butler 2060		metal and concrete surface structure	?	Lauter-Reinman 1994	14	no	modified			
						Lauter-Reinman 1995	18	unev				
191.	WFANX	Butler 2060A		metal and concrete surface structure	?	Lauter-Reinman 1994	15	no	modified			
						Lauter-Reinman 1995	19	unev				
192.	WFANX	Butler 2068		metal surface structure	?	Lauter-Reinman 1994	16	no	modified			
						Lauter-Reinman 1995	20	unev				
193.	WFANX	Butler 2070		metal surface structure	?	Lauter-Reinman 1994	17	no	modified			
						Lauter-Reinman 1995	21	unev				
						Lauter-Reinman 1994	18	no	common			
						Lauter-Reinman 1995	22	unev				

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194.	WFANX	Cable Station Remains	66-03-1043	masonry surface structures; 6.1 acres	1905-1944	Craib and Yoklavich 1992d		I	probably Criterion A, possibly D	Sept 79	Oct 74	
						Lauter-Reinman 1994	19	yes				
						Lauter-Reinman 1995	23	yes				
195.	WFANX	Captain Glass Monument			1971	Craib and Yoklavich 1992d		I	marker with design significance			
						Lauter-Reinman 1995	24	no-st				
196.	WFANX	Circular Concrete Pad A4-2		surface concrete feature	?	Lauter-Reinman 1994	20	unev				
						Lauter-Reinman 1995	25	no				
197.	WFANX	Concrete Foundation TN-19		concrete surface feature	?	Carucci 1993	TN-19	NE				
						Lauter-Reinman 1994	22	no				
						Lauter-Reinman 1995	26	no				
198.	WFANX	Concrete Foundations A5-9 & 10			1950?	Lauter-Reinman 1995	27	no				
199.	WFANX	Concrete Pad A4-3			?	Lauter-Reinman 1995	28	no				
200.	WFANX	Concrete Pads A8-1			?	Lauter-Reinman 1995	33	no				
201.	WFANX	Concrete Pads A5-2			?	Lauter-Reinman 1995	32	no				
202.	WFANX	Concrete Pads and Debris TN-16		disturbed surface materials	?	Carucci 1993	TN-16	NE				
						Lauter-Reinman 1994	23	no				
						Lauter-Reinman 1995	29	no				
203.	WFANX	Concrete Pads TN-6		concrete surface features	?	Carucci 1993	TN-6	NE				
						Lauter-Reinman 1994	24	no				
						Lauter-Reinman 1995	30	no				
204.	WFANX	Concrete Pads TN-8		concrete surface features	?	Carucci 1993	TN-8	NE				
						Lauter-Reinman 1994	25	no				
						Lauter-Reinman 1995	31	no				
205.	WFANX	Concrete Remains A5-1			?	Lauter-Reinman 1995	34	no				
206.	WFANX	Concrete Stair Segment A4-10			?	Lauter-Reinman 1995	36	no				
207.	WFANX	Concrete Structural Remains A5-8			?	Lauter-Reinman 1995	35	no				
208.	WFANX	Concrete Wall TN-10		concrete surface feature	?	Carucci 1993	TN-10	NE				
						Lauter-Reinman 1994	26	no				
						Lauter-Reinman 1995	37	no				
209.	WFANX	Concrete Waste Dump TN-7		concrete surface features	?	Carucci 1993	TN-7	NE				
						Lauter-Reinman 1994	27	no				
						Lauter-Reinman 1995	38	no				
210.	WFANX	Coral Facing TN-2		masonry surface feature	?	Carucci 1993	TN-2	NE				
						Lauter-Reinman 1994	28	no				
						Lauter-Reinman 1995	39	no				
211.	WFANX	Dadi Beach	66-02-0143	possible remnant shell midden; HPO reported site "destroyed by post WWII grading and construction"	prehistoric	Craib and Yoklavich 1992c			potential cultural deposits			
						Craib and Yoklavich 1992d		II				
						Carucci 1993						
212.	WFANX	Features Off Dadi Beach TN-9		concrete, metal and other historic objects below high water mark	?	Carucci 1993	TN-9	uncertain				
						Lauter-Reinman 1994	32	unev				
						Lauter-Reinman 1995	44	unev				
213.	WFANX	Displayed Objects; scattered locations		anchors, guns, and sinkers of both Japanese and U.S. origin	?	Lauter-Reinman 1995	40	no-st	removed from original locations; lack integrity of location, setting or association			
214.	WFANX	War Dog Cemetery	66-04-1098	surface and subsurface feature	1994	Lauter-Reinman 1995	138	no-st				
215.	WFANX	Equipment Shed - Bldg. 1463		concrete and metal surface features	1945	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy WWII base construction			
						Lauter-Reinman 1994	30	no				
						Lauter-Reinman 1995	41	no				
216.	WFANX	Fallout Shelter - Bldg. 5507			1946	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
						Lauter-Reinman 1995	43	unev				

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217.	WFANX	Finger Pier R-96		concrete structure	1945	Lauter-Reinman 1994	34	nce	significantly altered			
						Lauter-Reinman 1995	45	nce				
218.	WFANX	Fire Debris TN-18		disturbed surface materials	?	Carucci 1993	TN-18	NE				incorrectly located at NAVMAG in Appendix B, L-R 1994
						Lauter-Reinman 1994	35	no				
						Lauter-Reinman 1995	62	no				
219.	WFANX	Floating Dry Dock	66-01-1026		?	Craib and Yoklavich 1992d		II				
						Lauter-Reinman 1994	38	no				
						Lauter-Reinman 1995	47	no				
220.	WFANX	Football Field 1973			1949	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy WWII and permanent base construction			
						Lauter-Reinman 1995	49	no				
221.	WFANX	Fort San Luis	66-03-1126		Spanish	Craib and Yoklavich 1992d		III				
						Lauter-Reinman 1995	50	no				
222.	WFANX	Fort Santa Cruz	66-03-1010		Spanish	Craib and Yoklavich 1992d						
						Lauter-Reinman 1995	51	no				on map, but not listed among resources
223.	WFANX	Foxholes - Leepers Loop A6-1			WWII	Lauter-Reinman 1995	52	no-st				
224.	WFANX	Fuel Tanks - A5-14			1945+	Lauter-Reinman 1995	54	no				
225.	WFANX	Fuel/Water Tank and RD A8-4&5			?	Lauter-Reinman 1995	53	no				
226.	WFANX	FY4 Corsair Wreckage			WWII	Craib and Yoklavich 1992d		II	distinctive object type			
						Lauter-Reinman 1995	42	no				
227.	WFANX	Gab Gab Beach Fortifications	66-03-1346 66-03-1347	concrete surface structures	1944	Craib and Yoklavich 1992d		II	assoc. with WWII battles			Former site number of 66-03-1128 retired by Guam HPO and replaced with two new numbers
						Lauter-Reinman 1994	40	yes				
						Lauter-Reinman 1995	55	yes				
228.	WFANX	Gab Gab Beach Recreation Area		original structures destroyed	1944	Lauter-Reinman 1994	41	nce				
						Lauter-Reinman 1995	56	nce				
229.	WFANX	Gab Gab Beach Site			prehistoric	Craib and Yoklavich 1992d		II	potential cultural deposits			
						Lauter-Reinman 1995	57	unev				
230.	WFANX	Garbage Stand - 5829			1946	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
231.	WFANX	Glass Breakwater		limestone rubble structure	1941-1944	Craib and Yoklavich 1992d		II	Criteria A and B			
						Lauter-Reinman 1994	43	yes				
						Lauter-Reinman 1995	59	yes				
232.	WFANX	Guns at Polaris Point			?	Lauter-Reinman 1995	61	no				
233.	WFANX	Guns near USMC Jungle School		metal objects; present location unknown	?	Craib and Yoklavich 1992d		II	distinct object type; assoc. with WWII battles			
						Lauter-Reinman 1994	44	unev				
						Lauter-Reinman 1995	60	no				
234.	WFANX	Historical Monument and Spanish Shrine	66-03-1012	no description	?	Craib and Yoklavich 1992d						
235.	WFANX	Housing Area 8 Remains A7-1&2			1950s	Lauter-Reinman 1995	63	no				on map, but not discussed in text
236.	WFANX	Japanese Anchors - Objects		metal objects; removed from original locations	?	Craib and Yoklavich 1992d		II	distinctive object type			
						Lauter-Reinman 1994	47	no				
						Lauter-Reinman 1995	64	no				
237.	WFANX	Japanese Bunker - Atypical	66-02-1303	concrete surface structure; unusual	WWII	Carucci 1993	TN-14	A,C,D,MP				
						Lauter-Reinman 1994	50	yes				
						Lauter-Reinman 1995	67	yes				
238.	WFANX	Japanese Bunker and Cave-Cmp B	66-02-1301	modified rockshelter; disturbed deposits	WWII	Carucci 1993	TN-12	A,D,MP				
						Lauter-Reinman 1994	49	yes				
						Lauter-Reinman 1995	66	yes				

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239.	WFANX	Japanese Bunkers and Cave	66-02-1129	modified rockshelters; no cultural materials	1944	Carucci 1993		A,D,MP				
						Lauter-Reinman 1994	48	yes				
						Lauter-Reinman 1995	65	yes				
240.	WFANX	Japanese Defense Position T-4		semi-subterranean stone and concrete feature	WWII	Craib and Yoklavich 1992d		I	assoc. with WWII battles			
						Lauter-Reinman 1994	58	no				
						Lauter-Reinman 1995	75	no				
241.	WFANX	Japanese Defense Position T-5		stone and metal subsurface feature	WWII	Craib and Yoklavich 1992d		III	assoc. with WWII battles			
						Lauter-Reinman 1994	59	no				
						Lauter-Reinman 1995	76	no				
242.	WFANX	Japanese Defensive Cave I	66-02-1305	modified rockshelter	WWII	Carucci 1993	TN-22	A,D,MP				
						Lauter-Reinman 1994	51	yes				
						Lauter-Reinman 1995	69	yes				
243.	WFANX	Japanese Defensive Cave II	66-02-1306	modified rockshelter	WWII	Carucci 1993	TN-26	A,D,MP				
						Lauter-Reinman 1994	52	yes				
						Lauter-Reinman 1995	70	yes				
244.	WFANX	Japanese Defensive Cave III	66-02-1307	modified rockshelter	WWII	Carucci 1993	TN-27	A,D,MP				
						Lauter-Reinman 1994	53	yes				
						Lauter-Reinman 1995	71	yes				
245.	WFANX	Japanese Defensive Cave IV	66-02-1308	modified rockshelter	WWII	Carucci 1993	TN-28	A,D,MP				
						Lauter-Reinman 1994	54	yes				
						Lauter-Reinman 1995	72	yes				
246.	WFANX	Japanese Defensive Cave V	66-02-1309	modified rockshelter	WWII	Carucci 1993	TN-29	A,D,MP				
						Lauter-Reinman 1994	55	yes				
						Lauter-Reinman 1995	73	yes				
247.	WFANX	Japanesu Defensive Cave VI	66-02-1310	modified rockshelter; elaborate modifications	WWII	Carucci 1993	TN-30	A,D,MP				
						Lauter-Reinman 1994	56	yes				
						Lauter-Reinman 1995	74	yes				
248.	WFANX	Japanese Gun Position T-1		metal and concrete surface features	WWII	Craib and Yoklavich 1992d		III	assoc. with WWII battles; "too disturbed to be significant"			
						Lauter-Reinman 1994	60	no				
						Lauter-Reinman 1995	77	no				
249.	WFANX	Japanese Gun Position T-2		concrete platform	WWII	Craib and Yoklavich 1992d		I	assoc. with WWII battles			
						Lauter-Reinman 1994	61	no				
						Lauter-Reinman 1995	78	no				
250.	WFANX	Japanese Mass Grave Site	66-03-1092	subsurface feature	1944	Craib and Yoklavich 1992d		I	assoc. with WWII battles			
						Lauter-Reinman 1994	62	no				
						Lauter-Reinman 1995	79	no				
251.	WFANX	Japanese Midget Submarine	66-03-1088	metal object	WWII	Craib and Yoklavich 1992d		II	Criteria A and C; assoc. with WWII battles		Sep 77	
						Lauter-Reinman 1994	63	yes				
						Lauter-Reinman 1995	80	yes				
252.	WFANX	Japanese sinker and anchor		metal objects	WWII	Lauter-Reinman 1994	64	no	removed from original locations			
						Lauter-Reinman 1995	81	no				
253.	WFANX	Japanese Steps and Wall		masonry surface structure; POW built	1945	Craib and Yoklavich 1992d		II	distinctive method of construction			
						Lauter-Reinman 1994	65	yes				
						Lauter-Reinman 1995	82	yes				
254.	WFANX	Lathe from NY Shipyard			1936	Lauter-Reinman 1995	83	unev				
255.	WFANX	Maanot Water Reservoir - Site 380		roofed, concrete surface structure	1931	Yoklavich and Craib 1992		I	assoc. with broad patterns of pre-WWII Navy construction			

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256.	WFANX	Marine Barracks Plaque			1921-on	Craib and Yoklavich 1992d		I	distinct object type			
						Lauter-Reinman 1994	70	no				
257.	WFANX	Marine Barracks Site	66-03-1036	no surface features remaining		Lauter-Reinman 1995	87	no-st				
					1921-1941	Craib and Yoklavich 1992d		III	assoc. with broad patterns of Navy WWII base construction			not mapped
258.	WFANX	Military Dump A5-5				Lauter-Reinman 1995	88	no				
259.	WFANX	Miramar Road Remains - A8-2			?	Lauter-Reinman 1995	89	no				
260.	WFANX	Modified Karst Pits A5-6 & 7			?	Lauter-Reinman 1995	90	no				
261.	WFANX	NOB Hill Bowl Theater		masonry surface structure, remnant	?	Lauter-Reinman 1995	91	no				
					1945	Yoklavich and Craib 1992		I	Criterion C; assoc. with broad patterns of pre-WWII Navy construction; only extant example			
						Lauter-Reinman 1994	72	yes				
262.	WFANX	Office Bldg. for Shop Area - 1770		wooden surface structure		Lauter-Reinman 1995	92	yes				
					1947	Yoklavich and Craib 1992		I	assoc. with broad patterns of pre-WWII Navy permanent base construction; "unique structure due to its materials"			
						Lauter-Reinman 1995	93	unev				
263.	WFANX	Operational Storage Building (former Armco hut) - Bldg. 501A		surface structure	1950?	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy permanent base construction (WWII?)			
264.	WFANX	Orote Airfield	66-03-1066	limestone surface structure; modified	1942-1944	Craib and Yoklavich 1992d		II	assoc. with WWII battles	June 75	Feb 75	
						Lauter-Reinman 1994	76	yes				
265.	WFANX	Orote Historical Complex	66-03-1009	masonry surface features including Fort Santiago, Spanish Steps, Spanish Well, Orote Archaeological Site; pre-Latte pottery, rockshelter with surface materials; no *latte* remains reported		Lauter-Reinman 1995	94	yes				
					prehistoric/ historic	Craib and Yoklavich 1992d		I	research potential; assoc. with important events in history	Oct 79	Oct 79	
						Lauter-Reinman 1995	95	yes				
266.	WFANX	Orote Mangrove Battle Site	66-03-1058	"destroyed site"; no location	1944	Craib and Yoklavich 1992d		II	possible cultural deposits			
						Lauter-Reinman 1994	77	no				
267.	WFANX	Orote Village				Lauter-Reinman 1995	96	no				
					1676	Craib and Yoklavich 1992c		II	potential cultural deposits			
						Craib and Yoklavich 1992d		II				
						Carucci 1993						
268.	WFANX	Pad Complex A4-6				Lauter-Reinman 1995	97	unev				
269.	WFANX	Pan American Airways Hotel Remains	66-03-0142	concrete foundation only, location in question; destroyed during recapture of Guam	?	Lauter-Reinman 1995	100	no				
					1936-1944	Craib and Yoklavich 1992d		III	presence of existing remains questionable		Oct 74	
						Lauter-Reinman 1994	78	mq				
270.	WFANX	Pan American Airways Seaplane Ramp		concrete quay		Lauter-Reinman 1995	98	no				
					1935-1944	Lauter-Reinman 1994	79	mq				
271.	WFANX	Picnic Structure Pads TN-24		concrete surface features		Lauter-Reinman 1995	99	unev				
					?	Carucci 1993	TN-24	NE				
						Lauter-Reinman 1994	80	no				
272.	WFANX	Piti *Latte* Site	66-03-0137	single 10 pillar *latte*; probably destroyed		Lauter-Reinman 1995	101	no				
273.	WFANX	Potable Water Tank - 532			prehistoric	Craib and Yoklavich 1992d		II				
274.	WFANX	Potable Water Well - C534			1945	Lauter-Reinman 1994	81	no				
275.	WFANX	Pottery and Lithic Scatter			1945	Lauter-Reinman 1994	82	no				
276.	WFANX	Pottery Scatters A8-3			prehistoric	Lauter-Reinman 1995	104	unev				
277.	WFANX	Pottery Sherds TN-17			prehistoric	Lauter-Reinman 1995	105	unev				
					prehistoric	Carucci 1993	TN-17	NE				
278.	WFANX	Prehistoric Rockshelter TN-13	66-02-1302			Lauter-Reinman 1995	103	no				
					prehistoric	Carucci 1993	TN-13	D				
						Lauter-Reinman 1995	106	yes				

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279.	WFANX	Public Toilet - Bldg. 3170		metal surface structure	1945	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy WWII base construction; modified			
						Lauter-Reinman 1994	83	nce				
						Lauter-Reinman 1995	107	no				
280.	WFANX	Quonset 151		metal surface structure; uncertain date	1944-1945?	Craib and Yoklavich 1992d		unev	assoc. with broad patterns of Navy WWII base construction; unique design			
						Lauter-Reinman 1994	85	mq				
						Lauter-Reinman 1995	108					
281.	WFANX	Quonset 1627		metal surface structure; in disrepair	?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII base construction			
						Lauter-Reinman 1994	96	no				
						Lauter-Reinman 1995	118	no				
282.	WFANX	Quonset 2001A		metal surface structure	1945	Lauter-Reinman 1994	98	no	common			
						Lauter-Reinman 1995	120	no				
283.	WFANX	Quonset 2004		metal surface structure	1944	Lauter-Reinman 1994	99	nce	early date			
						Lauter-Reinman 1995	121	nce				
284.	WFANX	Quonset 2006		metal surface structure	1944	Lauter-Reinman 1994	100	no	modified			
						Lauter-Reinman 1995	122	no				
285.	WFANX	Quonset 2008		metal surface structure	1944	Lauter-Reinman 1994	101	no	modified			
						Lauter-Reinman 1995	123	no				
286.	WFANX	Quonset 2013		metal surface structure	1944	Lauter-Reinman 1994	102	no	modified			
						Lauter-Reinman 1995	124	no				
287.	WFANX	Quonset 2039		metal surface structure	1944	Lauter-Reinman 1994	103	no	modified			
						Lauter-Reinman 1995	125	no				
288.	WFANX	Quonset 2049		metal surface structure	1944	Lauter-Reinman 1994	104	no	modified			
						Lauter-Reinman 1995	126	no				
289.	WFANX	Quonset 2053		metal surface structure	1944	Lauter-Reinman 1994	105	no	common			
						Lauter-Reinman 1995	127	no				
290.	WFANX	Quonset 2054		metal surface structure	1944	Lauter-Reinman 1994	106	no	common			
						Lauter-Reinman 1995	128	no				
291.	WFANX	Quonset 5407		metal surface structure	1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII base construction; good example of type			
						Lauter-Reinman 1994	107	yes				
						Lauter-Reinman 1995	129	yes				
292.	WFANX	Quonset 5408		metal surface structure	1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII base construction; good example of type			
						Lauter-Reinman 1994	108	yes				
						Lauter-Reinman 1995	130	yes				
293.	WFANX	Quonset 5409		metal surface structure; destroyed by typhoon	1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII base construction			
						Lauter-Reinman 1994	109	no				
294.	WFANX	Quonset 609		metal surface structure	1945	Craib and Yoklavich 1992c		II	common; assoc. with the broad patterns of Navy WWII base construction; distinctive construction type			
						Lauter-Reinman 1994	87	no				
						Lauter-Reinman 1995	110	no				
295.	WFANX	Quonset 611		metal surface structure	1945	Craib and Yoklavich 1992c		II	common; assoc. with the broad patterns of Navy WWII base construction; distinctive construction type			
						Lauter-Reinman 1994	88	no				
						Lauter-Reinman 1995	111	no				
296.	WFANX	Quonset 6118		metal surface structure	1945	Lauter-Reinman 1994	110	no	common			
						Lauter-Reinman 1995	131	no				
297.	WFANX	Quonset 630		metal surface structure; in disrepair	1945	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy WWII base construction; distinctive construction type			
						Lauter-Reinman 1994	89	no				
298.	WFANX	Quonset 634A		metal surface structure	1944-1945?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII base construction; unremarkable example			
						Lauter-Reinman 1994	90	mq				
						Lauter-Reinman 1995	112	mq				

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299.	WFANX	Quonset 634B		metal surface structure	1944-1945?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	91	mq	base construction; unremarkable example			
300.	WFANX	Quonset 634C		metal surface structure		Lauter-Reinman 1995	113	mq				
					1944-1945?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
301.	WFANX	Quonset 730				Lauter-Reinman 1994	92	mq	base construction; unremarkable example			
						Lauter-Reinman 1995	114	mq				
					1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
302.	WFANX	Quonset 731				Lauter-Reinman 1994	93	no	base construction			
						Lauter-Reinman 1995	115	no				
					1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
303.	WFANX	Quonset 732				Lauter-Reinman 1994	94	no	base construction			
						Lauter-Reinman 1995	116	no				
					1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
304.	WFANX	Quonset Hut in Shop Area - Site 1686		metal surface structure		Lauter-Reinman 1994	95	no	base construction			
						Lauter-Reinman 1995	117	no				
					1945	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
305.	WFANX	Refueling Structure T-3		concrete surface features; unknown function		Lauter-Reinman 1994	97	nce	Navy permanent base construction; common			
					WWII	Lauter-Reinman 1995	119	nce				
						Craib and Yoklavich 1992d		II	assoc. with WWII battles			
306.	WFANX	Remains at Camp Bright TN-11	66-02-1300	concrete features and foundations		Lauter-Reinman 1994	112	no				
					WWII	Lauter-Reinman 1995	132	unev				
						Carucci 1993	TN-11	A				
307.	WFANX	Remains of Aircraft Eng. A4-12				Lauter-Reinman 1994	113	no-st				
308.	WFANX	Remains of Comm. Cond.				Lauter-Reinman 1995	133	no-st				
309.	WFANX	Sewer Features TN-23		concrete and metal surface features	?	Lauter-Reinman 1995	134	no				
					?	Lauter-Reinman 1995	135	no				
					?	Carucci 1993	TN-23	NE				
						Lauter-Reinman 1994	115	no				
310.	WFANX	Sewer Features TN-25		metal surface features		Lauter-Reinman 1995	136	no				
					?	Carucci 1993	TN-25	NE				
						Lauter-Reinman 1994	116	no				
311.	WFANX	Shipboard Guns - Objects		metal objects		Lauter-Reinman 1995	137	no				
					?	Craib and Yoklavich 1992d		II	distincitve object type; removed from			
312.	WFANX	Shop Bldgs. 1714, 1771-1774, 3000-3004, 1767, 1768		metal surface structures		Lauter-Reinman 1994	117	no	original locations			
					1947 & 1949	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
313.	WFANX	Sinkhole Caverns - PS-1 & 2	66-03-1304	subsurface features		Lauter-Reinman 1995	138	unev	Navy permanent base construction			
					prehistoric	Carucci 1993	PS-1, PS-2	D				
						Lauter-Reinman 1995	139	no				
314.	WFANX	Stone Wall and Steps TN-21		concrete surface features	?	Carucci 1993	TN-21	A,C,D				
						Lauter-Reinman 1994	118	no				
315.	WFANX	Storm Drain & Bridge TN-15		surface features		Lauter-Reinman 1995	140	no				
					?	Carucci 1993	TN-15	NE				
						Lauter-Reinman 1994	119	no				
316.	WFANX	Structure Foundations A4-4&5				Lauter-Reinman 1995	141	no				
317.	WFANX	Sumay Caves Fortifications		modified rockshelters; surface artifacts	?	Lauter-Reinman 1993	142	no				
					WWII	Lauter-Reinman 1994	120	mq				
						Lauter-Reinman 1995	143	mq				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
318.	WFANX	Sumay Cemetery	66-03-1041	cemetery with surface features	1910-1943	Craib and Yoklavich 1992d		II	Criterion A		Sep 74	
						Lauter-Reinman 1994	121	yes				
						Lauter-Reinman 1995	144	yes				
319.	WFANX	Sumay Village	66-03-1038	no surface structures remain	WWII	Craib and Yoklavich 1992d		II	potential cultural deposits			
						Lauter-Reinman 1994	122	mq				
						Lauter-Reinman 1995	145	mq				
320.	WFANX	Tennis Court - 1794		surface feature	?	Lauter-Reinman 1994	123	no				
						Lauter-Reinman 1995	147	no				
321.	WFANX	Tennis Court -1792			1947	Lauter-Reinman 1995	146	no				
322.	WFANX	Tipalao Bay South End Caves	66-02-1312	rockshelters; modified or used??	WWII	Carucci 1993	PS-13	A,D,MP				
						Lauter-Reinman 1994	125	mq				
						Lauter-Reinman 1995	149	mq				
323.	WFANX	Tipalao Marsh	66-03-1327	swamp or wetland	?	Carucci 1993	PS-6	D				
324.	WFANX	Toilet Remains - PS 17		concrete and metal surface feature	?	Carucci 1993	PS-17	NE	lack integrity			
						Lauter-Reinman 1995	150	no				
325.	WFANX	Transit Shed No. 1 - Bldg. 3169		metal surface structure	1947	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	151	unev	permanent base construction; distinctive construction type			
326.	WFANX	Transit Shed No. 2 - Bldg. 3171		metal surface structure	1945	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1994	126	yes	WWII base construction; distinctive			
						Lauter-Reinman 1995	152	yes	construction type			
327.	WFANX	Tuparao Village	66-02-1311		1672	Craib and Yoklavich 1992d		II	potential cultural deposits			
						Carucci 1993	PS-12	C,D				
						Lauter-Reinman 1995	153	unev				
328.	WFANX	Type 96 Anti-aircraft gun		metal object	19367	Craib and Yoklavich 1992d		II	distinctive object type; moved from original			
						Lauter-Reinman 1994	128	unev	location			
						Lauter-Reinman 1995	154	unev				
329.	WFANX	Vehicular Bridge - 1632 - Cmp. C.			1946	Lauter-Reinman 1995	155	unev				
330.	WFANX	Walled Structure A5-11		concrete surface feature	?	Lauter-Reinman 1995	156	mq				
331.	WFANX	Water Distribution Building - 4181		surface structure	1945	Yoklavich and Craib 1992		I	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1994		no	Navy construction; only extant example			
332.	WFANX	Water Reservoir - 4180		subsurface concrete structure	1949	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1995	161	unev	Navy permanent base construction			
333.	WFANX	Water System TN-20		concrete surface features	?	Carucci 1993	TN-20	NE				
						Lauter-Reinman 1994	131	no				
						Lauter-Reinman 1995	162	no				
334.	WFANX	Water Tank and Wall - A7-3&4			?	Lauter-Reinman 1995	164	no				
335.	WFANX	Water/Drainage Tanks A5-3			?	Lauter-Reinman 1995	160	no				
336.	WFANX	West Orote Bunker A4-7			WWII	Lauter-Reinman 1995	165	yes				
337.	WFANX	Wharves L thru Q		concrete structures	1945	Lauter-Reinman 1994	132	nce	significantly altered			
						Lauter-Reinman 1995	166	no				
338.	WFANX	Alpha, Bravo, Uniform, and Victor Wharves			1946	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
339.	WFANX	Sierra, Tango and X-Ray Wharves		metal and wood surface structures	1946	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy WWII base construction			
340.	WFANX	Aichi D3A2 "Val"		submerged Japanese Navy dive bomber	WWII	Lauter-Reinman 1994						
						Lauter-Reinman 1995	SR-30					
341.	WFANX	Barge - ABJ Lagoon breakwater		submerged remains		Lauter-Reinman 1994	SR-20					
						Lauter-Reinman 1995	SR-20					

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
342.	WFANX	Barge - Dry Dock Island		submerged remains		Lauter-Reinman 1994	SR-13					
						Lauter-Reinman 1995	SR-13					
343.	WFANX	Barge - east of Dry Dock Island		submerged remains		Lauter-Reinman 1994	SR-14					
						Lauter-Reinman 1995	SR-14					
344.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 1994	SR-25					
						Lauter-Reinman 1995	SR-25					
345.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 1994	SR-26					
						Lauter-Reinman 1995	SR-26					
346.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 1994	SR-27					
						Lauter-Reinman 1995	SR-27					
347.	WFANX	Barge - northeast 26, 27		submerged remains		Lauter-Reinman 1994	SR-28					
						Lauter-Reinman 1995	SR-28					
348.	WFANX	Barge - northeast of Adotgan Point		submerged remains		Lauter-Reinman 1994	SR-23					
						Lauter-Reinman 1995	SR-23					
349.	WFANX	Barge - Piti channel		submerged remains		Lauter-Reinman 1994	SR-30					
350.	WFANX	Caribia - Harbor mouth		submerged remains		Lauter-Reinman 1995	SR-29					
351.	WFANX	Fishing Boat - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-21					
352.	WFANX	LCU - Glass Breakwater		submerged remains		Lauter-Reinman 1995	SR-9					
						Lauter-Reinman 1994	SR-19					
353.	WFANX	LCU - north of Orote		submerged remains		Lauter-Reinman 1995	SR-19					
						Lauter-Reinman 1994	SR-24					
354.	WFANX	LCU - Piti back bay		submerged remains		Lauter-Reinman 1995	SR-24					
						Lauter-Reinman 1994	SR-4					
355.	WFANX	Kitsugawa Maru	66-03-1154	submerged Japanese Navy transport ship	1941	Craib and Yoklavich 1992d			nomination form completed			
						Lauter-Reinman 1994						
356.	WFANX	Nichiyu Maru	66-03-1155	submerged Japanese Navy freighter	1933	Lauter-Reinman 1995	SR-18					
						Craib and Yoklavich 1992d						
						Lauter-Reinman 1994						
357.	WFANX	RMS Scotia		submerged ship	1904	Lauter-Reinman 1995	SR-5					
358.	WFANX	SMS Cormoran	66-03-1037	submerged ship	1917	Lauter-Reinman 1995	SR-22					
						Lauter-Reinman 1994						
359.	WFANX	Tokai Maru	66-03-1089	submerged Japanese Navy transport ship	1930	Lauter-Reinman 1995	SR-15				July 74	no discussion in report
						Lauter-Reinman 1994						
360.	WFANX	Japanese Naval Tug		submerged remains		Lauter-Reinman 1995	SR-16			July 88	July 88	
361.	WFANX	Tug - Seaplane Ramp		submerged remains		Lauter-Reinman 1995	SR-17					
362.	WFANX	Tug - Dry Dock Island		submerged remains		Lauter-Reinman 1995	SR-11					
363.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-12					
364.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-6					
365.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-7					
366.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-8					
367.	NCTAMS	Barrigada Battlefield	66-04-1059	no surface remains		Lauter-Reinman 1995	SR-10					
					1944	Craib and Yoklavich 1992a		II	associated with significant event in Guam history			
						Lauter-Reinman 1994	7	no-st				
368.	NCTAMS	Barrigada Golf Course - Facility No. 95		surface feature		Craib and Yoklavich 1996		II	warrants plaque only			
					1948	Craib and Yoklavich 1992a		II	associated with broad patterns of Navy			
						Craib and Yoklavich 1996		III	permanent base construction; earliest extant golf course on Guam			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
369.	NCTAMS	Bone Discovery	66-08-1193	surface find of isolated human remains with WWII artifacts; likely to yield information important in history; along top of cliff line above the beach	1941-1945	Craib and Yoklavich 1992a Craib and Yoklavich 1996 Lauter-Reinman 1994	71	II II no				Incorrectly cited as "66-03-1193" in reports.
370.	NCTAMS	Haputo	66-08-0007	extensive *latte* village - 20 sets identified on coastal flat	prehistoric	Craib and Yoklavich 1992a Craib and Yoklavich 1996		I I		Nov 74	Nov 74	
371.	NCTAMS	Officers Country entry gates and area - Facility No. 46		two masonry entry pillars	1944-1945	Craib and Yoklavich 1992a Craib and Yoklavich 1996		II II	likely to yield information important in history; distinctive masonry construction			
372.	NCTAMS	Officers' Country Pillars		masonry surface features	1945	Lauter-Reinman 1994	73	no-st				
373.	NCTAMS	Pugua Point Complex	66-08-0008	rockshelter, midden deposits and surface artifacts on coastal flat; 12.35 acres	prehistoric	Craib and Yoklavich 1992a Craib and Yoklavich 1996		II II				
374.	NCTAMS	Tweed's Cave	66-08-1051	rockshelter with surface materials	1942-1944	Craib and Yoklavich 1992a Lauter-Reinman 1994 Craib and Yoklavich 1996	127	II yes II	Criterion A; assoc. with significant persons and events in Guam history			
375.	NCTAMS			surface sherd scatter, 2.2 m in diameter, no subsurface remains encountered	prehistoric	Kurashina, McGrath, and Manner 1987	T6					Not included in CRMP document
376.	NCTAMS			surface sherd scatter, 12 m in diameter	prehistoric	Kurashina, McGrath, and Manner 1987	T8					Not included in CRMP document
377.	NCTAMS			surface sherd scatter, 11 x 9 m	prehistoric	Kurashina, McGrath, and Manner 1987	T14					Not included in CRMP document
378.	NCTAMS			pottery scatter, ca 7 m in diam, subsurface sherds recovered	prehistoric	Haun 1988	T-1					Not included in CRMP document
379.	NCTAMS			pottery scatter, ca 100 m^2, no subsurface remains encountered	prehistoric	Haun 1988	T-2					Not included in CRMP document
380.	NCTAMS			isolated *Tridacna* adze fragment, no subsurface remains encountered	prehistoric	Haun 1988	T-6					Not included in CRMP document
381.	NCTAMS			pottery scatter, , ca 35 m^2, no subsurface remains encountered	prehistoric	Haun 1989b	T-1					Not included in CRMP document

Significance/National Register Eligibility Keys:

Title 36 CFR 60.4 (used by Carucci 1993, Craib and Nees 1995, Henry et al. 1996)		Lauter-Reinman 1994, 1995		Navy HARP (used by Craib and Yoklavich 1992a-d, Yoklavich and Craib 1992)	
A	The site is associated with events that have made a significant contribution to the broad patterns of our history.	yes	Eligible for listing in the National Register (date given if already listed) – retain integrity	I	...of outstanding historical, architectural, engineering or cultural significance. Further, these resources have been evaluated as having retained their 'integrity' i.e., original and/or authentic Period materials, design and context.
B	The site is associated with the lives of persons significant in our past.	nce	Non-contributing element in a National Register District or Thematic Grouping – lacking integrity	II	Resources of lesser historical, architectural, archaeological, engineering or cultural significance than resources included in Category I. They may not be able to match Category I properties in terms of integrity.
C	The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.	mq	May qualify as an element of a National Register District or Thematic Grouping, but needs more research	III	Resources that qualified professionals have concluded do not met national Register eligibility criteria, as well as all World War II temporary buildings, and buildings in historic districts that have been professionally evaluated as non-contributing elements of the district.
D	The site yielded, or may be likely to yield, information important in prehistory or history.	no-st	Not eligible but is deserving of special treatment		
		unev	Unevaluated; needs more research before it can be properly evaluated		
		no	Not eligible		

In addition to the National Register criteria, Carucci 1993 also used:

MP Sites are significant and should be added to the already existing "Japanese Defensive Fortifications on Guam" Multiple Property nomination to the National Register.

NE Not eligible

In addition to the National Register criteria, Henry et al. 1996 also used:

TC Based upon guidelines in National Register Bulletin 38 (1990) sites are significant if they include those properties related to cultural or ethnic identity and values. Evaluated upon their value to contemporary populations, sites defined as significant under this category include those exhibiting rock art, *latte* stones, and human burials.

Appendix K
Socioeconomic Assessment for Apra Harbor

Socioeconomic Impacts of
Underwater Demolition in Apra Harbor

Prepared by:
Ernst & Young LLP

Prepared for:
Belt Collins Hawaii

January 1998

I - Introduction

Under contract with the U.S. Department of the Navy, Belt Collins Hawaii is completing an Environmental Impact Statement (EIS) pertaining to the conduct of military exercises in the Mariana Islands. As part of the study leading to the EIS, Ernst & Young LLP was engaged to compile and report on information relevant to various socioeconomic factors. This update is intended for the use of Belt Collins Hawaii as it pertains to proposed underwater demolition training activities in outer Apra Harbor.

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II - Background

As part of the proposed military training exercises planned for the Mariana Islands, there are two proposed areas for underwater demolition training on Guam. One of the areas is located in outer Apra Harbor, near the glass breakwater. The second area is located around Orote Point, near the village of Agat. It is tentatively planned that training would occur once a month for approximately four hours during daylight hours.

Apra Harbor is considered a mixed- use area, serving both the military and civilian communities. Guam's commercial port, operated by the Port Authority of Guam (an autonomous agency of the territorial government) is located on one side of the harbor, providing an essential shipping link for Guam to Asia and the U.S. Two domestic carriers, Matson Navigation and Sea Land Services, provide regular cargo service between Guam and the mainland U.S. There are four lines in inter-regional trade between Guam and the Far East/Australia. Six intra-regional lines operate between Guam and the other islands in Micronesia. Approximately 635 containers per week are off-loaded at the commercial port.

The following summarizes the shipping activity for the commercial port:

	Total Containers	Total Revenue Tons
1990	78,873	1,533,000
1991	84,345	2,014,000
1992	90,559	1,865,000
1993	89,711	1,730,000
1994	87,211	1,939,000
1995	86,844	1,963,000

	Total Containers	Total Revenue Tons
1996	91,372	1,830,000

The commercial port also received port calls from 19 passenger vessels during 1996, accounting for a total 10,239 arrivals (11,354 in 1995). Sea arrivals occur sporadically during year with no arrivals in October and November 1996 and 1,633 in December 1996. The pattern was similar in 1995. The passenger vessels range in size from those with accommodations for 120 to 150 passengers to larger cruise ships that can hold 600 to 800 passengers. These vessels use primarily Hotel Wharf which is located on the glass breakwater towards the mouth of the harbor.

The commercial port is also utilized by purse-seiner and longliner fishing vessels. The longliner vessels dominate the market with 2,742 port calls in 1996, down from 3,115 in the previous year. Approximately, 450 of the longliner vessels were based in Guam. Transshipment of tuna is the primary purpose for the port calls with activity ranging from a high of 15,000 metric tons off-loaded in the peak year of 1989 to a current level of 10,469 metric tons in 1996. The Governor of Guam has called for expansion of the fishing industry from its current level of $150 million per year to $400 million by 2001. However, certain industry experts have indicated that changes in the migratory patterns of tuna could reduce the supply in the region. Additionally, the government of the Federated States of Micronesia require vessels licensed to fish in their territorial waters to off-load their shipments in the ports of Pohnpei, Yap, Chuuk or Kosrae.

In 1996, the U.S. Immigration and Naturalization Service changed its policy concerning visa allowances to foreign fishermen. Due to tighter restrictions related to disembarkation from foreign vessels and visa requirements, certain foreign vessels have moved to other ports in the Western Pacific. Additionally, there is pending legislation with the Guam Legislature that would impose tariffs and restrictions on tuna trans-shipped from the Federated States of Micronesia.

The U.S. Navy occupies a significant portion of the harbor, located across the harbor from the commercial port. Its activities have ranged from the Fleet and Industrial Supply Center, Ship Repair Facility and home-porting of various Navy vessels. The majority of the vessels have been decommissioned although several have returned to Guam as part of the military sea-lift command with contracted merchant marine crews. The USS Frank Cable, a submarine tender, is also home-ported on Guam. Both the Fleet and Industrial Supply Center and the Ship Repair Facility have been closed. However, the Ship Repair Facility has been leased to the Government of Guam who, in turn, has contracted with a private company. The company, XenoTechnix, will operate the installation, employing approximately 275 people. There is a pending environmental assessment related to the transfer of the facility and the underlying land from the federal government to the local government.

The U.S. Navy also has an ammunition wharf on its property, along with various recreational facilities for its personnel. While the ammunition wharf is only used sporadically during the year, the recreational facilities, such as Polaris Point and the GabGab beaches are frequented by both military personnel and local residents, particularly on the weekends and holidays.

There is also a high degree of recreational use by both commercial enterprises and the general population. There are a number of reefs and submersed "wrecks" which are popular dive spots. Portions of the harbor are also used by jet ski and wind surfing enthusiasts and entrepreneurs. There is also a limited amount of sport fishing conducted in and around the harbor, particularly on the glass breakwater.

The larger commercial enterprises providing water sports activities include Micronesian Divers Association, Inc. (MDA), Guam Tropical Dive Station, Coral Reef, Atlantis Submarine and S.S. Neptune. The largest dive shop operator on Guam, MDA, conducts daily scuba diving tours of various dive spots in the harbor. MDA has three boats of which each can accommodate between 20 to 40 passengers depending on the boat. While, at times, the dive boats operate out of the Agat Bay Marina, Apra Harbor is popular due its sheltered nature. During the rainy season (May to October), the majority of diving in Guam is confined to Apra Harbor.

Apra Harbor has approximately 20 significant dive spots within its boundaries. Those that are more frequented include:

- Jade Shoals
- Western Shoals
- Tokai Maru
- Cormoran
- Kizogawa Maru
- American Tanker
- Dogleg Reef
- Middle Ground
- GabGab I and II
- Finger Reef
- Sponge Reef
- Hidden Reef

While many of these dive spots are used by dive operators during the weekdays, there is a significant increase in recreational activity during the weekends. Generally, during the weekdays, the major dive operators have two tank dive tours scheduled in the morning and then again in the afternoon. On Saturdays and Sundays, additional boat dives are added to accommodate local residents.

Outside of the harbor and around Orote Point are Blue Hole & Crevice dive spots. Generally, these spots have less traffic, especially during stormy weather. On average, there is one to two dive boats visiting the two spots per day. The general area is also popular with local fishermen.

III - Impact of Proposed Military Exercises

The impact of the planned underwater demolition military exercise on socioeconomic elements of Apra Harbor would be expected to be minimal.

For the private sector, the most significant potential impact would be delays in shipping resulting from closure of the harbor. However, the ship channel would remain open during the exercises and, accordingly, harbor traffic to and from the commercial port would not be restricted. As the exercise would be limited to four hours each month, it would be expected that the military could easily coordinate their activities with the commercial port and the major shipping lines to ensure minimal interruption to shipping schedules. However, during a recent exercise there was miscommunication between the Navy and the Guam port authorities. As a result, all activities in the port were halted until the problem was cleared.

The tourism industry would be affected to a greater degree as certain operators, such as Atlantis Submarine and S.S. Neptune, would have to suspend their activities during the exercises. The actual impact would depend highly on the timing of the exercises during the day. Although use of the harbor by tour operators and local residents ranges from early morning (6:00 am) to early evening (8:00 pm) [420 hours per month], the harbor is more widely used for recreational activities during the weekends. The Apra Harbor demolition exercise extends for 4 weekday hours once a month, or approximately 1% of the time, avoiding the more heavily used weekend days. Atlantis has daily excursions on its 46-passenger fully submersible vessel at the GabGab II reef. These excursions start at 8:30 am with additional departures occurring at forty-five minute intervals until late in the afternoon. Based on estimates compiled by the management of Atlantis Submarine, Inc., a potential loss of $15,000 per day would be incurred if their activities were halted during the four hour exercise. However, in discussions with Atlantis Submarine officials, it was indicated that tour activities were not halted during previous exercises conducted by the U.S. Navy. These exercises only lasted approximately one hour and there was close communications between company representatives and the U.S. Navy. Management also indiciated that actual tour activities of the submarine did not cease during the exercise; however, the company's fish feeders are not able to scuba dive during the actual demolition activities. Accordingly, the economic impact of past activities has been minimal.

The S.S. Neptune is a similar sized, semi-submersible that operates in the Western Shoals region. Its rates are approximately half of the Atlantis Submarine rates. Accordingly, maximum loss of gross revenues would be estimated at approximately $7,500 per month. Again, this assumes all seats filled with adult tourists and does not include cost savings. Communication with the operator of the S.S. Neptune (see attachment) indicates significant opposition to the exercises. It should be noted that this operator also conducts scuba diving training and tours in the harbor.

There are several tour operators who conduct dinner cruises, such as the Stars and Stripes catamaran. While these tours have decreased during the past several years, they still actively

utilize the harbor. As these tours are conducted during the sunset hours, it would be expected there would be no impact from the demolition activities.

There are a number of optional tour entrepreneurs who offer varied water-based activities in the harbor to tourists. These activities range from scuba diving training, jet skiing and board sailing. It is difficult to precisely calculate the number of entrepreneurs operating in the harbor. However, it is unlikely that more than 200 customers of these entrepreneurial enterprises would be inconvenienced by the four hour demolition exercise. Using a high average of $65 per optional tour, the monthly economic impact would be $13,000.

There would be no extra cost to harbor police and US Coast Guard, as the US Navy monitors affected harbor areas for the presence of civilians.

In the past, closures of the Glass Breakwater to civilian traffic was not well-communicated to the local community. During a previous demolition exercise, the Guam port authorities closed the harbor to all activities due to miscommunication between the U.S. Navy and the port officials. Given the high degree of usage of the breakwater and Hotel Wharf by commercial businesses, early communication of any closure is important. This would include public notices in the print, radio and television media. As with monitoring activities, it would be expected that the Navy would be responsible for the public notifications and, accordingly, there would be no socioeconomic impact.

In summary, the maximum potential economic impact of the underwater demolition exercises, if all businesses operated at 100% capacity and if the submarines ceased operations during the exercise, would be estimated at:

Description	Monthly	Annual
Atlantis submarine (if operations halted during exercise)	$ 15,000	$ 180,000
S.S. Neptune (if operations halted during exercise)	7,500	90,000
Misc. tour operators (assumes 200 customers @ $65 each)	13,000	156,000
Total	$35,500	$426,000

For the public sector, there would be concerns about the restricted access during the military exercises. The beaches and water areas of the harbor are used by the local population throughout the year, with especially high usage on the weekends and holidays. Currently, the local government is involved in litigation to obtain increased access to U.S. government lands in the northern section of Guam. It is possible that serious objections may be raised by government officials and local activist about the restricted use. Informal studies conducted among local residents indicates resistance to the demolition activities.

Underwater demolition activities in the area offshore of Dadi Beach would not appear to have a significant adverse impact on shipping and related commercial activities. As previously noted, there are two popular dive spots—Hap Reef and Blue Hole—1.3 and 2.2 miles, respectively—from the proposed demolition site; these sites would not be affected.. It should also be noted that this area is frequented by local fishermen and divers. Restricting access would be a significant concern given the location of proposed site near the Agat Bay Marina and Apra Harbor.

IV - Possible Mitigation

As noted above, the limitations of this study did not allow for precise estimates for the economic impact. Additionally, timing of the exercises would directly impact the economics of the exercises. Although use of the harbor by tour operators and local residents ranges from early morning (6:00 am) to early evening (8:00 pm), the harbor is more widely used for recreational activities during the weekends. By scheduling the exercises on days where usage is reduced, such as during the middle of the week, the detrimental impact would be minimized. Atlantis Submarine management indicated that the submarine tours are not in operation on alternate Tuesday due to scheduled maintenance. If the exercises were scheduled on these days (see attached schedule for 1998), the economic impact on Atlantis Submarine would be minimized. Adverse impact would also be reduced by close contact with the various tour operators and recreational groups. As noted above, impact on shipping and commercial fishing would be minimal, given the fact that the ship channel would remain open. Accordingly, mitigation is not considered to be critical to these activities.

Appendix L
Botanical Survey of the Mariana Islands Military Training Areas
(March 1996)

grass Phragmites karka. In some areas this grass is entirely dominant, but in areas where the soil is not so saturated, or is periodically dry, other weedy introduced species, such as Saccharum spontaneum (wild sugarcane), Waltheria indica, Chromolaena odorata, and Calopogonium mucunoides, become common. Other species present in the wetlands are typical wetland plants, such as the delicate climbing fern Lygodium microphyllum (vining fern) and the sedges Fuirena umbellata and Fimbristylis littoralis, as well as typical weedy species, such as as Mikania scandens (mile-a-minute vine) and Bidens alba (beggar's-tick), Hyptis capitata, and Chromolaena odorata.

4. Ravine Forest

This type of vegetation occurs in the deeper ravines and gullies that contain small tributary streams to the Maemong River. These are mostly in the hilly terrain on the western portion of the site, but there is also one on the southeast side that may just be within the boundaries of the site. The shallower gullies are usually dominated by herbaceous vegetation, particularly by Phragmites karka if sufficient moisture is available. The deeper ravines and gullies are the only places on the site that are dominated by woody vegetation.

The ravine forest is highly disturbed, not so much because of recent physical disturbance, but more because of the presence of introduced species--both aboriginal and recent introduced tree species. The dominant trees in this kind of forest are Pandanus tectorius (screwpine), Hibiscus tiliaceus (beach hibiscus), Cocos nucifera (coconut), Pimenta racemosa (allspice), Areca catechu (betelnut), and Cananga odorata (perfume tree), with smaller trees such as Triphasia trifolia (limeberry) and Cycas circinalis (cycad) also being common. Along the stream itself Phragmites may also be common where there is sufficient sunlight. Lianas are also common in this forest, especially Freycinetia reineckei.

All the above tree species are either naturalized weedy species or possibly native trees that are often cultivated (coconut, perfume tree). However, the ravine forest at the southeast side of the site (Fig. 3), which as was noted above is mostly or entirely outside of the site, was dominated by most of the same plants, but had a number of other, less common native species present, such as the woody species Ochrosia mariannensis, Discocalyx megacarpa, and Decaspermum fruticosum, and the ferns Angiopteris evecta, Belvisia spicata, and Microsorium punctatum. There is a well-beaten path leading to this ravine, including steeps cut into the steep ravine slopes. At the attractive waterfall at the end of the path (Fig. 4), a bamboo platform has been constructed.

Sensitive Vegetation and Plants

The vast majority of the site is covered by grasslands dominated by introduced species, and is in no way sensitive. The wetlands, because they are wetlands, are sensitive. However, those on the site are very small in extent (limited to the margins of streams) and do not harbor many native wetland species

other than phragmites. The forests in the ravines are dominated by woody species that are either alien (introduced) or common native or aboriginally introduced species. Of the 104 species found at this site (Table 1, column 1), about 61 are indigenous, and none is threatened or endangered.

Bivouac Area Site

This area is located on the west side of the Naval Magazine, south of the "West Lookout Tower." It is reached by means of a dirt road that leads south downslope from the tower, past a proposed site for a "shooting house" and up to a flattened area between the hills and ridges. Three plant communities are found at the site: (1) Managed Land Vegetation; (2) Sword-grass Savanna; and (3) Limestone Forest.

(1) Managed Land Vegetation

This type of vegetation covers most of the flat areas at the site, and hence most of the land that is or would be used in bivouac activities. It is heavy disturbed by previous military activities, that have included bulldozing and clearing, and the vast majority of species at the site are weedy alien herbs and grasses. The dominant of these are Stachytarpheta jamaicensis (Jamaica vervain), Hyptis capitata, Mimosa pudica (sensitive plant), Polygala paniculata, Bidens alba (beggar's-tick), and Pilea microphylla (artillery plant).

(2) Sword-grass Savanna

This vegetation occurs on the slopes surrounding the flat disturbed areas and the limestone forest on the upper slopes. It is a disturbed type of vegetation that is probably maintained by periodic wildfires that ravage the area. The dominant species are Miscanthus floridulus (sword grass) and Pennisetum polystachyon (mission grass), which form a dense grass cover in which few other species are able to compete. In more open areas of this grass land on the slopes, other species such as Stachytarpheta jamaicensis, Fimbristylis cymosa, Saccharum spontaneum (wild cane), and Scaevola taccada are common. Of these, only the scaevola and Fimbristylis are native.

(3) Limestone Forest

Limestone forest is probably the original vegetation for the entire site, but the less rocky slopes and the flat areas were long ago cleared by agricultural and/or military activities or burned by fires. It presently occurs on the steeper, rocky slopes that are not subject to grassland fires and are not suitable for military activities or, formerly, agriculture.

This forest is not in the area that would be expected to be impacted by bivouac activities, only on the margins. The dominant species recorded here are Pandanus tectorius (screwpine), Pandanus dubius (pahong), Aglaia mariannensis, Ficus prolixa (banyan), Guamia mariannae, and Elaeocarpus joga.

Sensitive Vegetation and Plants

Since the area is entirely disturbed, there is no sensitive vegetation, except, perhaps, the limestone forest. However, this forest is up the slope away from the main impact area, and is unlikely to be affected by bivouac activities. Most of the plants at the site are alien species (see Table 1, column 2), and nearly all of the native species are in the limestone forest rather than on the areas that will be affected by the bivouac areas. One native tree species found in this forest, Fagraea berteroana, is rather rare in Guam. However, it is indigenous rather than endemic, and in any case is not likely to be impacted by bivouac activities, since it occurs up the slope in the limestone forest.

Sniper Range Site

This site is located at the west side of the Naval Magazine and consists of a small hill (the former site of the "West Lookout Tower") and extends southeast between 115--135° in a narrow fan shape that ends on a ridge running south-southwest about 1000 m away. The topography consists of hilltops, ridges, gentle to steep slopes, and a ravine that eventually leads down into the lower elevations of the Naval Magazine. Five plant communities can be distinguished: (1) Managed Land Vegetation; (2) Mission-grass Savanna; (3) Sword-grass Savanna; (4) Fernland; and (5) Ravine Forest. The boundaries between these communities are sometimes difficult to distinguish, except for the Ravine Forest, and may, to some degree, represent successional stages in a mosaic that is determined by land use and frequency of fires.

(1) Managed Land Vegetation

This type of vegetation covers areas that have been recently disturbed (managed) by human activities. This is mostly along and on dirt roads and at the cleared area on the hilltop (West Lookout Tower site). At the tower site (the tower is now gone), the top of the hill has been bulldozed to a flat surface, which is dominated by weedy herbaceous species, especially Pennisetum polystachyon (mission grass), Fimbristylis cymosa, Eragrostis brownii, and Stachytarpheta jamaicensis (Jamaica vervain). In some places there are patches of the wild cane Saccharum spontaneum (wild cane), especially along the edges where the bulldozing did not reach, or perhaps where it has not been cleared recently.

From the road leading to the bivouac area there is another dirt road leading SSW on a ridge top and curving around to the target area. At the terminus of the road there is a cleared area that has obviously been bulldozed (along with the road). It is dominated by common weedy species, especially Pennisetum polystachyon, Fimbristylis cymosa, and Stachytarpheta jamaicensis (generally the same dominants at the cleared top of West Lookout Tower hilltop). The vegetation along the bulldozed roads is similar, but where the soil is more impervious and wet, the tiny sedge Eleocharis geniculata is common.

(2) Mission-grass Savanna

On the other sides of the hill, and along the road that leads up to the West Lookout Tower site, are grasslands dominated in some places by sword grass, but in other places, in a mosaic pattern, by Pennisetum polystachyon (mission grass) and in other places by Saccharum spontaneum (wild cane), especially in the more highly disturbed places adjacent to the road. There are also a few scattered coconut palms and pandanus trees on the slope. The area is probably periodically burned, which keeps it in grassland rather than allowing it to revert to native forest.

The fan extends down to the road and onto a flat area, and then across a ravine and up the slope to the ridge where the sniper targets would presumably be placed. The flat area has probably been bulldozed, and is dominated by disturbed vegetation, especially by dense clumps of Saccharum spontaneum. There is even a small amount of Phragmites karka in presumably wetter places, but no actual wetland is present.

(3) Sword-grass Savanna

Down the slopes of the hill and extending up to the dirt road running perpendicular to the axis of the fan and up to the bivouac area, the vegetation is also highly disturbed (Fig. 5), but except for the dirt road leading up to West Lookout Tower, it has not been bulldozed. It is dominated by Miscanthus floridulus (sword grass), making passage through it difficult even with protection from the sharp-edged leaves. Mixed in with the sword grass are scattered individuals of Hyptis capitata and a few other weedy species that are able to grow out of the dense grassland vegetation. There are also patches of Leucaena leucocephala occurring sporadically along the slope.

The hillsides at the SSW end of the fan are dominated by the same types of grassland as the slopes of the West Lookout Tower hill, a mosaic of grasslands, dominated in some places by sword grass and in other places by mission grass, both with other scattered weedy species, especially Hyptis capitata.

(4) Fernland

In some areas, perhaps on the poorest, most eroded places, the dominant species is Dicranopteris linearis (false staghorn fern), often mixed with lesser amounts of Lycopodium cernuum. A few areas are nearly devoid of vegetation, leaving the exposed eroding red lateritic soil.

(5) Ravine Forest

This vegetation is typical of ravines in the inland areas of Guam, and is dominated by a mixture of native and introduced trees that are protected near the stream from the wildfires that periodically ravage the grasslands. At this site the ravine is part of the upper reaches of the Maulap River that drains into the Fena Reservoir.

The dominant species in this forest are Pandanus tectorius (screwpine), Hibiscus tiliaceus (beach hibiscus), and Areca catechu (betelnut). Less common are Artocarpus mariannensis (breadfruit), Cocos nucifera (coconut), and Leucaena leucocephala (tangantangan). All of these are useful plants and although some of them are native, it is likely that their presence next to the stream is associated with past human activity.

In areas that are open, Phragmites karka often dominates, as it does in wetlands all over the island. Also common in these open areas is the weedy alien Mikania scandens (mile-a-minute vine).

Sensitive Vegetation and Plant Species

Virtually all of the area is disturbed, most of it by the periodic fires that ravage the hillsides and eliminate tree species, allowing the sword grass and mission grass to dominate. Most of the native species (see Table 1, column 3) are likely to be found in the ravine forest, but no endemic species were found there. Because of this, and because the planned activity, as a sniper range, there are not likely to be any significant impact on the vegetation or flora of the site.

Helicopter Landing Site

This site is located on a ridge just south of Mt. Alifan near the northwest corner of the Naval Magazine, at an elevation of about 1000 ft. The original vegetation of the site was limestone forest, but the area is now highly disturbed by a road that runs north-south and a trail that leads to the top of Mt. Alifan. Four plant communities can be recognized at the site: (1) Managed Land Vegetation; (2) Mission-grass Savanna; (3) Scaevola shrubland; and (4) Limestone Forest.

(1) Managed Land Vegetation

This is the vegetation that covers the area of the site that is actively being used, mostly as a road (Fig. 6). The ridge appears to have been bulldozed in the past into a flat surface, upon which the road is situated, and this surface is dominated by low-growing weedy alien species that are able to survive on the compacted road surface and to withstand crushing by car tires and periodic mowing. The dominant species here are Sporobolus diander, Fimbristylis cymosa, Stachytarpheta jamaicensis (Jamaica vervain), Pennisetum polystachyon (mission grass), and Bidens alba (beggar's-tick, all of them weedy species typical of these habitats in the area.

A variation of this habitat is on the steep low roadbanks at the north end of the road. These are barren except for a few alien species, mostly the two ferns Pteris vittata and Nephrolepis hirsutula.

(2) Mission-grass Savanna

The area away from the road and its edges is apparently not

being actively disturbed at this time and is covered by a grassland vegetation dominated by Pennisetum polystachyon (mission grass). A number of other weedy alien species, especially Bidens alba, are interspersed with the dominant mission grass. This type of vegetation may be in a dynamic equilibrium with the next plant community, Scaevola shrubland, and their relative dominance may depend upon fires that may frequent the area. Much of the naval magazine is dominated by the savanna, which is maintained by periodic burning of the hillsides, which favors this grass species.

(3) Scaevola Shrubland

This shrubland is dominated by Scaevola taccada, a shrub that is more commonly dominant on seashores. Although it is native to Guam, it is probably not native to this area, but thrives in the open habitat created by the removal of the original limestone forest. In addition to Scaevola, the other dominant species are the two ferns Nephrolepis hirsutula and Phymatosorus scolopendria, and various weedy alien herbaceous species. In a few places there are patches of Caesalpinia major (gray nickers), a scrambling shrub with nasty thorns that make passage through it extremely difficult. There are also scattered Casuarina equisetifolia trees in the area.

There are no distinct boundaries between this and the Mission-grass savanna, and the two form somewhat of a mosaic pattern (Fig. 7). The shrubland is probably more susceptible to wildfires and not as able as mission grass to become re-established after burning.

(4) Limestone Forest

The native vegetation of this site was limestone forest, but this has all been removed in the areas used for various military activities (probably both Japanese and American). The remaining limestone forest occurs on the steeper slopes and is probably out of the area that will be actively used during helicopter landings.

The forest is not pristine, and is quite ragged, possibly due to the effects of recent hurricanes, or from past disturbance during the last World War. The dominant species include Aglaia mariannensis, Pandanus tectorius (screwpine), and Guamia mariannae. Other native tree species included Guettarda speciosa, Ficus prolixa (banyan), Intsia bijuga (ifil), Premna serratifolia, Macaranga thompsonii, and Psychotria mariana.

Sensitive Vegetation and Plant Species

The first three communities are dominated by alien weedy species (Table 1, column 4), and are in no need for any particular concern. Most of the native species at the site are in the limestone forest, which is usual for Guam. Since this forest lies on the periphery of the site, it will probably not be very impacted by helicopter landings, unless larger areas downslope and at either end are needed. Limestone forest is one

of the few remaining types of native vegetation on Guam, and is dominated by native species. Thus care should be taken to ensure that it is not removed without compelling reasons.

Rappelling Site

This site is located near the northwest corner of the Naval magazine, between Mt. Alifan and the main entrance to the magazine. It is situated in a borrow pit or quarry that appears to be in current usage. The proposed rappelling would be down the artificially created cliff (Fig. 8) at the edge of a quarry. Because of the small size of the site, its highly disturbed condition, and its current usage, only two plant communities can be distinguished: (1) Managed Land Vegetation, and (2) Cliff-face Scrub.

(1) Managed Land Vegetation

The bottom of the borrow pit is almost devoid of vegetation, since this is where the limestone rock has been quarried and where gravel trucks and bulldozers maneuver, and is currently covered with crushed limestone. The only vegetation present is near the margins at the base of the cliff, and its component species are all common weeds such as Bidens alba (beggar's-tick), Pennisetum polystachyon (mission grass), Stachytarpheta jamaicensis (Jamaica vervain), and Chamaesyce hypericifolia.

(2) Cliff-face Scrub

Since the face of the cliffs is a smooth artificial surface formed by quarrying activities, it does not offer a very hospitable habitat for plants, as would a natural cliff formed by weathering and erosion. Consequently, the vegetation is sparse and is comprised of only a few species that are able to colonize the cliff face. The dominant species here are scattered individuals of Casuarina equisetifolia (ironwood) and Scaevola taccada that find a tenuous hold in the inhospitable surface. Also present are some clumps of the non-native fern Pteris vittata.

Sensitive Vegetation and Plant Species

Cliffs are usually good places to find rare and endangered species on islands, since these may be the only place where goats and other browsers are not able reach and consume the vegetation. However, this cliff is recent and man-made, and although all three species present are either native or ancient introductions, they are all common plants in Guam (Table 1, column 5). Consequently, no sensitive plants and no threatened or endangered plant species are found at this site.

APRA HARBOR, GUAM

Riverine Training Site

This site is located outside of the Naval Magazine just north of Apra Harbor. Where the stream joins the ocean, the area is dominated by mangroves. The stream continues inland, where the mangrove gives way to disturbed vegetation dominated by Hibiscus tiliaceus (beach hibiscus) and Pandanus tectorius (screwpine), with lesser amounts of trees such as Casuarina equisetifolia (ironwood) and Leucaena leucocephala (tangantangan).

This vegetation lining the stream is highly disturbed, and does not contain any sensitive vegetation or plant species, except for the mangroves, which are protected since they are on wetlands. However, the proposed use for the site involves boating upstream, and this is unlikely to affect any of the vegetation.

TINIAN

Live Fire Weapons Range

This site is located on the north end of Tinian, east of the North Field complex and west of the main north-south road (Broadway), and the plan calls for the creation of a live fire weapons range. The site has been heavily disturbed in the past, since it is adjacent to the airfield complex that during the latter part of World War II was one of the busiest in the world. Nearly all of the area was cleared for the airfield, living quarters, and storage facilities. However, since the war the area has fallen into disuse, and there is little current disturbance to the vegetation present, except along the sides of the roads. Five plant communities can be distinguished here: (1) Managed Land Vegetation; (2) Leucaena Scrub Forest; (3) Disturbed Littoral Shrubland; (4) Casuarina Woodland; and (5) Littoral Vegetation. A checklist of the flora of the site is found in Table 2.

(1) Managed Land Vegetation

A half century ago, virtually the whole site was probably in this category, but now it is limited to the sides of the road, mostly along the main road (Broadway). This vegetation is disturbed by cars that travel the road, and probably by road crews that keep the roadsides free of woody vegetation. The dominant species found here include Bidens alba (beggar's-tick), Bothriochloa pertusa, Digitaria ciliaris, Stachytarpheta jamaicensis (Jamaica vervain), Chamaesyce hirta, Passiflora suberosa, and numerous other weedy alien species. There are virtually no native species in this habitat.

(2) Leucaena Scrub

The vast majority of the site is covered with a scrub forest

of Leucaena leucocephala (tangantangan), that probably accounts for over 95% of the biomass of the community. In the northern portion of the site, north of the cross road leading from Broadway to the airfield complex, this forest is between 5 and 8 m in height. Few other species--trees or herbaceous species--are found here. The most frequent woody species are Thespesia populnea (milo), Albizia lebbek, Melanolepis multiglandulosa, and Carica papaya (papaya). Two of these, Thespesia and Melanolepis are indigenous, the other two are aliens. The most common herbaceous species is Passiflora suberosa, a weedy alien species of passionfruit. Much less common is Jasminum marianum, a native vine. Several other herbaceous species are found here, such as Passiflora foetida, Capsicum frutescens (chili pepper), Lantana camara (lantana), Blechum brownei, and Desmanthus virgatus, but these weedy aliens are found mostly on the edge of the scrub forest where sufficient sunlight is available.

At the south end of the site, south of the cross road, the Leucaena scrub forest is shorter in stature (2--4 m in height), probably because of its proximity to the sea and the absence of a buffer to protect it from the salty sea winds. Some of the area appears to have a "dieback" caused by these winds. Leucaena is by far the dominant species in this area, with small amounts of woody species, such as Morinda citrifolia (Indian mulberry) and Callicarpa candicans, and herbaceous species such as Passiflora suberosa, Passiflora foetida, Blechum brownei, and Lantana camara. With the exception of the Jasminum and the Callicarpa, all of the species in this community are aliens.

(3) Disturbed Littoral Shrubland

There is a small area of what would be best described as littoral shrubland along the west side of Broadway several hundred meters north of the cross road. This is probably an area that was bulldozed fairly recently, and instead of Leucaena scrub forest becoming re-established, a low herbaceous or shrubby vegetation predominates, somewhat like that found on the east side of the road (and outside the study site).

The dominant species in the community are Wollastonia biflora, which is a native littoral shrub, and Cardiospermum halicacabum (balloon vine), a weedy alien species. Also common here are the native subshrub Senna sophera, the weedy alien Passiflora suberosa, and to a lesser extent, a mixture of native, mostly littoral species, such as Phyllanthus marianus, Cassytha filiformis, and Mariscus javanicus, and weedy alien herbs and subshrubs, such as Stachytarpheta jamaicensis (Jamaica vervain), Oxalis corniculata (wood sorrel), and Digitaria ciliaris. Inland from the road, this vegetation dominated by dense thickets of the weedy noxious shrub Lantana camara (lantana).

(4) Casuarina Woodland

This type of vegetation is dominated by tall Casuarina equisetifolia (ironwood) trees up to 18 m in height, forming an open canopy. It is mostly concentrated just to the south of the cross road. In addition to the ironwood trees, Thespesia

populnea is also common in this area, with lesser amounts of Albizia lebbek, Morinda citrifolia, and Premna serratifolia. There is also some Leucaena leucocephala, which dominates in the areas surrounding this woodland.

The forest floor is rather open and covered with a thick accumulation of ironwood "needles." The most common herbaceous species are the alien weed Blechum brownei, the native grass Lepturus repens, and the native shrub Callicarpa candicans, with lesser amounts of other native species, such as Achyranthes aspera and Deeringia amaranthoides, and various weedy alien species, such as Vernonia cinerea, Pennisetum polystachyon (mission grass), and Passiflora suberosa.

There is also a patch of this woodland near the southeast corner of the airfield complex. It includes a number of native species, some of which were not seen elsewhere at the site, including Neisosperma oppositifolium, Ficus prolixa (banyan), Melanolepis multiglandulosa, Premna serratifolia, Pandanus tectorius (screwpine), Capparis cordifolia, Callicarpa candicans, and Eugenia palumbis.

(5) Littoral Vegetation

The cliff and slopes that run roughly perpendicular to the proposed Live Fire Weapons Range at its southern end are covered with native littoral vegetation. This area is not within the boundaries of the site, but the vegetation was briefly examined to assess its value as native forest and as a site for native species, some of which were reported to be used medicinally by the inhabitants.

On the cliffs and slopes near the shore, the vegetation is scrubby and sparse, and is dominated by littoral species that find a tenuous hold in this inhospitable habitat. The dominant species are Bikkia tetrandra, Pemphis acidula, and Phyllanthus marianus, with lesser amounts of Lepturus repens, Hedyotis sp., Capparis cordifolia, and Fimbristylis cymosa. In more hospitable areas littoral forest trees dominate, the most common of which is Hernandia nymphaeifolia (Chinese lantern tree). Also present but less dominant are Tournefortia argentea (tree heliotrope), Cordia subcordata (cordia), Barringtonia asiatica (fish-poison tree), and Terminalia catappa (tropical almond).

All of these are native species that are typical of makatea (karst) coastlines of the Marianas.

Sensitive Vegetation and Plants

Since virtually the whole site is dominated by disturbed vegetation, there is no sensitive vegetation present, except for the native littoral vegetation beyond the south end of the site. The best of vegetation present on the site is the Casuarina woodland, where a number of native species are found, particularly in the woodland at the southeast corner of the airfield complex. None of the species encountered at the site (Table 2) or in the adjacent littoral vegetation is rare or endangered in the Northern Marianas.

Parachute Drop Zone

The parachute drop zone site on Tinian comprises a rectangular area measuring 700 x 1400 yards, with the long sides aligned in a north-south direction. It lies just to the east of the runway of Tinian Airport, beginning about two hundred yards from the main north-south road (Broadway).

The original vegetation of the site has been entirely removed, without a trace of what it originally was (probably limestone forest). This probably happened centuries ago as the Chamarros used the flat topography for farming and villages. The whole island was subsequently disturbed by military activities during World War II, and probably by sugar cane farming. More recently (and perhaps before the war) it has been utilized for cattle grazing. Only one type of plant community is currently present at the site, Managed Land Vegetation.

Managed Land Vegetation

The entire area is currently covered with pasture, with occasional solitary trees and small groves. The most common tree species are Pithecellobium dulce (Manila tamarind) and Acacia confusa (Formosan koa), with lesser amounts of Albizia lebbek, Casuarina equisetifolia (ironwood), and Leucaena leucocephala (tangantangan). At the northern end, there is a large bamboo (Bambusa vulgaris) stand.

Two variations of pasture occur at the site, one that is currently being used for grazing and one that appears to have been abandoned. Originally the area appears to have been planted with pasture grasses, such as Panicum maximum (Guinea grass) and Brachiaria subquadripara, but now these have been joined by the often more common weedy species. The weedy species most frequently found in the areas currently used for grazing are Stachytarpheta jamaicensis (Jamaica vervain), Stachytarpheta urticifolia (blue rat's-tail), Sida acuta, Ipomoea triloba, Malvastrum coromandelianum, Centrosema pubescens, Momordica charantia (balsam pear), Mimosa invisa (giant sensitive plant), and Desmanthus virgatus. In the abandoned areas, weedy species completely dominate, the most common of which are are the two thorny species, Mimosa invisa and Lantana camara (lantana).

Sensitive Vegetation and Plants

There is no native vegetation at the site. It was removed long ago and the land has been in use for farming and grazing of cattle for many decades. A total of 70 plant species were recorded at the site (see Table 3). Of these, only seven or fewer are native, none of which are endemic. All of these native species are weedy or semi-cultivated, and none could be considered rare or endangered. This is to be expected in an area as highly disturbed as this pasture is.

DISCUSSION

Nearly the whole area included in the botanical survey is covered with disturbed vegetation. Even those areas of native vegetation present are highly disturbed and their native species intermixed with weedy alien species. The only vegetation that could be considered to be sensitive would be wetlands, which are protected under U.S. laws. These are mainly along the streams in the area in the "ravine forest."

It is does not appear that the activities planned for the various sites would be detrimental to native vegetation. The only sites of any concern in the Naval Magazine would be the ravine forest, but this would not likely be impacted by the proposed land navigation and sniper range activities. Limestone forest is present at the Bivouac Site and Helicopter Landing Site, but these are marginal to the probable area of activity, since they are on steep or rugged slopes. But if the area of activity is to be expanded into these area, care should be taken not to damage this native limestone forest.

The Rappelling Site in the Naval Magazine and the Parachute Drop Zone on Tinian have no native vegetation at all. Although the Live Fire Weapons Range has no native vegetation, the Casuarina woodland does have certain aesthetic interest and is home to a number of native species. If would be advisable to avoid using the woodland if at all possible, especially the one at the southeast corner of the airfield complex.

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CHECKLISTS OF THE FLORA OF THE STUDY SITES

Table 1. Checklist of the Flora of the Naval Magazine Sites, Guam.

The species are arranged in four groups: (1) ferns; (2) gymnosperms; (3) monocots; and (4) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
FERNS (PTERIDOPHYTES)			
ADIANTACEAE (Maidenhair-fern Family)			
Pityrogramma calomelanos (L.) Link	X	-----	X - - - -
Pteris quadriaurita Retz.	I	-----	- - X - -
Pteris vittata L.	X	-----	- X X X X
DAVALLIACEAE (Leather-fern Family)			
Davallia solida (Forst. f.) Sw.	I	leather fern, pagua-machena	X - X - -
Humata heterophylla (Smith) Desv.	I	-----	- - X - -
Nephrolepis hirsutula (Forst. f.) Presl	I	sword fern	X X X X -
GLEICHENIACEAE (Gleichenia Family)			
Dicranopteris linearis (Burm.) Underwood	I	false staghorn	X - - X -
LINDSAEACEAE (Lacefern Family)			
Lindsaea ensifolia Sw.	I	-----	X - - - -
LYCOPODIACEAE (Clubmoss Family)			
Lycopodium cernuum L.	I	club moss	X - X - -
MARATTIACEAE (Marattia Family)			
Angiopteris evecta (Forst. f.) Hoffm.	I	king fern	X - - - -
POLYPODIACEAE (Common Fern Family)			
Belvisia spicata (L. f.) Mirb. ex Copeland	I	-----	- - X - -
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----	X - X X -
Pyrrosia lanceolata (L.) Farw.	I	-----	- - X - -
Microsorium punctatum (L.) Copeland	I	-----	X - - - -
SCHIZAEACEAE (Schizaea Family)			
Lygodium microphyllum (Cav.) R. Br.	I	-----	X - X - -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
THELYPTERIDACEAE (Downy Woodfern Family)			
Amphineuron opulentum (Kaulf.) Holtum	I	-----	X X - - -
Christella parasitica (L.) Léveillé	I	-----	X - X - -
Sphaerostephanos unitus (L.) Holttum	X	-----	X X X - -
VITTARIACEAE (Ribbon-fern Family)			
Vittaria incurvata Cav.	I	-----	X - - - -
GYMNOSPERMS			
CYCADACEAE (Cycad Family)			
Cycas circinalis L.	I	cycad, fadang	X X X X -
MONOCOTS			
ARECACEAE (Palm Family)			
Areca catechu L.	X	betel-nut, pagua	X - X - -
Cocos nucifera L.	I	coconut, niyog	X - X X -
CYPERACEAE (Sedge Family)			
Carex fuirenoides Gaudich.	X	-----	X - X - -
Cyperus compressus L.	X	-----	- - X - X
Cyperus aff. compressus	X	-----	- - X - X
Eleocharis geniculata (L.) R.& S.	I?	-----	- X X - -
Fimbristylis autumnalis (L.) R. & S.	I	-----	- X X - -
Fimbristylis cymosa R. Br.	I	-----	X X X X -
Fimbristylis dichotoma (L.) Vahl	I	-----	X X X X -
Fimbristylis littoralis Gaudich.	I	-----	X - - - -
Fimbristylis tristachya R. Br.	I	-----	X - - - -
Fuirena umbellata Rottb.	I	-----	X - - - -
Kyllinga brevifolia Rottb.	I	chaguan lemae	- - X - -
Machaerina mariscoides (Gaudich.) J.H. Kern	I	-----	X - - - -
Pycreus polystachyos (Rottb.) Beauv.	X	-----	X - X X -
Rhynchospora rubra (Lour.) Makino	I	-----	X - - - -
Scleria lithosperma (L.) Swartz	I	-----	X - X - -
Scleria polycarpa Boeck.	I	-----	X - X - -
FLAGELLARIACEAE (Flagellaria Family)			
Flagellaria indica L.	I	false ratan	X - X X -
LILIACEAE (Lily Family)			
Curculigo orchioides Gaertn.	I	yellow-eyed grass	X - - - -
Dianella saffordiana Fosb. & Sachet	I	-----	X - - - -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
ORCHIDACEAE (Orchid Family)			
Arundinaria graminifolia (D. Don) Hochr.	X	bamboo orchid	X - - - -
Bulbophyllum guamense Ames	E	cebollo halumtano	- - X - -
Dendrobium guamense Ames	E	-----	- - X - -
Geodorum densiflorum (Lam.) Lindl.	X	-----	X - - - -
Spathoglottis plicata Bl.	X	Philippine ground orchid	X - X X -
Taeniophyllum mariannense Schlechter	E	kamuke-annofe	X - X - -
PANDANACEAE (Screwpine Family)			
Freycinetia reineckei Ward.	I	fianiti	X - X - -
Pandanus dubius Spreng.	I	pahong	X X X X -
Pandanus tectorius Parkinson	I	screwpine, kafu	X X X X -
POACEAE (Grass Family)			
Centosteca lappacea (L.) Desv.	I	-----	X - - - -
Chloris virgata Sw.	X	-----	- - - - X
Chrysopogon aciculatus (Retz.) Trin.	I	-----	X - - - -
Dichantium bladhii (Retz.) Clayton	X	-----	X X X X -
Dimeria chloridiformis (Gaud.) K. Schum. & Laut.	E	-----	X - X - -
Eragrostis brownii (Kunth) Nees ex Steud.	X	-----	- - X - -
Eustachys petraea (Sw.) Desv.	X	-----	- - X X X
Imperata conferta (Presl) Ohw	X	-----	- - X - -
Miscanthus floridulus (Labill. Warb. ex K. Schum. & Laut.	I	sword grass, neti	X X X - -
Oplismenus hirtellus (L.) P. Beauv.	I	-----	X - X - -
Paspalum conjugatum Berg.	X	T-grass	- X X X -
Paspalum fimbriatum Kunth	X	-----	- - - - X
Paspalum orbiculare Forst. f.	I	rice grass	X - - - -
Pennisetum polystachion (L.) Schult.	X	mission grass	X X X X X
Phragmites karka (Retz.) Trin. ex Steud.	I	reed, karriso	X - X - -
Pogonantherum crinitum (Thunb.) Kunth	X	-----	- - X - -
Saccharum spontaneum L.	I	wild cane	X X X - -
Sacciolepis indica (L.) Chase	X	-----	- X - - -
Sporobolus diander (Retz.) P. Beauv.	I	dropseed	- - - X -
Sporobolus fertilis (Steud.) Clayton	I	rat-tail dropseed	- - X - -
Zoysia matrella (L.) Merr.	I	Manilla templegrass	- - - X -
DICOTS			
ANACARDIACEAE (Cashew Family)			
Mangifera indica L.	X	mango, mangga	X - - - -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
ANNONACEAE (Soursop Family)			
Cananga odorata (Lam.) Hook. f. & Thoms.	X	ilang-ilang	X - - - -
Guamia mariannae (Safford) Merr.	E	pai-pai	- X - X -
APIACEAE (Carrot Family)			
Centella asiatica (L.) Urb.	X	Asiatic pennywort	X X X - -
APOCYNACEAE (Dogbane Family)			
Cerbera dilatata Markgraf	E	chiute	- - X - -
Ochrosia mariannensis A. DC.	E	langiti	X - - - -
ASCLEPIADACEAE (Milkweed Family)			
Asclepias curassavica L.	X	asuncion, milkweed	- - - X -
ASTERACEAE (Sunflower Family)			
Ageratum conyzoides L.	X	mumutung	X X X - -
Bidens alba (L.) DC.	X	beggar's-tick	X X X - -
Chromolaena odorata (L.) King & Robin.	X	masigsig	X X X X -
Conyza canadensis (L.) Cronq.	X	Canadian fleabane	- - X X X -
Elephantopus mollis Kunth	X	elephant's-foot	X - - - -
Emilia sonchifolia (L.) DC.	X	emilia	- X - - -
Mikania scandens (L.) Willd.	X	mile-a-minute vine	X X X X -
Pluchea carolinensis (Jacq.) D. Don	X	pluchea	- - X - -
Synedrella nodiflora (L.) Gaertn.	X	saigon	X - - - -
Vernonia cinerea (L.) Less.	I	ironweed	- X - - -
BARRINGTONIACEAE (Barringtonia Family)			
Barringtonia racemosa (L.) Bl. ex DC.	I	langasat	- - X - -
BORAGINACEAE (Heliotrope Family)			
Heliotropium procumbens Mill.	I	huning-tasi	- - - - X
CAMPANULACEAE (Bluebell Family)			
Hippobroma longiflora (L.) G. Don	X	-----	- - X X -
CARICACEAE (Papaya Family)			
Carica papaya L.	X	papaya	- - - X -
CASSYTHACEAE (Cassytha Family)			
Cassytha filiformis L.	I	agasi	X - - X -
CASUARINACEAE (Ironwood Family)			
Casuarina equisetifolia L.	I	ironwood, gagu	X - - X -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
CLUSIACEAE (Mangosteen Family)			
Calophyllum inophyllum L.	I	Alexandrian laurel, da'og	X - X - -
CONVOLVULACEAE (Morning-glory Family)			
Ipomoea littoralis Bl.	I	-----	X - - X -
Ipomoea triloba L.	X	fofgu-sabana	X - X - -
Stictocardia tiliifolia (Desr.) Hall. f.	I	-----	- X X - -
ELAEOCARPACEAE (Elaeocarpus Family)			
Eleocarpus joga Merr.	X	yoga	- X - - -
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hypericifolia (L.) Millsp.	X	-----	- - - X X
Euphorbia heterophylla L.	X	-----	X - - - -
Glochidion marianum Muell. Arg.	I	chosga	X - X - -
Macaranga thompsonii Merr.	I	pengua	- - - X -
Phyllanthus marianus Muell. Arg.	I	gaogao-uchan	- X - X -
Phyllanthus saffordii Merr.	E	-----	X - - - -
FABACEAE (Pea Family)			
Abrus precatorius L.	X	rosary pea	X - - - -
Acacia sp.	X	-----	X - - - -
Acacia sp.	X	-----	X - - - -
Alysicarpus vaginalis (L.) DC.	X	-----	X - X - -
Caesalpinia major (Medic.) Dandy & Exell	I	gray nickers, pakao	- - - X -
Calapogonium mucunoides Desv.	X	akankan-guakag	X - - - -
Centrosema pubescens Benth.	X	-----	X - - - -
Chamaecrista nicitans (L.) Moench	X	Japanese tea-senna	- X X - -
Crotalaria retusa L.	X	-----	X - - X -
Desmodium heterophyllum (Willd.) DC.	X	-----	- - X - -
Desmodium triflorum (L.) DC.	X	agsom	X - X - -
Entada pursaetha DC.	I	snuff-box bean, gayi	X - - - -
Intsia bijuga (Colebr.) Kuntze	I	ifil	- - - X -
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan	X X X X X
Mimosa pudica L.	X	sensitive plant	X X X X -
Pueraria phaseoloides (Roxb.) Benth.	X	tropical kudzu	X - - - -
Vigna adenantha (G.F.W. Meyer) Maréchal	X	akangkang-kalatun	- X - - -
GOODENIACEAE (Goodenia Family)			
Scaevola taccada (Gaertn.) Roxb.	I	nanaso	X X X X X

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
LAMIACEAE (Mint Family)			
Hyptis capitata Jacq.	X	botones	X X X - -
Hyptis suaveolens (L.) Poir.	X	-----	X - - - -
LOGANIACEAE (Logania Family)			
Buddleja asiatica Lour.	X	-----	- - - - X
Geniostoma micranthum A. DC.	E	anasser	X - - - -
Fagraea berteroana A. Gray ex Benth.	I	-----	- - X - -
Polypremnum procumbens L.	X	-----	- - - X -
MALVACEAE (Mallow Family)			
Hibiscus abelmoschus L.	X	kamang	X - - - -
Hibiscus tiliaceus L.	I	hibiscus, pago	X - X X -
Sida acuta Burm. f.	X	escobilla papago	X - - - -
MELASTOMACEAE (Melastoma Family)			
Medinilla medinilliana (Gaudich.) Fosb. & Sach.	E	gafus	X - X - -
Melastoma malabathricum L.	I	gafau	X - X - -
MELIACEAE (Mahogany Family)			
Aglaia mariannensis Merr.	E	mapunyao	- X - X -
MORACEAE (Mulberry Family)			
Artocarpus mariannensis Trécul	I	dokdok	- - X - -
Ficus prolixa Forst. f.	I	banyan, nunu	- X - X -
Ficus tinctoria Forst. f.	I	dyer's fig	- - X - -
MYRSINACEAE (Myrsine Family)			
Discocalyx megacarpa Merr.	E	otot	X - - - -
MYRTACEAE (Myrtle Family)			
Decaspermum fruticosum Forst.	I	-----	X - X - -
Melaleuca quinquenervia (Cav.) Blake	X	paperbark	X - - - -
Myrtella bennigseniana (Volk.) Diels	I	-----	X - - - -
Pimenta racemosa (Willd.) J.W. Moore	X	bay rum	X - - - -
Psidium guajava L.	X	guava, abas	- X X - -
PASSIFLORACEAE (Passionflower Family)			
Passiflora foetida L.	X	love-in-a-mist	X - - - -
Passiflora suberosa L.	X	-----	X - X X -
PIPERACEAE (Pepper Family)			
Piper guahamense C. DC.	E	wild piper	- - X X -
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	X	-----	X X X X -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
RUBIACEAE (Coffee Family)			
Guettarda speciosa L.	I	panao	- - - X -
Morinda citrifolia L.	I	Indian mulberry, lada	X X X X -
Psychotria mariana Bartl. ex DC.	I	-----	- - - X -
Spermacoce assurgens R. & P.	X	-----	X X X X -
Spermacoce ernstii Fosb. & Powell	X	-----	X X X X -
Timonius nitidus (Bartling) F.-Vill.	I	-----	X - - - -
RUTACEAE (Citrus Family)			
Triphasia trifolia (Burm f.) P. Wils.	I?	limeberry, limon-china	X X X X -
SAPOTACEAE (Sapodilla Family)			
Pouteria obovata (R. Br.) Baehni	I	lalahag	X - - - -
SCROPHULARIACEAE (Snapdragon Family)			
Buchnera floridanus Sm.	X	-----	- - - X -
SOLANACEAE (Nightshade Family)			
Cestrum diurnum L.	X	day cestrum, tinta'n-china	- X X - -
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	X	escobilla sabana	X - - X -
THYMELAEACEAE (Mezereum Family)			
Wikstroemia elliptica Merr.	I	gapit atayake	X - - - -
URTICACEAE (Nettle Family)			
Pilea microphylla (L.) Liebm.	X	-----	- X X X X
Pipturus argenteus (Forst. f.) Wedd.	I	amahadyan	- - - X X
VERBENACEAE (Verbena Family)			
Clerodendrum inerme (L.) Gaertn.	I	lodugao	X - X - -
Premna serratifolia L.	I	ahgao	- - - X -
Stachytarpheta jamaicensis (L.) Vahl	X	Jamaica vervain	X X X X X
Vitex parviflora Juss.	X	-----	- - X X -

[1] Status: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native)

[2] Distribution: 1 = Navigation range; 2 = Bivouac area; 3 = Firing range; 4 = Helicopter landing site; and 5 = Rappelling site.

Table 2. Checklist of the Flora of the Live Fire Weapons Range Site, Tinian.

The species are arranged in three groups: (1) ferns; (2) monocots; and (3) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name
FERNS (PTERIDOPHYTES)		
POLYPODIACEAE (Common Fern Family)		
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Zebrina pendula Schnizl	X	wandering Jew
CYPERACEAE (Sedge Family)		
Fimbristylis cymosa R. Br.	I	-----
Fimbristylis dichotoma (L.) Vahl	I	-----
Mariscus javanicus (Houtt.) Merr. & Metcalfe	I	-----
PANDANACEAE (Screwpine Family)		
Freycinetia reineckei Ward.	I	fianiti
Pandanus dubius Spreng.	I	pahong
Pandanus tectorius Parkinson	I	screwpine, kafu
POACEAE (Grass Family)		
Bothriochloa bladhii (Retz.) S.T. Blake	X	-----
Bothriochloa pertusa (L.) A. Camus	X	pitted beardgrass
Cenchrus echinatus L.	X	bur grass
Chloris barbata (L.) Sw.	X	finger grass
Chrysopogon aciculatus (Retz.) Trin.	I	-----
Cynodon dactylon (L.) Pers.	X	Bermuda grass, grama
Dactyloctenium aegyptium (L.) Willd.	X	crowfoot grass
Dichantium caricosum (L.) A. Camus	X	-----
Digitaria ciliaris (Retz.) Koel.	I	-----
Digitaria insularis (L.) Mez	X	sourgrass
Eleusine indica (L.) Gaertn.	X	goose grass, umog
Eragrostis ciliaris (L.) R. Br.	X	love grass
Eragrostis tenella (L.) P. Beauv. ex R. & S.	I?	love grass
Eustachys petraea (Sw.) Desv.	X	-----
Lepturus repens (Forst.) R. Br.	I	lesaga
Panicum maximum Jacq.	X	Guinea grass
Paspalum paniculatum L.	X	-----
Pennisetum polystachion (L.) Schult.	X	mission grass
Rhynchelytrum repens (Willd.) Hubb.	X	Natal redtop
Sporobolus fertilis (Steud.) Clayton	I	rat-tail dropseed

FAMILY Scientific name	Status[1]	Common Name
DICOTS		
ACANTHACEAE (Acanthus Family)		
Blechum brownei Juss.	X	yerbas babui
AMARANTHACEAE (Amaranth Family)		
Achyranthes aspera L.	I	chichitun
Deeringia amaranthoides (Lam.) Merr.	I	-----
APOCYNACEAE (Dogbane Family)		
Neisosperma oppositifolium (Lam.) Fosb. & Sachet	I	fago
ASTERACEAE (Sunflower Family)		
Bidens alba (L.) DC.	X	beggar's tick
Chromolaena odorata (L.) King & Robin.	X	masigsig
Tridax procumbens L.	X	coat buttons
Vernonia cinerea (L.) Less.	I	ironweed, chaguan Santa Maria
Wollastonia biflora (L.) DC.	I	masigsig
BORAGINACEAE (Heliotrope Family)		
Heliotropium procumbens Mill.	I	huning-tasi
CAPPARIDACEAE (Caper Family)		
Capparis cordifolia Lam.	I	atkaparas
CARICACEAE (Papaya Family)		
Carica papaya L.	X	papaya
CASSYTHACEAE (Cassytha Family)		
Cassytha filiformis L.	I	agasi
CASUARINACEAE (Ironwood Family)		
Casuarina equisetifolia L.	I	ironwood, gagu
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea pes-caprae (L.) R. Br.	I	beach morning-glory, alalag-tasi
Ipomoea triloba L.	X	fofgu-sabana
Operculina ventricosa (Bert.) Peter	X	-----
CUCURBITACEAE (Gourd Family)		
Momordica charantia L.	X	balsam pear, almagosa
CUSCUTACEAE (Dodder Family)		
Cuscuta campestris Yuncker	X	dotter

FAMILY Scientific name	Status[1]	Common Name
EUPHORBIACEAE (Spurge Family)		
Acalypha indica L.	X	hierba del cancer
Chamaesyce hirta (L.) Millsp.	X	garden spurge
Chamaesyce hyssopifolia (L.) Small	X	-----
Chamaesyce prostrata (Ait.) Millsp.	X	prostrate spurge,
Euphorbia cyathophora Murray	X	wild poinsettia
Jatropha gossypifolia L.	X	-----
Melanolepis multiglandulosa (Reinw. (Reinw. ex Bl.) Rchb. f. & Zoll.	I	alom
Phyllanthus amarus Sch. & Th.	X	maigo-lalo
Phyllanthus marianus Muell. Arg.	I	gaogao-uchan
FABACEAE (Pea Family)		
Abrus precatorius L.	X	rosary pea, kolales halomtano
Albizia lebbeck (L.) Benth.	X	trongkon-mames
Alysicarpus vaginalis (L.) DC.	X	-----
Clitoria ternata L.	X	bukike, butterfly pea
Crotalaria pallida Ait.	X	kaskabeles, rattlepod
Desmanthus virgatus (L.) Willd.	X	-----
Desmodium triflorum (L.) DC.	X	agsom
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan
Pithecellobium dulce (Roxb.) Benth.	X	kamachile
Rhychosia calosperma Warb.	X	-----
Senna occidentalis (L.) Link	X	coffee senna
Senna sophera (L.) Roxb.	I	amot-tumaga
GOODENIACEAE (Goodenia Family)		
Scaevola taccada (Gaertn.) Roxb.	I	nanaso
MALVACEAE (Mallow Family)		
Abutilon indicum (L.) Sweet	X	matbas, mallow
Malvastrum coromandelianum (L.) Garcke	X	-----
Sida acuta Burm. f.	X	escobilla papago
Thespesia populnea (L.) Sol. ex Corr.	I	milo, banalo
MORACEAE (Mulberry Family)		
Ficus prolixa Forst. f.	I	nunu, strangler fig
MYRTACEAE (Myrtle Family)		
Eugenia palumbis Merr.	I	agatelang
NYCTAGINACEAE (Four-o'clock Family)		
Boerhavia repens R. Br.	I	dafao
OLEACEAE (Olive Family)		
Jasminum marianum DC.	E	banago

FAMILY Scientific name	Status[1]	Common Name
OXALIDACEAE (Woodsorrel Family)		
Oxalis corniculata L.	X	wood sorrel, agsom
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	X	love-in-a-mist
Passiflora suberosa L.	X	-----
PORTULACACEAE (Purslane Family)		
Portulaca australis Endl.	I	-----
Portulaca oleracea L.	X	purslane, botdolagas
RUBIACEAE (Coffee Family)		
Hedyotis corymbosa (L.) Lam.	X	-----
Morinda citrifolia L.	I	Indian mulberry, lada
Psychotria mariana Bartl. ex DC.	E	aplokating
SAPINDACEAE (Soapberry Family)		
Cardiospermum halicacabum L.	X	balloon vine
SOLANACEAE (Nightshade Family)		
Capsicum frutescens L.	X	chili pepper, doni-sali tomate chaca
Solanum americanum Mill.	X	black nightshade
TILIACAEAE (Linden Family)		
Muntingia calabura L.	X	Panama cherry, calabura
URTICACEAE (Nettle Family)		
Pilea microphylla (L.) Liebm.	X	-----
Pipturus argenteus (Forst. f.) Wedd.	I	amahadyan
VERBENACEAE (Verbena Family)		
Callicarpa candicans (Burm.f.) Hochr.	I	qualitay
Lantana camara L.	X	lantana
Premna serratifolia L.	I	ahgao
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena

[1] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

Table 3. Checklist of the Flora of the Parachute Drop Zone Site, Tinian.

The species are arranged in three groups: (1) ferns; (2) monocots; and (3) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name
FERNS (PTERIDOPHYTES)		
POLYPODIACEAE (Common Fern Family)		
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Commelina benghalensis L.	X	-----
CYPERACEAE (Sedge Family)		
Cyperus compressus L.	X	-----
Cyperus rotundus L.	X	nutgrass
POACEAE (Grass Family)		
Bambusa vulgaris Schrad. ex Wendl.	X	bamboo
Bothriochloa bladhii (Retz.) S.T. Blake	X	-----
Bothriochloa pertusus (L.) A. Camus	X	pitted beardgrass
Brachiaria subquadripara (Trin.) Hitchc.	X	-----
Chloris barbata (L.) Sw.	X	finger grass
Cynodon dactylon (L.) Pers.	X	Bermuda grass, grama
Dactyloctenium aegyptium (L.) Willd.	X	crowfoot grass
Dichanthium caricosum (L.) A. Camus	X	-----
Digitaria ciliaris (Retz.) Koel.	I	-----
Digitaria insularis (L.) Mez	X	sourgrass
Eleusine indica (L.) Gaertn.	X	goose grass, umog
Eragrostis tenella (L.) P. Beauv. ex R. & S.	I?	love grass
Panicum maximum Jacq.	X	Guinea grass
Paspalum paniculatum L.	X	-----
Sorghum bicolor (L.) Moench.	X	broomcorn
Sporobolus diander (Retz.) Beauv.	X	dropseed
DICOTS		
ACANTHACEAE (Acanthus Family)		
Blechum brownei Juss.	X	yerbas babui

FAMILY Scientific name	Status[1]	Common Name
AMARANTHACEAE (Amaranth Family)		
Amaranthus spinosus L.	X	kuletes, spiny amaranth
Amaranthus viridis L.	X	kuletes apaka
ASCLEPIACACEAE (Milkweed Family)		
Asclepias curassavica L.	X	asuncion, milkweed
ASTERACEAE (Sunflower Family)		
Bidens alba (L.) DC.	X	beggar's tick
Chromolaena odorata (L.) King & Robin.	X	masigsig
Mikania scandens (L.) Willd.	X	mile-a-minute vine
Synedrella nodiflora (L.) Gaertn.	X	saigon
Vernonia cinerea (L.) Less.	I	ironweed, chaguan Santa Maria
BORAGINACEAE (Heliotrope Family)		
Heliotropium procumbens Mill.	I	huning-tasi
CARICACEAE (Papaya Family)		
Carica papaya L.	X	papaya
CASUARINACEAE (Ironwood Family)		
Casuarina equisetifolia L.	I	ironwood, gagu
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea obscura (L.) Ker-Gawl.	X	-----
Ipomoea triloba L.	X	fofgu-sabana
CUCURBITACEAE (Gourd Family)		
Momordica charantia L.	X	balsam pear, almagosa
EUPHORBIACEAE (Spurge Family)		
Acalypha indica L.	X	hierba del cancer
Chamaesyce hirta (L.) Millsp.	X	garden spurge
Jatropha gossypifolia L.	X	-----
Phyllanthus amarus Sch. & Th.	X	maigo-lalo
FABACEAE (Pea Family)		
Acacia confusa Merr.	X	Formosan koa
Aeschynomene indica L.	X	-----
Albizia lebbeck (L.) Benth.	X	trongkon-mames
Centrosema pubescens Benth.	X	-----
Crotalaria retusa L.	X	-----
Desmanthus virgatus (L.) Willd.	X	-----
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan
Macroptilium lathyroides (L.) Urb.	X	cowpea

FAMILY Scientific name	Status[1]	Common Name
FABACEAE (cont'd.)		
Mimosa invisa Mart.	X	giant sleeping-grass
Mimosa pudica L.	X	sensitive plant
Pithecellobium dulce (Roxb.) Benth.	X	kamachile
Senna alata (L.) Roxb.	X	candlebush, andadose
Senna occidentalis (L.) Link	X	coffee senna
MALVACEAE (Mallow Family)		
Malvastrum coromandelianum (L.) Garcke	X	-----
Sida acuta Burm. f.	X	escobilla papago
Sida rhombifolia L.	X	escobilla dalili
MORACEAE (Mulberry Family)		
Ficus tinctoria Forst. f.	I	dyer's fig, hoda
MYRTACEAE (Myrtle Family)		
Psidium guajava L.	X	guava, abas
NYCTAGINACEAE (Four-o'clock Family)		
Boerhavia repens R. Br.	I	dafao
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	X	love-in-a-mist
Passiflora suberosa L.	X	-----
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	X	purslane, botdolagas
RUBIACEAE (Coffee Family)		
Spermacoce assurgens R. & P.	X	-----
SAPINDACEAE (Soapberry Family)		
Cardiospermum halicacabum L.	X	balloon vine
SOLANACEAE (Nightshade Family)		
Capsicum frutescens L.	X	chili pepper, doni-sali
Physalis angulata L.	X	wild cape-gooseberry, tomate chaca
Solanum americanum Mill.	X	black nightshade
Solanum torvum Sw.	X	-----
VERBENACEAE (Verbena Family)		
Lantana camara L.	X	lantana
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena
Stachytarpheta urticifolia (Salisb.) Sims	X	blue rat's-tail

[1] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

342.0414/019-1m r7.24.96



Figure 1. Land navigation site, NAVACTS Ordnance Annex



Figure 2. Land navigation site, NAVACTS Ordnance Annex



Figure 4. Land navigation site waterfall, NAVACTS Ordnance Annex



Figure 3. Land navigation site ravine forest, NAVACTS Ordnance Annex



Figure 5. Sniper range site, NAVACTS Ordnance Annex



Figure 6. Helicopter landing site, NAVACTS Ordnance Annex



Figure 7. Helicopter landing site, NAVACTS Ordnance Annex



Figure 8. Rappelling site, NAVACTS Ordnance Annex

Appendix M
Report of a Faunal (Bird and Mammal) Survey of the NAVACTS Guam Ordnance Annex Proposed Training Site and Portions of the Atantano River (May 17, 1996)

montanus) and Black Drongo (Dicrurus macrocercus). The numbers of each of these species are given in Table One.

Non-endangered Mammals:

Tracks, scats, habitat disturbance and visual sightings were used to identify three species of mammals at NAVACTS: feral pig (Sus scrofa), Guam Deer (Cervus unicolor) and Carabao (Bubalus bubalis). All three species are apparently common to abundant. The understory vegetation and ground cover were disturbed in many areas visited on the survey. Apparently fires are sometimes set by poachers to burn off mature vegetation and allow new grass to grow to attract deer at NAVACTS according to Jennings Bunn, Cultural Resources Manager, NAVACTS (pers. comm.)

Endangered Birds and Mammals:

No endangered species were found on the survey. Reports of sightings of the Mariana Fruit Bat (Pteropus mariannus) in this region by archeologists (pers. comm.) suggest that this endangered species occurs in the area. G. Wiles of Government of Guam Division of Aquatic and Wildlife Resources (pers. comm.) indicated that such sightings may represent foraging animals, but did not know of any roosting areas for this species on NAVACTS. The Mariana Crow (Corvus kubaryi) has not been recorded from sourthern Guam since the 1960s-1970s. The Common Moorhen (Gallinula chloropus guami) occurs on Fena Valley Reservoir and could use two small wetlands to the east and one to the northwest of the reservoir. The Island Swiftlet (Aerodramus vanikorensis bartschi) nests in caves

in the southeast section of the Ordnance Annex and forages around the southern end of Fena Valley Reservoir.

CONCLUSIONS

The NAVACTS proposed training site is covered in a mixture of grasslands and forest. Few birds were seen on or near the site. The only mammals in the area are introduced species which may be causing damage to the understory vegetation and could impact the site by increasing erosion. No endangered species were recorded but the Mariana Fruit Bat may forage on occasion in this region. The Common Moorhen and Island Swiftlet occur around Fena Valley Reservoir.

One significant impact that could occur as a result of using this site for live fire training is the chance of stray rounds starting fires. The topography and dense vegetation could create extreme challenges in controlling a fire. The grass would regenerate and the cycle of fires would likely continue. The deer population would profit by new feeding areas and their increase could further impact the remaining forest.

Birds along the Atantano River should not be impacted by the proposed use of boat traffic. Few birds were seen in this area and no endangered species were encountered.

TABLE 1

Birds recorded at NAVACTS and Atantano River, Guam. Number indicates total seen or heard and NAV= NAVACTS while AR= Atantano River.

COMMON NAME	SCIENTIFIC NAME	NUMBER RECORDED
Cattle Egret	Bubulcus ibis	NAV= 29
Yellow Bittern	Ixobrychus sinensis	NAV= 2 AR= 3
Black Francolin	Francolinus francolinus	NAV= 5
Pacific Golden-Plover	Pluvialis fulva	NAV=12
Siberian Tattler	Heteroscelus brevipes	NAV= 1
Eurasian Tree Sparrow	Passer montanus	AR= 3
Black Drongo	Dicrurus macrocercus	AR= 2

SOURCES CITED

American Ornithologists' Union. 1983. Check-list of North American Birds. 6th edition. American Ornithologists' Union. Washington, D.C.

Honacki, J.H., K.E. Kinman, and J.W. Koeppl ed. 1982. Mammal species of the world: A taxonomic and geographic reference. Allen Press. Inc. and the Association of Systematic Collections. Lawrence, Kansas.

Pratt, H.D., P.L. Bruner, and D.G. Berrett. 1987. A field guide to the birds of Hawaii and the Tropical Pacific. Princeton Univ. Press. Princeton, New Jersey.

Appendix G
Rota NVG Noise

To identify the scale of potential noise impacts from NVG training on Rota, noise contours for helicopter training were developed by Darby & Associates (Appendix K). Noise presently generated by commercial aircraft at Rota International Airport is sporadic and generally limited to daytime hours,[1] while the NVG noise will be continuous for a period of up to three hours. The study identified day-night equivalent sound level contours (Ldn) for a typical training day (see Figure 4-4).[2] Results show that sound levels generated by helicopters in the nearby crow habitat will not exceed 55 dBA, roughly the equivalent of average suburban sound levels. This sound level is generally considered compatible with natural wildlife areas (Figure 4-5).

However, the Ldn is an average value and it is often the peak noise level that wildlife find most disturbing. Therefore, a peak noise level was calculated. The peak noise level for the helicopter used for NVG training is estimated to be 118 dBA at a horizontal distance of 30.5 meters from the source.[3]

Because sound levels vary with distance from the source, the peak noise level at the nearest edge of the high density Mariana crow population area (see Figure 4-4) needed to be calculated. A logarithmic equation and several assumptions were used to determine the peak noise levels. The equation used is as follows:

$$L_{n2} = L_{n1} - 20 * \log \frac{r_2}{r_1} - A_{12}$$

where L_{max} = peak noise level at a specific location x
r_x = distance between the source (runway) and location x
A_{12} = attenuation due to vegetation and terrain

The assumptions made were:

- sound level data from CH-46 helicopter operations provide a reasonable basis for estimating sound levels of H-46D helicopter;
- acoustical environment at Bellows Air Force Station where measurements were taken is similar to that at Rota Airport
- a Mariana crow would be located no closer than the edge of the high population density area (see Figure 4-4);
- NVG training activities take place above the centerline of the runway;

[1]Personal communication with Michael Muña, Saipan FAA, August 8, 1996.

[2]The Ldn is measured in units of A-weighted decibels, which emulate the response of the human ear. It is the level of sound measure over a 24-hour period, with a penalty added to noises between 2200 and 0700 (to account for people's higher sensitivity to noise at night, when the background noise level is typically lowered).

[3]Personal communication with Thao N. Ngyuen, Darby & Associates, August 22, 1996, based on previous measurements.

- attenuation of noise due to vegetation and/or terrain is not estimated, therefore the peak sound level may actually be lower than calculated.

The distance was first assumed to be the shortest horizontal distance between the runway and the high density area. A distance of about 154.2 m (between the middle of the runway and the edge of the high density area) was used for the calculations. Based on this assumption, the peak noise level at the nearest edge of the high density Mariana crow population area would be 104 dBA.

The distance was then assumed to be the greatest distance between the runway and the high density area. A distance of 219 m (between the eastern end of the runway and the edge of the high density area) was used. The peak noise level for this scenario is estimated to be about 101 dBA.

The nearest known crow nest within this high density population area is located approximately 2 km from the runway. The peak sound level at this location was calculated to be slightly less, at 82 dBA. For nests deeper in the forest, farther from the edge of the high density area, noise attenuation due vegetation would be significant, greatly reducing the peak sound levels experienced.

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Project No. 96-05

HC-5 HELICOPTER NOISE STUDY FOR NIGHT VISION GOGGLE TRAINING AT ROTA AIRPORT ROTA, MARIANA ISLANDS

May 9, 1996

Prepared for
BELT COLLINS HAWAII
Honolulu, Hawaii

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SUMMARY

Helicopter noise contours for the proposed HC-5 night vision goggle training exercises at Rota Airport were generated. Day-night equivalent sound level (L_{dn}) contours for a typical training exercise day and for a daily average are presented. The latter are based on 120 training exercises per year as proposed.

COMPUTER NOISE MODEL AND INPUT DATA

The helicopter noise model used in this study was NOISEMAP Version 6.4 [Reference 1]. Input data required was flight tracks, approach and takeoff profiles, number of daytime (0700 - 2200 hours) and nighttime (2200 - 0700 hours) operations and other information pertaining to the runway location, such as longitude and latitude, field elevation, average yearly temperature, average yearly humidity, etc.

Data and information pertaining to the HC-5 night vision goggle training exercises at Rota Airport were obtained from Lt. H. S. Parrish, HC-5 NVD Officer, [References 2 and 3]. A typical training exercise was described as follows:

- Helicopter will maintain altitude of 500 feet above ground level (AGL) at all times except during approach to and departure from landing.
- Rates of climb and descent will not exceed 1,000 feet per minute.
- Helicopter makes normal approach and descent to landing from the northwest side of Rota Island. Landing types will consist of the following:
  1. Approach to a 10-foot hover for approximately 15 seconds followed by a vertical landing,
  2. No hover landing, and
  3. Running landings at maximum forward speed of 50 knots.
- Helicopter spends a maximum of five minutes on deck before vertical ascent to a ten-foot hover and takeoff. After takeoff, helicopter will not commence turn to downwind leg until reaching an altitude of 200 feet AGL. Helicopter commences a climbing 180° left turn to an altitude of 500 feet AGL for the downwind leg. When abeam the approach end of the runway, helicopter will make a 180° descending left turn before landing. It is estimated that the helicopter will repeat this closed pattern maneuver 19 times before departing from the Rota Airport.

- Approximately 120 flights per year to Rota Airport for the HC-5 trainingt exercises are proposed.
- The planned flight tracks are as shown in Figure 1.
- These HC-5 training exercises will commence one hour after sunset and departure will occur before 2200 hours.

DAY-NIGHT EQUIVALENT SOUND LEVEL CONTOURS

Day-night equivalent sound level (L_{dn}) contours for the modeled HC-5 night vision goggle training exercises at Rota Airport were computer generated using NOISEMAP. Figure 2 represents the L_{dn} contours for a typical training exercise day based on the estimated 19 closed pattern maneuvers, one approach to and one departure from Rota Airport per day. The L_{dn} contours for a daily average, based on the proposed 120 training exercises per year, are presented in Figure 3. Appendix A provides a brief description of the acoustic terminology used in this report. Enlargements of the contours in the vicinity of the airstrip are shown in Figures 4 and 5.

Land areas encompassed by each contour are as follows:

1. L_{dn} Contours for a Typical Training Exercise Day (Figure 2)

L_{dn} (dB)	Millions of Square Feet
40	72.25
45	45.10
50	29.11
55	7.90
60	0.04

2. Daily Average L_{dn} Contours Based on One Year (Figure 3)

L_{dn} (dB)	Millions of Square Feet
40	45.74
45	29.31
50	8.37
55	0.04

REFERENCES:

1. NOISEMAP Version 6.4, Department of the Air Force, July, 1995.
2. Facsimile Transmittal from Lt. H. S. Parrish, HC-5 NVD Officer, Helicopter Combat Support Squadron Five, to Darby & Associates, Received April 3, 1996.
3. Telephone Conversation with Lt. H. S. Parrish, April 4, 1996 and April 15, 1996.

APPENDIX A

ACOUSTICAL TERMINOLOGY

Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

Statistical Sound Levels

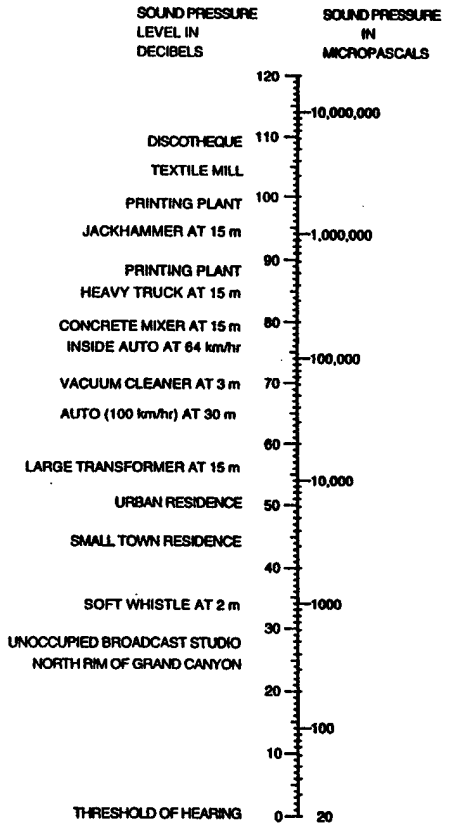
The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, L_n. The Exceedence Level, L_n, represents the sound level which is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include L_1, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Equivalent Sound Level

The Equivalent Sound Level, L_{eq}, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. L_{eq} is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

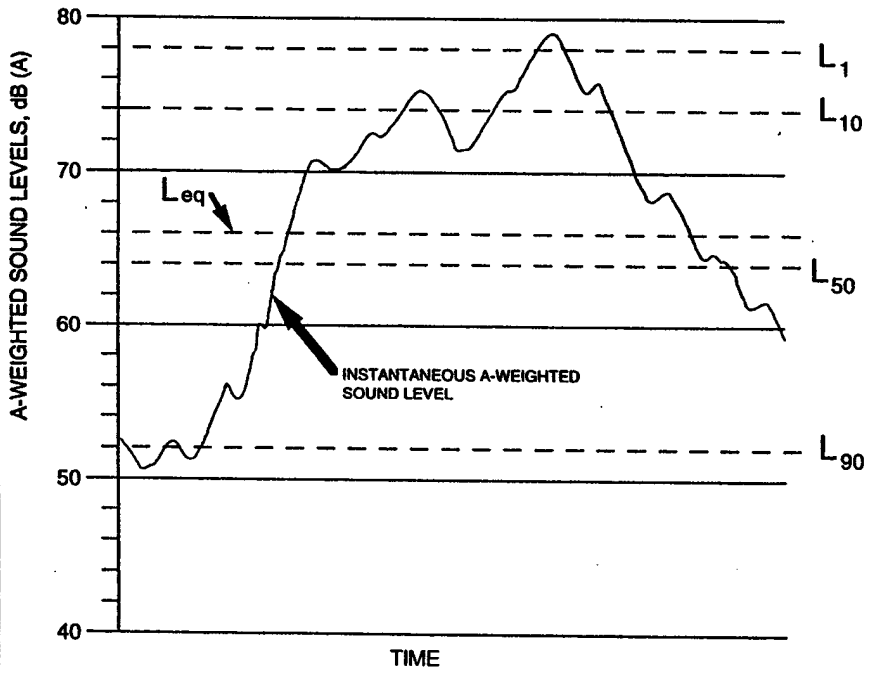
Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of L_{dn}, are shown in Figure A-3.



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FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.



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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

Flight Tracks

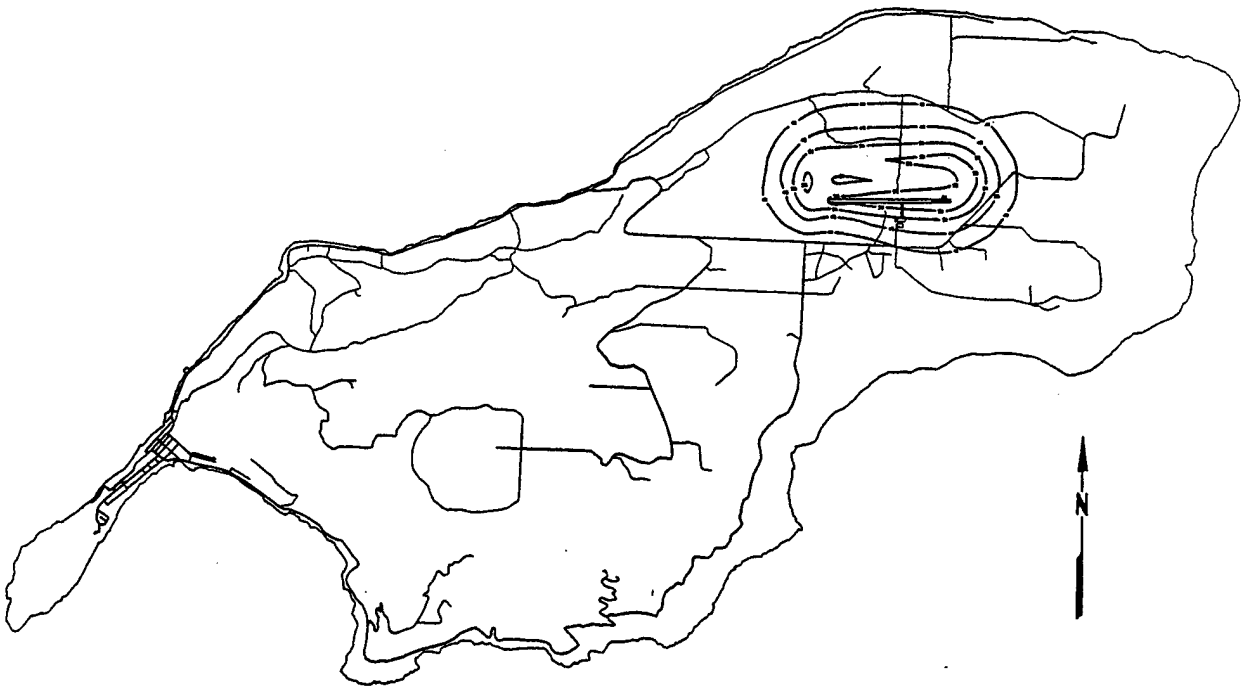
HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 1

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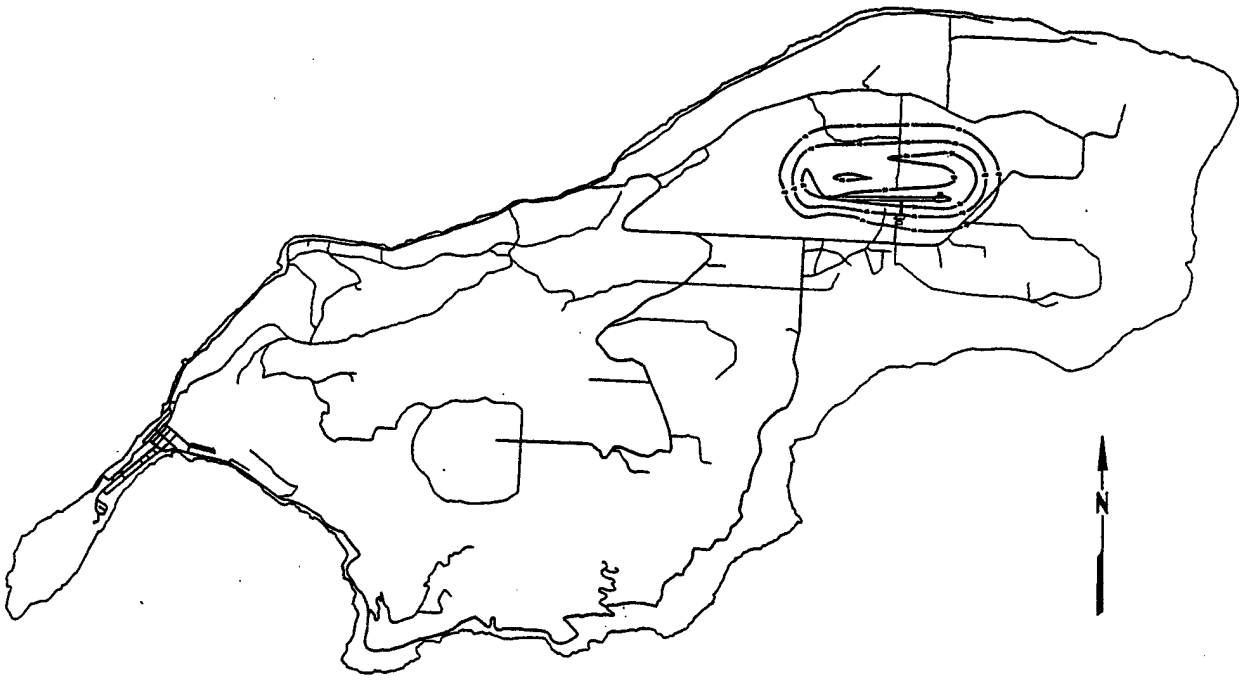
Ldn Contours for A Typical Training Exercise Day

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 2

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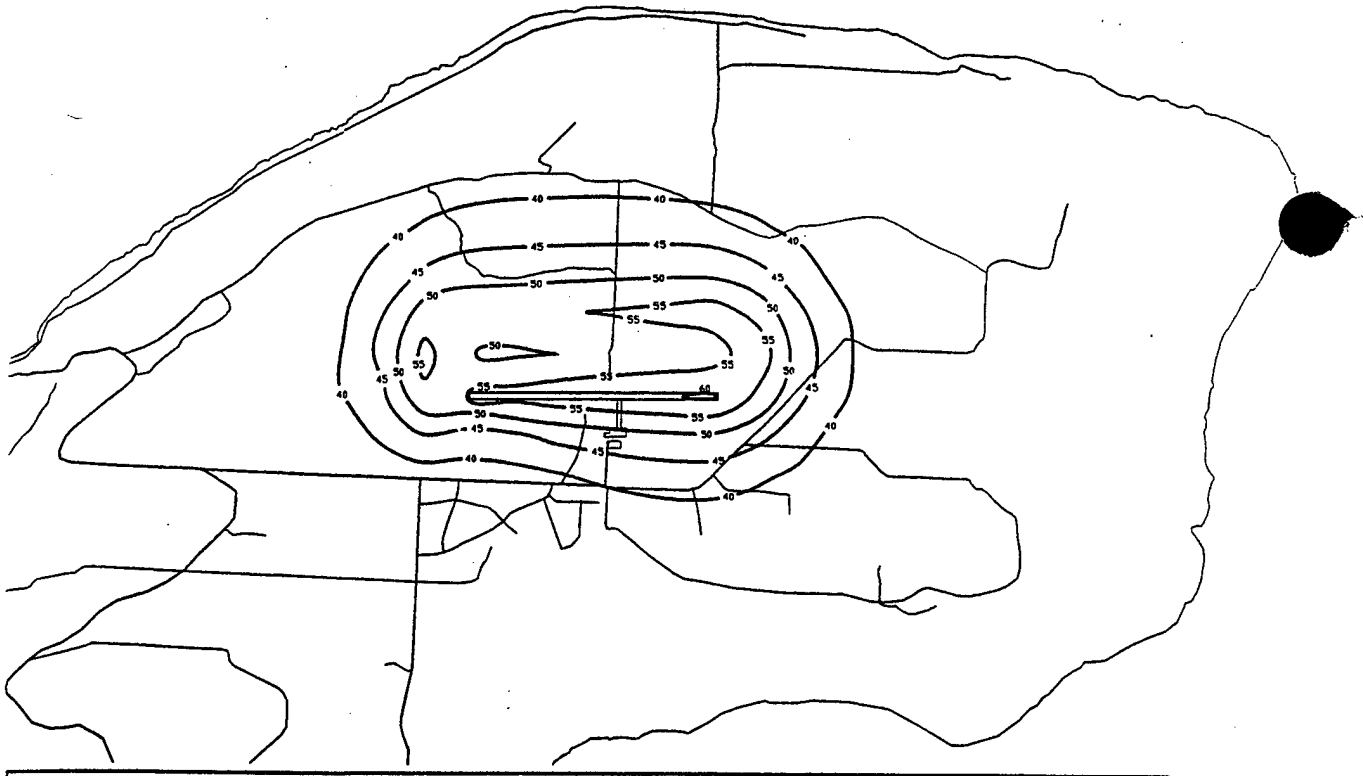
Daily Average Ldn Contours Based on One Year

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 3

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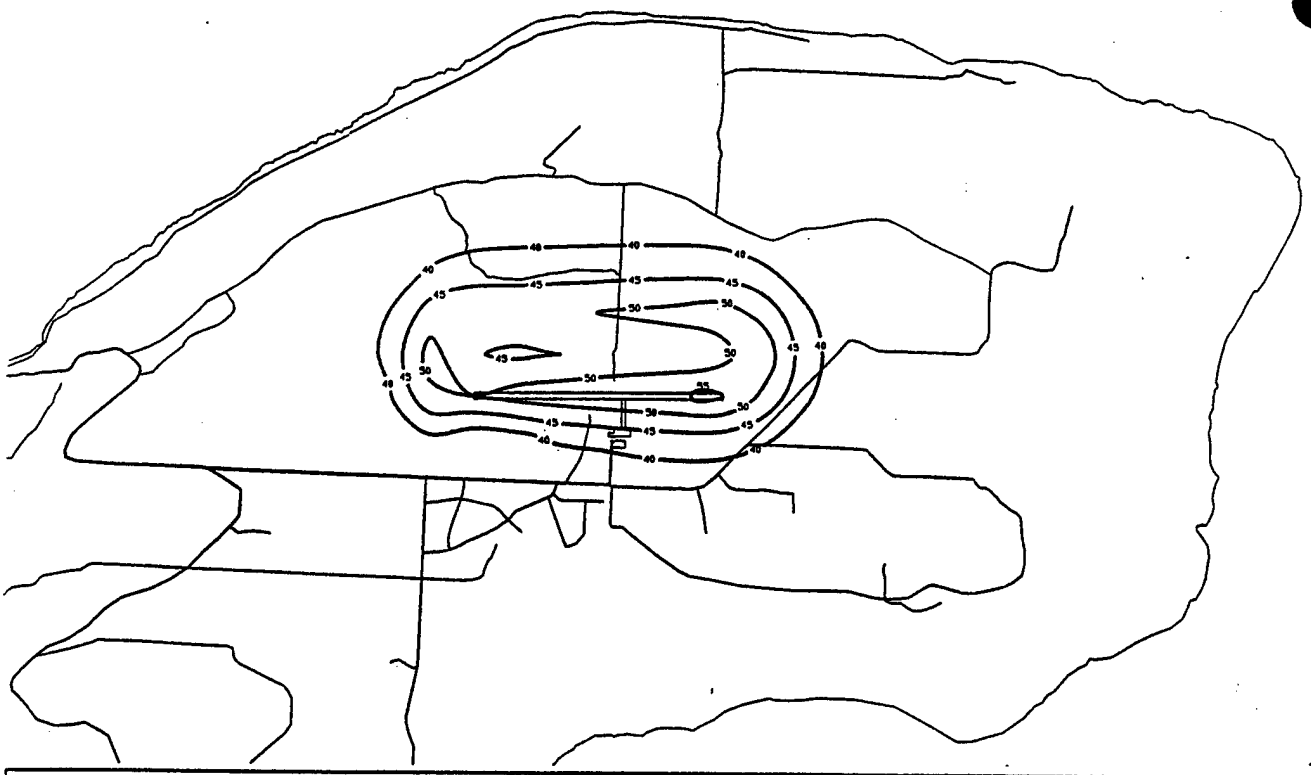
Enlargement of Figure No. 2

HC-5 Training Exercises at Rota Airport

Scale: 1" = 3,000'

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Figure No. 4



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Enlargement of Figure No. 3

HC-5 Training Exercises at Rota Airport

Scale: 1" = 3,000'

Date	Project No.	Drawn By
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Figure No. 5